9.3 Alternative Sites

This section discusses PEF's alternative site-selection process for possible siting of a new nuclear power plant. It provides the review team's description of the alternative sites selected and the building and operational impacts of locating two new units at each alternative site. Finally, the construction and operational impacts of the proposed and alternative sites are compared.

9.3.1 Alternative Sites Selection Process

NRC EISs prepared in conjunction with a COL application are to analyze alternatives to the proposed action (10 CFR 51.71(d)). This section discusses PEF's process for selecting its proposed and alternative sites and the review team's evaluation of the process. PEF's site-selection process was based on guidance in the following documents (PEF 2009a): the NRC's ESRP (NRC 2000), Regulatory Guide 4.2 (NRC 1976), Regulatory Guide 4.7 (NRC 1998), and the Electric Power Research Institute's (EPRI) Siting Guide (EPRI 2002). In evaluating sites, PEF assumed that a twin-unit Westinghouse Electric Company, LLC (Westinghouse) AP1000 pressurized water reactor would be built and operated (PEF 2009a).

NRC's site-selection process guidance calls for identification of an ROI, followed by successive screenings to identify candidate areas, potential sites, candidate sites, and the proposed site (NRC 2000). Candidate areas are those areas within an ROI that remain after areas unsuitable for nuclear power plant construction or operation have been excluded. Potential sites are those sites within candidate areas that meet minimum size and other siting criteria. Candidate sites are chosen from potential sites using a defined site-selection methodology and are those that would be expected to be granted construction permits or COLs. Candidate sites include both the proposed site and alternative sites.

9.3.1.1 Selection of Region of Interest

The ROI is the geographic area considered by an applicant in searching for candidate areas and potential sites for a new nuclear power plant. The ROI is typically the state in which the proposed site is located or the relevant service area for the proposed plant (NRC 2000). PEF selected as its ROI the land area included in the PEF service territory and all or parts of the Florida counties surrounding PEF's service territory, including Bay, Calhoun, Jackson, Suwannee, Columbia, Union, Bradford, Alachua, Clay, Putnam, Flagler, Volusia, Seminole, Brevard, Indian River, Okeechobee, St. Lucie, Glades, Highlands, DeSoto, Hardee, Manatee, Pasco, Polk, and Hillsborough (see Figure 8-1) (PEF 2009a). PEF expanded the ROI around the periphery of its service territory to provide additional flexibility and to make sure it would not overlook any viable sites within a reasonable distance of the service territory. PEF's service territory is further discussed in Section 8.1.

9.3.1.2 Selection of Candidate Areas

Candidate areas are one or more areas within the applicant's ROI that remain after unsuitable areas for a new nuclear power plant (e.g., due to high population, lack of water, fault lines, or distance to transmission lines) have been removed from consideration (NRC 2000). PEF systematically reviewed candidate areas within the ROI using the ESRP guidance (NRC 2000) and the EPRI Siting Guide (EPRI 2002) as the basis for its selections. The following broad criteria were applied in screening for candidate areas within the ROI: population density, availability of cooling-water sources, dedicated Federal and State land uses, and regional ecological features (e.g., threatened or endangered species habitats) (PEF 2009a and December 14, 2009 RAI response). Areas were removed from consideration if they did not meet the required characteristics (e.g., population density no more than 300 persons/mi^2, no Federal or State parks). Nine areas that met the required characteristics were designated candidate areas and were plotted on a map of Florida. The following nine candidate areas were identified by PEF (PEF 2009a):

- Western Panhandle along the Gulf Coast/St. Joseph Bay (Bay and Gulf Counties)
- Apalachicola and Chipola River basin areas (Calhoun, Gulf, and Liberty Counties)
- Ochlockonee River basin along borders of Liberty, Franklin, Leon, and Wakulla Counties
- Gulf Coast along Taylor and Dixie, Levy, Citrus, and Hernando Counties
- Tampa Bay area/Manatee River south of Tampa/St. Petersburg area (Hillsborough and Manatee Counties)
- Suwannee River Basin (Dixie, Levy, Gilchrist, and Lafayette Counties)
- Kissimmee River near Lake Okeechobee (Highlands, Okeechobee and Glades Counties)
- St. Johns River Basin (Seminole, Volusia, and Putnam Counties)
- Atlantic Coastal areas (numerous locations between Flagler County to the north, and Indian River County to the south).

9.3.1.3 Selection of Potential Sites

Potential sites are those sites within a candidate area that have been identified by an applicant for preliminary assessment in establishing candidate sites (NRC 2000). Within the nine candidate areas, PEF used aerial photographs and other geographic information to identify potential sites for its planned new nuclear units.

In the first phase of the potential site-selection process, PEF used the following considerations to identify a number of general siting areas within the candidate areas (PEF 2009g):

- at least one potential site for each major water source

- proximity to transmission/load centers
- avoidance of high-population areas in the area
- consideration of ecologically sensitive and special designation areas, both along the coast and river corridors (e.g., Outstanding Florida Waters as defined by the FDEP(2009a)
- proximity to transportation (e.g., railroad lines, barge terminals)
- diversity of potential sites within the ROI (coastal and inland waterways)
- areas particularly compatible with PEF's business objectives.

PEF then searched within the general siting areas to identify potential sites, using the following factors:

- flexibility to optimize site layout and design to minimize costs and to avoid or mitigate environmental impacts
- minimization of the number of land parcels contained within the site
- optimization of site engineering factors (e.g., topography, foundation conditions, grading requirements).

Finally, the following criteria were applied in locating potential sites (PEF 2009a):

- distance to existing transmission-load centers in the Orlando and Tampa/St. Petersburg areas was minimized to the extent possible.
- distance from towns, villages, and developed areas was maximized.
- distance from industrial areas identifiable from the aerial photographs and topographic maps (e.g., airports, industrial complexes) was maximized.
- when possible, land near existing water-supply sources (rivers, lakes, and coastal areas) was identified.
- the optimal topography was assumed to be a relatively flat area above the 100-year floodplain for construction of the plant, adjacent to streams with surrounding topography showing some relief.
- vehicle transportation access to the potential sites was qualitatively evaluated. Land areas around major highways were avoided, but those within a reasonable distance of State highways were considered.
- potential sites were generally 6000 ac in size, although some sites as small as 2000 ac were considered (PEF 2009a). PEF selected 20 potential sites for new nuclear units based mainly on the availability of sufficient land for two AP1000 reactors and the availability of sufficient cooling water for the units. As shown in Figure 9-1, the 20 potential sites are located in the following counties: Calhoun, Liberty (two sites), Gilchrist, Putnam (three sites), Volusia,

Seminole, Highlands and Glades, Manatee, Hillsborough, Citrus, Levy (three sites), Dixie, Lafayette, Taylor, and Gulf (PEF 2009a).

9.3.1.4 Selection of Candidate Sites

Candidate sites are those potential sites within the ROI that are considered in the comparative evaluation of sites to be among the best that can reasonably be found for the siting of a nuclear power plant (NRC 2000).

PEF's technical evaluation and screening of the 20 potential sites were based on criteria derived from the EPRI Siting Guide (EPRI 2002) as well as PEF staff expertise on transmission issues, environmental issues, community support, economic development, and State and local regulations at each of the sites. The following nine screening criteria were used to select candidate sites:

- availability of an adequate cooling-water supply
- flooding potential
- distance to nearest population center and regional population density
- distance from hazardous land uses (e.g., airports, pipelines)
- numbers of threatened or endangered species within the site area
- acreage of wetlands within the site area
- railroad access
- transmission-line access
- estimated cost of acquiring the land at the site.

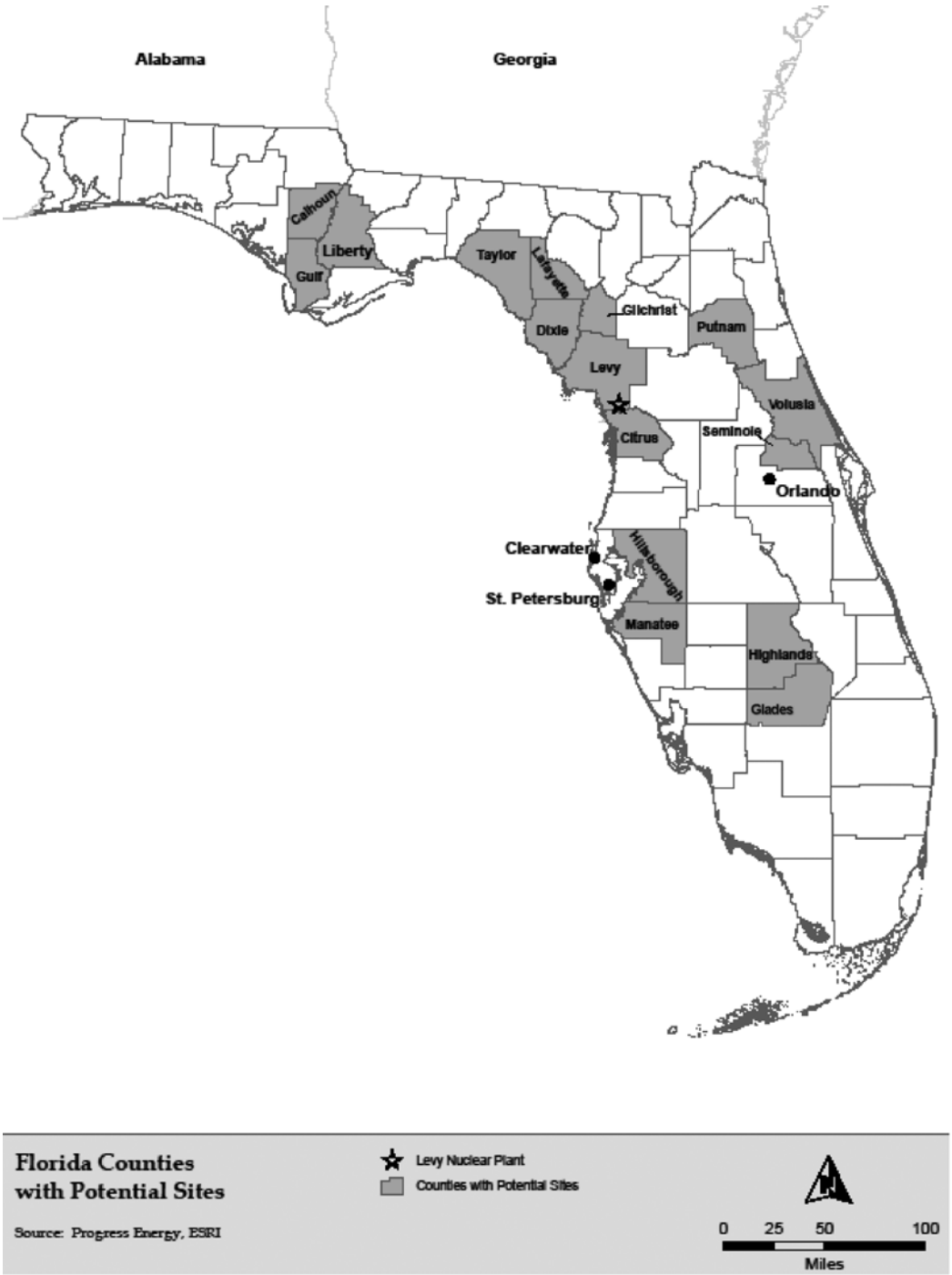

Figure 9-1. Map Highlighting the Florida Counties in Which the Top 20 Potential Sites for New Nuclear Units Are Located (need reference)

Numerical ranges were defined for each of the nine criteria. For example, for the wetlands criterion, the metric used in the screening process was the number of acres of wetlands within the potential site area, and the following ratings were defined (PEF 2009a):

- 5 = less than 60 ac
- 4 = less than 300 ac
- 3 = less than 600 ac
- 2 = less than 1200 ac
- 1= greater than 1200 ac

Each of the 20 potential sites was assigned a rating of 1, 2, 3, 4, or 5 on the wetlands criterion, and a rating was also assigned for the other eight screening criteria. PEF staff obtained criteria weights from previous nuclear power plant siting studies to reflect the relative importance of each criterion. The overall score for each potential site, reflecting its overall suitability for construction of a nuclear power plant, was developed by multiplying each criterion rating by its corresponding criterion weight, and then summing over all nine criteria. The potential sites with the highest overall scores were selected for more detailed analysis (PEF 2009g).

PEF's technical evaluation identified the following eight candidate sites for more detailed evaluation:

- Crystal River
- Dixie
- Gilchrist
- Hillsborough
- Lafayette
- Levy 2
- Levy 3
- Taylor.

For the reasons described below, PEF decided to make several modifications to the initial list of candidate sites (PEF 2009a):

Gilchrist was removed from the list due to the need for a supplemental reservoir and related water supply constraints.

Hillsborough was removed from the list due to water supply uncertainties and potential transmission connection constraints.

Putnam 3 was added to the list based on its location allowing an alternative water source (St. Johns River), proximity to PEF load centers, rail and transmission access advantages, and real estate considerations.

Highlands was added to the list based on its location allowing an alternative water source (Kissimmee River) and proximity to PEF load centers.

So the final list of eight candidate sites selected by PEF for more detail evaluation was as follows (PEF 2009a):

Crystal River

Dixie

Highlands

Lafayette

Levy 2

Levy 3

Putnam 3

Taylor

9.3.1.5 Selection of Alternative Sites

The next step in the site-selection process was to select from the eight candidate sites a suite of alternative sites for detailed evaluation and consideration. General siting criteria derived from the EPRI Siting Guide (EPRI 2002) were tailored to specific issues applicable to the candidate sites. PEF used 40 criteria related to health and safety (e.g., geology and seismology, extreme weather conditions, surface-water radionuclide pathway), environmental considerations (e.g., disruption of important species/habitats, dewatering effects on adjacent wetlands, thermal discharge effects), socioeconomics (e.g., construction-related effects, operations-related effects, environmental justice), and engineering and cost considerations (e.g., pumping distance, highway access, land rights) to screen the candidate sites and identify the five alternative sites.

The process used for this more-detailed analysis was analogous to the process described in Section 9.3.1.4. Each of the eight candidate sites was assigned a rating from 1 to 5 on each of the 40 criteria. PEF staff obtained criteria weights from other siting studies to reflect the relative importance of each criterion. The overall score for each candidate site, reflecting its overall suitability for construction of a nuclear power plant, was developed by multiplying each criterion rating by its corresponding criterion weight, and then summing over all 40 criteria (PEF 2009a). In addition to this quantitative analysis, helicopter flyovers of the sites provided additional input to the decision (PEF 2009g).

Following this analysis, PEF selected the following alternative sites:

- Crystal River
- Dixie
- Highlands
- Levy 2
- Putnam 3.

The other three candidate sites (Taylor, Levy 3, and Lafayette) were dropped from further consideration based on a number of factors. Even though Taylor had ranked in the top 5 sites using the 40-criteria evaluation, Taylor, along with Levy 3, would require extended pipelines in estuarine areas between the sites and the Gulf of Mexico, which could result in permitting and regulatory concerns. Both sites are also located along the coast, which makes them vulnerable to storm surge flooding. The Lafayette site would require zoning and land-use changes due to existing residential and recreational land uses. In addition, the Lafayette site has lower water flows than the Dixie site (PEF 2009a).

9.3.1.6 Selection of the Proposed Site

To screen the five alternative sites to identify a proposed site, PEF performed a technical evaluation of each alternative site that included the following components: transmission-line evaluations, geotechnical studies, environmental assessments, reliability analyses, and land-acquisition analyses. PEF's evaluations considered the land-use, water-related, ecological, and socioeconomic impacts of locating two new reactors at each of the five alternative sites. PEF concluded that all five alternative sites represented a cross-section of siting tradeoffs available within the ROI, including a variety of water sources, locations, and transmission connection strategies (PEF 2000a). The Crystal River and LNP sites were ranked highest mainly due to geological conditions and the availability of cooling-water sources (PEF 2009a).

PEF also evaluated whether the advantages of collocating new nuclear power-generating units with its existing power plant at the Crystal River site outweighed the potential advantages of the other alternative sites. The following potential advantages of collocation were identified in the application (PEF 2009a):

- The total number of required power-generating sites is reduced.
- Construction of new transmission-line corridors may not be required due to potential use of existing corridors.
- No additional land acquisitions would be necessary because PEF already controls the property.

- The site has already gone through the alternatives review process mandated by NEPA, and was the subject of extensive environmental screening during the original site-selection process.
- The site-development costs and environmental impacts of any preconstruction activities would be reduced.
- Construction, installation, and operation and maintenance costs would be reduced because of the existing site infrastructure.

However, strategic considerations indicated the LNP site would be preferable to the Crystal River site because it is located farther from the Gulf Coast and at a higher elevation. Thus, the LNP site would provide increased protection from wind and flood damage over the Crystal River site. In addition, adding new nuclear generating capacity at the CREC would result in a significant concentration of PEF's generating assets at one location, which would make the PEF system overly vulnerable to a major hurricane or other natural disaster. On the basis of its environmental analysis and strategic business considerations, PEF selected the Levy 2 area as its proposed site.

9.3.1.7 Review Team Evaluation of PEF's Site-Selection Process

The review team evaluated the methodology used by PEF to select its proposed and alternative sites. PEF's designated ROI is consistent with the description in NRC's guidance for preparation of ERs for nuclear power stations (NRC 2000). PEF established candidate areas based on a group of exclusionary criteria similar to those described in ESRP 9.3. The staff evaluated the exclusionary criteria and determined that they were reasonable. Next PEF identified potential sites within the candidate areas based on aerial photographs and other geographic information, and evaluated them against a set of high-level criteria. PEF then used more specific criteria to evaluate the potential sites and identify candidate sites, including the alternative sites and its preferred site. The staff reviewed the specific criteria used to identify potential sites, candidate sites, and alternate sites and concluded that application of the criteria would result in the identification of alternate sites that are among the best that can reasonably be found in the candidate areas. Additionally, the staff reviewed the technical evaluation used to evaluate each of the identified alternative sites and found the criteria and the application of the criteria to each alternative site reasonable.

Based on its review of PEF's site-selection process using NRC's guidance, the review team concludes that PEF's process for selecting its ROI, candidate areas, potential sites, candidate sites, alternative sites, and the proposed LNP site was reasonable; resulted in the identification of alternative sites that were among the best that could reasonably be found in the region of interest; did not arbitrarily exclude locations that might be suitable choices for siting two new nuclear generating units to satisfy the need for power identified in Chapter 8; and was consistent with the guidance in ESRP 9.3 and the EPRI siting guidance (EPRI 2002).

9.3.1.8 Evaluation of the Alternative Sites

The four alternative sites examined in detail in this chapter are Crystal River, located in Citrus County; Dixie, located in Dixie County; Highlands, located in Highlands and Glades counties; and Putnam, located in Putnam County – all in Florida. The NRC staff visited each of the four alternative sites and the proposed site. The review team used information in PEF's ER related to the four alternative sites and also independently collected and analyzed reconnaissance-level information for each of the alternative sites using ESRP 9.2 (NRC 2000) as guidance.

In the discussion of the alternative sites that follows, the review team evaluated cumulative impacts of building and operating two new nuclear units at each site for each resource category, considering the impacts of other nearby projects on that resource. Included in the cumulative analysis are past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts with the proposed action. For purposes of this analysis, the past is defined as the time period before receipt of the COL application. The present is defined as the time period from the receipt of the COL application until the start of building the proposed Units 1 and 2. The future is defined as the start of building Units 1 and 2 through operation and eventual decommissioning.

Using Chapter 7 as a guide, the specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the alternative site and other actions in the same geographic area were identified. The affected environment that serves as the baseline for the cumulative impacts analysis is described for each alternative site and includes a qualitative discussion of the general effects of past actions. For each resource area, the geographic area over which past, present, and future actions could reasonably contribute to cumulative impacts is defined and described in later sections. The analysis for each resource area at each alternative site concludes with a cumulative impact finding (SMALL, MODERATE, or LARGE). For those cases in which the impact level for a resource was greater than SMALL, the review team also discussed whether building and operating the nuclear units would be a significant contributor to the cumulative impact. In the context of this evaluation, "significant" is defined as a contribution that is important in reaching that impact-level determination.

The nonradiological waste impacts described in Sections 4.10 and 5.10 would not vary significantly from one site to another. The types and quantities of nonradiological and mixed waste would be approximately the same for the construction and operation of two AP1000 reactors at any of the alternative sites. For each alternative, all wastes destined for land-based treatment or disposal would be transported offsite by licensed contractors to existing, licensed, disposal facilities operating in compliance with all applicable Federal, State, and local requirements, and all nonradioactive, liquid discharges would be discharged in compliance with the provisions of the applicable NPDES permit. For these reasons, these impacts are not discussed separately in the evaluation of each alternative site.

The impacts described in Chapter 6 (e.g., nuclear fuel cycle, decommissioning) would not vary significantly from one site to another. This is true because all of the alternative sites and the proposed site are in low-population areas and because the review team assumes the same reactor design (therefore, the same fuel-cycle technology, transportation methods, and decommissioning methods) for all of the sites. As such, these impacts would not differ between the sites and would not be useful in the determination of whether an alternative site is environmentally preferable to the proposed site. For this reason, these impacts are not discussed in the evaluation of the alternative sites.

The cumulative impacts are summarized for each resource area at each site in the sections that follow. The level of detail is commensurate with the significance of the impact for each resource area. The findings for each resource area at each alternative site then are compared in Table 9-31 at the end of this chapter to the cumulative impacts at the proposed site (brought forward from Chapter 7). The results of this comparison are used to determine if any of the alternative sites is environmentally preferable to the proposed site.

9.3.2 Crystal River Site

This section covers the review team's evaluation of the potential environmental impacts of siting a new two-unit nuclear power plant adjacent to the CREC. The CREC is located in a rural area of Citrus County about 9 mi southwest of the LNP site, approximately 5 mi south-southwest of Inglis, and about 8 mi northwest of Crystal River. The Crystal River alternative site (hereafter Crystal River site) proposed for additional units would be located adjacent to the current CREC footprint on land owned by PEF. The Gulf of Mexico would be the source for water for plant cooling and other plant uses, and construction of a new water-storage reservoir would not be required. The CREC is an industrial site currently owned and operated by PEF (PEF 2009a). Conceptual routes of transmission lines necessary to connect the Crystal River site to the electrical grid are located in Levy, Citrus, Ocala, Sumter, Lake, and Hernando Counties.

The following sections include a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the Crystal River site and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction and operations and impacts of preconstruction activities. Also included in the assessment are past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Crystal River site. Other actions and projects considered in this cumulative analysis are described in Table 9-6.

Table 9-6. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Cumulative Analysis of the Crystal River Alternative Site

Project Name	Summary of Project	Location	Status
Energy Projects			
Operation and decommissioning of CREC Units 1 to 5	The CREC consists of five power-generating plants operated by PEF, four fossil-fuel plants, and one nuclear plant. The fossil-fuel plants began operations in 1966, 1969, 1982, and 1984. The nuclear plant began operations in 1977.	Adjacent to the Crystal River site	Operational. The State of Florida's Siting Board's Conditions of Certification for LNP would require PEF to discontinue the operations of two fossil-fuel units by December 31, 2020, assuming licensing, construction and commencement of operation of LNP occurs in a timely manner (DOE/EIA 2010; FDEP 2010a).
Renewal of the CREC nuclear Unit 3 Operating License,	Extension of operations of CREC Unit 3 for an additional 20-year period beyond the end of the current license term, which is valid through midnight December 3, 2016.	Adjacent to the Crystal River site	Proposed. If granted, the license renewal would provide PEF the authority to continue operations through 2036. The draft Supplemental EIS for the license renewal is scheduled to be issued in 2010 (NRC 2010al).
Uprate at CREC Unit 3	CREC Unit 3 is planning to request a power uprate or increase in the maximum power level at which the nuclear power plant may operate. The project would also include construction of a new helper cooling tower.	Adjacent to the Crystal River site	Proposed. The application submitted to the State of Florida was approved in August 2008. USACE issued a public notice on May 25, 2010 (USACE 2010a). A Federal application is expected to be submitted to NRC in 2010 (PEF 2009f).

Table 9-6 (contd)

Project Name	Summary of Project	Location	Status
Inglis Lock bypass channel spillway hydropower project	2-MW hydroelectric project at the existing Inglis Lock bypass spillway. This project would include construction of an intake structure, intake and discharge channels, turbines, and a transmission line.	About 5 mi northeast of the Crystal River site	Proposed. An application has been submitted to the Federal Energy Regulatory Commission (FERC 2009).
Florida Gas Transmission Company, LLC (FGT) Phase VIII Expansion Project	Construction and expansion of natural-gas pipelines, new compressor, meter, regulator stations, and other appurtenant facilities	Various Counties in Alabama and Florida, including Levy, Citrus, and Hernando. Route passes 2 mi east of Crystal River site.	Completion expected by 2011 (FERC 2010; Panhandle Energy 2010).
Mining Projects			
Tarmac King Road Limestone Mine	A 9400-ac aggregate mining site. The mining site would be 4900 ac (including 900 ac set aside for wetlands); with remaining 4500 ac donated to Florida for preservation.	The southern border of the site is about 8 mi north-northeast of the Crystal River site	Proposed. A permit application was submitted to USACE in September 2007. A draft EIS is expected to be completed in 2010 (USACE 2008; PEF 2009e).
Holcim Mine	Limestone quarry	About 1 mi north of the Crystal River site	Operational (FDEP 1997)
Inglis Quarry	Limestone quarry	About 3 mi north of the Crystal River site	Operational (EPA 2010a)
Crystal River Quarries – Red Level	Limestone quarry	About 3 mi east of the Crystal River	Operational (EPA 2010b)

Table 9-6 (contd)

Project Name	Summary of Project	Location	Status
		site	
Crystal River Quarries – Lecanto	Limestone quarry	About 16 mi east-southeast of the Crystal River site	Operational (EPA 2010c)
Gulf Hammock Quarry	Limestone quarry	About 19 mi north of the Crystal River site	Operational (EPA 2010d)
Transportation Projects			
Cross Florida Barge Canal (CFBC)/ Marjorie Harris Carr Cross Florida Greenway	The CFBC was a proposal to connect the Gulf of Mexico to the Atlantic Ocean. Two sections were partially constructed between 1964 and 1971. A constructed section extends westward from Lake Rousseau to the Gulf of Mexico. Portions of the CFBC are currently used as part of the Marjorie Harris Carr Cross Florida Greenway (FDEP 2010b).	About 3 mi north of the Crystal River site	Operational downstream of Lake Rousseau. Marjorie Harris Carr Cross Florida Greenway is currently managed as a protected greenbelt corridor. Construction was suspended January 1971 (FDEP 2010b).
Parks and Aquaculture Facilities			
Parks, forests, and reserves	Numerous State and national parks, forests, reserves, and other recreational areas, including: Goethe State Forest, Big Bend Seagrasses Aquatic Preserve, St. Martens Marsh, Fanning Springs State Park, Chassahowitzka National Wildlife Refuge, Fort Cooper State Park, Cedar Keys National Wildlife Refuge; Cummer Sanctuary, Crystal River National Wildlife Refuge, Lower Suwannee National	Throughout 50-mi region	Development likely limited in these areas (PEF 2008).

Table 9-6 (contd)

Project Name	Summary of Project	Location	Status
	Wildlife Refuge; Withlacoochee State Forest; Ocala National Forest; Crystal River Preserve State Park; Silver River State Park; and the Homosassa Springs Wildlife State Park.		
Crystal River Mariculture Center	Multi-species marine hatchery	Adjacent to Crystal River site	Operational (FFWCC 2010)
Other aquaculture facilities	Multi-species marine hatcheries	Throughout region	Operational
Other Actions/Projects			
Commercial forest management	Managed forests for timber production.	Throughout region	Operational
Commercial dairies	Several dairies are located within the 50-mi region, including the Levy County Dairy, Alliance, and Piedmont Dairies, Hill Top Dairy, and Oak Grove Dairy, Inc.	Throughout region	Operational
Minor water dischargers and wastewater-treatment plants	NPDES-permitted dischargers in Fanning Springs, Trenton, Blitchville, Bell, Chiefland, Cedar Key, Suwannee, and other locations.	Throughout region	Operational
Concrete companies	Two ready-mixed concrete suppliers.	Northern Levy County	Operational (EPA 2010e, f)
Various hospitals and industrial facilities that use radioactive materials	Medical and other industrial isotopes	Within 50 mi	Operational in nearby cities and towns
Future urbanization	Construction of housing units and associated commercial buildings such as the proposed Port District near Inglis; roads, bridges, and railroads, such as the Suncoast toll road expansion and the US-19 bridge and highway expansions; construction of water- and/or	About 3 mi north of the CREC and throughout region	Construction would occur in the future, as described in local land-use planning documents (FTE 2010; FDOT 2010a, b; Citrus County 2009).

Table 9-6 (contd)

Project Name	Summary of Project	Location	Status
	wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.		

The geographic area of interest for cumulative impacts considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Crystal River site. An accident at a nuclear plant within 100 mi of the Crystal River site could potentially increase this risk. However, other nuclear plants in Florida, Alabama, and Georgia that are more than 100 mi from the Crystal River site are not included in the cumulative impact analysis.

9.3.2.1 Land-Use Impacts

The following analysis includes impacts from building and operating two nuclear units at the Crystal River site, along with the necessary transmission lines to connect them to the electrical grid. The analysis also considers other past, present, and reasonably foreseeable future actions that affect land use, including the other Federal and non-Federal projects listed in Table 9-6. For this analysis, the geographic area of interest is the area within the 15-mi radius of the Crystal River site and the area within the transmission-line corridors. The review team determined that a 15-mi radius would represent the smallest area that would be directly affected because it includes the primary communities (such as Crystal River, Homossassa Springs, Inglis, and Yankeetown) that would be affected by the proposed project if it were located at the Crystal River site.

Historically, Citrus County was known for mining and timber operations as well as its namesake citrus orchards, but today only one large grove remains. From 1964 to 1972, the CFBC was partially constructed from the Gulf of Mexico to Lake Rousseau. Currently, this area and other lands that were acquired to construct the CFBC are managed as the Marjorie Harris Carr Cross-Florida Greenway to conserve natural resources and provide recreational opportunities. Construction of the CREC, which consists of five power-generating plants operated by PEF, four fossil-fuel plants, and one nuclear plant, began in the 1960s. The fossil-fuel plants began operations in 1966, 1969, 1982, and 1984. The 860-MW nuclear plant began operations in 1977. From 1960 until 1985, the population of Citrus County increased from about 10,000 to about 70,000, and the population of Levy County increased from about 10,000 to about 22,000 (USCB 2000a). Thus, residential land use in the region increased dramatically during that period.

The Crystal River site is adjacent to the existing CREC and has level terrain that gradually slopes west toward the Gulf of Mexico. The land uses in the region are a mix of industrial development, agriculture, forestry, and mining. The site already includes both nuclear and fossil-fuel power plants, so zoning is compatible with additional nuclear power-generating plants. The Crystal River site is subject to the Florida Coastal Management Act (The Florida Senate 2009), because the plant is located within one of the designated Florida coastal zone counties. There are several public properties within the region, including the Goethe State Forest, Cedar Keys National Wildlife Refuge, Cummer Sanctuary, Crystal River National Wildlife Refuge, Lower Suwannee National Wildlife Refuge, Withlacoochee State Forest, Ocala National Forest, Crystal River Preserve State Park, Fanning Springs State Park, Silver River State Park, Chassahowitzka National Wildlife Refuge, Fort Cooper State Park, and Homosassa State Park (PEF 2009a).

PEF would not have to acquire new land for the siting of new nuclear reactor units at Crystal River. Like the LNP site, the footprint of new power-generating units would be approximately 627 ac, with about 150 ac of additional land needed for temporary facilities and laydown yards. Because the Crystal River site already has been developed as a power station, the review team expects additional land conversions to industrial or utility use would be minimal.

Additional land-use impacts include possible additional growth and land conversions to accommodate new workers and services. Because the workforce would be dispersed over larger geographic areas in the labor supply region, the impacts from land conversion for residential and commercial buildings induced by new workers relocating to the local area can be absorbed into the wider region. Therefore, the review team concludes that such impacts would be minimal.

Although transmission-line corridors exist to serve the Crystal River site, approximately 180 mi of additional transmission system infrastructure would be needed. The review team estimated the linear run of the expected transmission-line corridors by referring to PEF Figure 3.3.3-6 (PEF 2010), which depicts the potential routing of corridors needed to connect the CREC units to the grid. In the case of Crystal River, this routing is somewhat similar to that described for LNP Units 1 and 2 in Section 4.1.2 and would amount to about 180 linear miles. For purposes of land-use impact analysis, the review team made the assumption that 10 ac/mi would be disturbed, based on the LNP case where 1790 ac are expected to be disturbed over the 180 mi of corridor, as discussed in Section 4.1.2. The review team concludes that this assumption is reasonable because siting in Florida through the Site Certification Application process is a rigorous process and the applicant would be bound by permit conditions resulting from that process, which would force it to use existing corridors to the extent practicable. The review team expects the FDEP Conditions of Certification for the LNP site (FDEP 2010a) would be consistently applied anywhere transmission lines are proposed in Florida, which would lessen the overall environmental impacts.

As stated above, the State of Florida requires that new transmission lines be collocated within existing transmission-line corridors to the extent possible, thereby minimizing potential terrestrial impacts (FDEP 2010a). In addition, transmission-line corridors, towers, and access road would be situated to avoid critical or sensitive habitats and species and historical and cultural resources to the extent possible. Transmission-line corridor width would be dependent on the size, voltage, and whether existing corridors could be used, and would vary from 55 ft to 460 ft. These widths were used in the analysis of the hypothetical routes for each alternative site to determine land-use cover types (CH2M Hill 2009). Existing transmission-line corridors run through counties designated under the Florida

Coastal Management Program (FDEP 2009b).[(a)] Any expansion of these transmission-line corridors would require review under the procedures established under the Florida Coastal Zone Management Act (The Florida Senate 2009). Procedures for siting new transmission lines in Florida are discussed in Section 4.1.2. The review team assumes that the conditions of certification issued to PEF by the FDEP would apply at all of the alternative sites. Similar to the case at the LNP site, the review team concludes that land-use impacts from developing about 180 mi of new transmission-line corridor to connect new units at the Crystal River site would be noticeable, but not destabilizing, and additional mitigation beyond the measures identified by PEF and conditions identified by the State of Florida would not be warranted.

Cumulative Impacts

Within the geographic area of interest, the reasonably foreseeable project with the greatest potential to affect cumulative land-use impacts would be the Tarmac King Road Limestone Mine. The 4900-ac mine site is located 1 mi west of the intersection of U.S. Highway 19 (US-19) and King Road in Levy County, within about 8 mi of the Crystal River site. About 2700 ac would be mined over about a 100-year period, with an additional 1300 ac disturbed to site a quarry processing plant, roads, and other infrastructure. The company plans to donate another 4500 ac of land to the State of Florida for preservation. Tarmac America LCC (Tarmac) has applied for permits to begin construction of the mine in 2011, with operations targeted to begin in 2013. Tarmac estimates that at the height of mining activity, about 500 trucks would leave the mine site daily and enter US-19 (Tarmac America 2010). The potential impacts from this increased traffic, coupled with traffic from the CREC site, are considered in Section 9.3.2.5. Completion of the new US-19 bridge and highway expansion in the fall of 2010 would alleviate some of the traffic issues. Because the mine would include less than 7 percent of the geographic area of interest, excluding the Gulf water area, the review team expects that the proposed Tarmac mine would have a detectable, but not noticeable, effect on land use.

(a) The Florida Coastal Management Program makes funds awarded under the Coastal Zone Management Act available as pass-through grants to State agencies, water-management districts, local governments, national estuary programs, and national estuarine research reserves for priority projects that protect coastal resources and communities.

In the State of Florida's Conditions of Certification (FDEP 2010a), CREC Unit 1 and 2, two coal-fired plants, would stop operating by December 31, 2020, as long as PEF completes the licensing process, construction activities, and commences commercial operation of LNP Units 1 and 2 within a timely manner. If the Crystal River site were selected, the review team expects the same condition would apply. If CREC Units 1 and 2 are shut down, land use at the units likely would remain industrial. Depending on economic conditions, PEF sells 60 to 95 percent of the coal plant ash to cement and building materials manufacturers, with the remainder going to Citrus Central Landfill in Lecanto, Florida. With the closure of CREC Units 1 and 2, this source of ash no longer would be available locally. The review team expects land-use impacts associated with this project would be minimal.

Future urbanization in the review area could contribute to additional decreases in open areas, forests, and wetlands and generally result in some increased residential and industrialized areas. Currently, only about 18 percent of Citrus County is in residential land use (PEF 2008), but local land-use planning documents describe future construction of residential and commercial buildings. The University of Florida, Bureau of Economic and Business Research (BEBR) projects that the Citrus County population will increase approximately 40 percent from 2000 to 2020, which constitutes an average annual increase of about 2 percent (Citrus County 2005).

Increased urbanization, especially long linear projects such as new or expanded roads or pipelines also would contribute to the loss of open or forested areas and increase fragmentation of habitats along or near the transmission lines. Due to the extent of new transmission lines that would be built, the review team expects that the corridors would have a noticeable impact on the local area. The Florida Department of transportation (FDOT) currently plans to expand the US-19 bridge and the Suncoast toll road. Florida Gas Transmission Company proposes to expand its liquefied natural gas (LNG) pipeline collocated with the existing pipeline in the vicinity of the Crystal River site. These projects would have limited impacts on land use because a small incremental amount of land would be converted to a new land use, and it would be adjacent to the current roads or pipelines. Development would likely be limited in the nearby Goethe State Forest and other parks and recreational areas. Therefore, the incremental impacts associated with increased urbanization would be minimal.

Global climate change could increase temperature and reduce precipitation, which could result in reduced crop yields and livestock productivity (GCRP 2009), which, in turn, may change portions of agricultural and ranching land uses in the geographic area of interest. In addition, global climate change could increase sea level and storm surges in the geographic area of interest (GCRP 2009), thereby changing land use through inundation and loss of coastal wetlands and other low-lying areas. However, existing State and national forests, parks, reserves, and managed areas would help preserve wetlands and forested areas to the extent that they are not affected by sea-level rise. Because other projects identified in Table 9-6 that are within the geographic area of interest would be consistent with applicable land-use plans

and control policies and would occur in dispersed locations, the review team considers their contribution to the cumulative land-use impacts to be relatively minor and manageable.

Because detailed information about the routing of the possible new transmission-line corridors is not known at this time, a complete evaluation of potential land-use impacts cannot be made. Based on the information provided by PEF and the review team's independent review, the review team concludes that the cumulative land-use impacts of building and operating two new nuclear power units at the Crystal River site and other projects would be MODERATE. The incremental impact from the proposed project would be a significant contributor to the MODERATE impacts due to the extent of new transmission lines that would be built.

9.3.2.2 Water Use and Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that could affect water use and quality, including the other Federal and non-Federal projects listed in Table 9-6.

The geographic area of interest for surface water at the Crystal River site includes the Gulf of Mexico and the Springs Coast watershed in the vicinity of the site and for groundwater, the surficial aquifer at the site and the Upper Floridan aquifer within 20 mi of the site. These regions are of interest because they represent the water resource potentially affected by building and operating the proposed project at the Crystal River site.

Building Impacts

PEF has not determined whether new cooling-water intake and discharge structures would be required for the Crystal River site, but use of the existing intake configuration for existing CREC Units 4 and 5 and the existing discharge canal are likely sites for these respective structures. CREC Units 4 and 5 use water discharged from CREC Units 1 to 3 for cooling water, and the effluents may be a possible source of cooling water for the additional two units (CH2M Hill 2009). Similarly, the discharge canal receives discharge from all five existing units, and the discharge for the additional two units could outfall into the existing canal, or tie into blowdown pipelines from one of the existing units.

Consistent with the proposed water use at the LNP site, the review team assumed that no surface water would be used to build the units at the Crystal River site. Therefore, the review team determined that there would be no impacts on surface-water use.

Wetlands located on or adjacent to the site could be affected by surface-water runoff during site preparation and the building of the facilities. The FDEP would require PEF to develop an Erosion and Sediment Control Plan (E&SCP) and a stormwater pollution prevention plan (SWPPP) (PEF 2009a). These plans would be developed before initiation of site-disturbance

activities and would identify control measures to be used during site-preparation activities to mitigate erosion and control stormwater runoff (PEF 2009a). The plan would identify BMPs to control stormwater runoff. The review team anticipates that PEF would construct new detention and infiltration ponds and drainage ditches to control delivery of sediment from the disturbed area to onsite waterbodies. Sediment carried with stormwater from the disturbed area would settle in the detention ponds and stormwater would infiltrate into the shallow aquifer. Implementation of BMPs should minimize impacts on bodies of surface water near the Crystal River site. Therefore, the impacts on surface-water quality near the Crystal River site would be temporary and minimal.

The review team assumes that the groundwater use for building activities at the Crystal River site would be identical to the proposed groundwater use for the LNP site. During building, the maximum groundwater withdrawal rate is projected to be 550,000 gpd and the projected average groundwater withdrawal rate would be 275,000 gpd (see Table 3-2). Groundwater would be used for potable and sanitary use as well as various building-related activities. The groundwater withdrawal rate during building activities would be less than the potential operation withdrawal rate. PEF provided no specific information about where it would obtain water for building the units at the Crystal River site. However, PEF currently draws water from the Upper Floridan aquifer for the operation of the existing units at the CREC (PEF 2008). The U.S. Geological Survey (USGS) estimates that the current groundwater withdrawal in Citrus County to be about 30 Mgd (PEF 2007a). The additional water that would be withdrawn to build the new units would be a small fraction of this current withdrawal. The review team concludes that the impact of groundwater use for building the potential plant at the Crystal River site would be minimal and limited to the building period.

While building the potential plant at the Crystal River site, groundwater quality may be affected by leaching of spilled effluents into the subsurface. The review team assumes that the BMPs PEF has proposed for the LNP site would also be in place at the Crystal River site during building activities and therefore the review team concludes that any spills would be quickly detected and remediated. In addition, groundwater impacts would be limited to the duration of these activities, and therefore, would be temporary. The review team examined the BMPs that could be implemented at such a site (FDEP 2010a). Because any spills related to building activities would be quickly remediated under BMPs, and the activities would be temporary, the review team concludes that the groundwater-quality impacts from building at the Crystal River site would be minimal.

Operational Impacts

PEF has proposed a closed-cycle cooling system for two additional units at the LNP site. PEF indicated that the Gulf of Mexico would be the source of cooling water. The review team assumed that the cooling water system for the proposed units, if they were to be built and operated at the Crystal River site, would be similar to that proposed at the LNP site; specifically,

the cooling water system would use cooling towers. The blowdown discharge from the additional units would be mixed with the CREC discharge. Because the two additional units at the Crystal River alternative site would also withdraw makeup water for their closed-cycle cooling systems, the review team assumed that the makeup water withdrawal rate and the blowdown discharge rate would be the same as that at the LNP site, specifically 84,780 gpm (190 cfs) and 57,923 gpm (129 cfs), respectively.

Because the Gulf of Mexico is a virtually unlimited source of water, the review team determined that the use of Gulf of Mexico waters for cooling the additional units at the Crystal River site would have a minimal impact. Therefore, the impact on surface-water resources due to plant use during operations would not be noticeable.

During the operation of the additional units at the Crystal River site, impacts on surface-water quality could result from stormwater runoff, discharges of treated sanitary and other wastewater, and blowdown from cooling towers into the Gulf of Mexico. The FDEP would require PEF to develop a SWPPP (PEF 2009a). The plan would identify measures to be used to control stormwater runoff (PEF 2009a). The blowdown would be regulated by FDEP pursuant to 40 CFR Part 423, and all discharges would be required to comply with limits established by FDEP in an NPDES permit.

The review team analyzed the impact of discharging effluent from the proposed Units 1 and 2 at the LNP site on the CREC discharge canal. The review team determined that the impact on water quality in the Gulf of Mexico would be small if the two proposed units were located at the LNP site. If the proposed units were located at the Crystal River site, the effluent would still be discharged to the Gulf of Mexico via the CREC discharge canal. Therefore, the review team determined that the assessment of surface-water quality impacts for the LNP site (see Section 5.2.3.1) would remain applicable to the Crystal River site. Therefore, the impact on surface-water quality due to operation of additional units at the Crystal River site would be minimal.

PEF currently relies on groundwater at the CREC to meet operational needs for potable water and other plant systems requiring freshwater (PEF 2008). PEF currently has seven active groundwater wells and three inactive groundwater wells at the CREC to supply groundwater to the existing power plants. The wells are currently permitted to withdraw 2 Mgd, and PEF is anticipating increasing the permitted amount by 265,000 gpd once the inactive wells are permitted. As indicated above, the USGS estimates the current groundwater withdrawal in Citrus County to be about 30 Mgd (PEF 2007a).

PEF indicated that the annual average groundwater withdrawal to support operations of two units at the LNP site would be 1.58 Mgd (PEF 2009e). The review team assumes that the groundwater use for operation of additional units at the Crystal River site would be similar to the proposed groundwater use for the LNP site. This would be an increase in groundwater withdrawal in the vicinity of the CREC of approximately 70 percent, and an increase in

groundwater withdrawal in Citrus County of approximately 5 percent. Permits would be required for the additional withdrawal and the permitting process would make sure impacts on surrounding users would not be significant (SWFWMD 2010).

During the operation of the additional units at the Crystal River site, impacts on groundwater quality could result from accidental spills. Because BMPs would be used to quickly remediate spills and no intentional discharge to groundwater would occur, the review team concludes that the groundwater-quality impacts from operation of the additional units at the Crystal River site would be minimal.

Cumulative Impacts

In addition to water-use and water-quality impacts from building and operations activities, cumulative analysis considers past, present, and reasonably foreseeable future actions that affect the same water resources.

The geographic area of interest for surface water includes the Gulf of Mexico in the vicinity of the Crystal River site. The geographic area of interest for groundwater includes the surficial aquifer at the site and the Upper Floridan aquifer in the region. These areas are of interest because they represent the water resource potentially affected by building and operating the additional units at the Crystal River site. Key actions that have past, present, and future potential impacts on water supply and water quality near the Crystal River site include the operation and decommissioning of the existing units at the CREC and the power uprate proposed for Unit 3 at the CREC.

The FDEP Conditions of Certification for the LNP Units 1 and 2 (FDEP 2010a) indicate that Crystal River Unit 1 and Unit 2 may cease to be operated as coal-fired units by December 31, 2020. The document indicates the shutdown of these units may be linked to the startup of the proposed units. If the additional units are located at the Crystal River site, the staff assumes that the same conditions would apply.

Cumulative Water Use

The only surface-water-use impacts of building and operating the additional units at this site are the water demands occurring during operation. Because the Gulf of Mexico is a virtually unlimited source of water supply compared to the makeup-water requirements for additional units at the site and the makeup-water requirements for the other units at the CREC including Unit 3 after the proposed power uprate, the review team determined that the use of water from the Gulf of Mexico would have essentially no impact on surface water. Therefore, the review team concludes that cumulative impacts on surface-water use would be SMALL.

Groundwater would be used during the building and operation of additional units at the LNP site. The analysis included above considered groundwater withdrawal to support the existing units at the CREC and the groundwater withdrawal associated with two additional units at the Crystal

River site. As mentioned above, PEF currently has permits to withdraw 2 Mgd and is anticipating increasing the permitted amount by 265,000 gpd once its inactive wells are permitted. An additional 1.58 Mgd (PEF 2009e) would be required to operate the additional units at the Crystal River site. Permits would be required for the additional withdrawal and the permitting process would make sure impacts on surrounding users would not be significant, or, otherwise alternative sources of freshwater would need to be developed (SWFWMD 2010). Therefore, the review team concludes that cumulative impacts on groundwater use would be SMALL. The impacts of other projects listed in Table 9-6 are either considered in the analysis included above or would have little or no impact on surface-water and groundwater use.

Cumulative Water Quality

As described above, the impacts from building and operating two additional units at the Crystal River site on surface-water quality would be minimal. Other present and reasonably foreseeable future actions in the geographic area of interest of the Crystal River site include the operation of CREC Units 1–5, the renewal of the operating license for Unit 3, and the shutdown of Unit 1 and Unit 2. As discussed in Chapter 7, the areal extent of the influence of these facilities on water quality is small, and the influence of these facilities would be minor in the Springs Coast watershed. The FDEP, under the Federal Water Pollution Control Act (Clean Water Act) Section 305(b), prepares a statewide Water Quality Inventory. The FDEP also identifies impaired waterbodies during this process and lists them on the 303(d) List.

Historically, streams, lakes, estuaries, and bays near the Crystal River site have been listed on the 303(d) list as impaired because of the presence of bacteria, nutrients, low dissolved oxygen, and mercury in fish. Therefore, the review team concludes that past and present actions in the region have noticeably affected the water quality adversely. Based on its evaluation, the review team concludes that the cumulative surface-water-quality impacts would be MODERATE. Building and operating the proposed units at the Crystal River alternative site would not be a significant contributor to these impacts on surface-water quality, because industrial and wastewater discharges from the proposed units would comply with NPDES permit limitations and any stormwater runoff from the site during operations would comply with the SWPPP (PEF 2009a).

As stated in Section 7.2.1.1, global climate change can result in a rise in sea level that may induce saltwater intrusion in the surficial and Floridan aquifers. Projected changes in the climate for the region during the life of the proposed units include an increase in average temperature and a decrease in precipitation. These changes are likely to result in changes to agriculture including crops, pests, and the associated changes in application of nutrients, pesticides, and herbicides that may reach groundwater. As a result, groundwater quality may be altered by the infiltration of chemicals. While the changes in groundwater quality that are indirectly attributable to climate change may not be insignificant, the review team did not identify anything that would alter its conclusion regarding groundwater quality above. The review team

also concludes that with the implementation of BMPs, the impacts of groundwater quality from building and operating two additional units at the Crystal River site would likely be minimal, and therefore, the cumulative impact on groundwater quality would be SMALL. The impacts of other projects listed in Table 9-6 are either considered in the analysis included above or would have little or no impact on surface-water and groundwater quality.

9.3.2.3 Terrestrial and Wetland Resources

Site Description

The following impact analysis includes direct, indirect, and cumulative impacts from construction and preconstruction activities and operations. The analysis also considers past, present, and reasonably foreseeable future actions that affect the terrestrial ecological resources, including the other Federal and non-Federal projects and the projects listed in Table 9-6. For the analysis of terrestrial ecological impacts at the Crystal River site, the geographic area of interest is considered to be a 20-mi-wide radius centered on the Crystal River site and the corridors surrounding the entire length of proposed route for the associated transmission-lines. This area within the 20-mi radius and transmission-line corridor is expected to encompass the ecologically relevant landscape features and species.

The Crystal River site was predominately pine flatwoods before the mid-twentieth century, but most flatwoods have been converted from natural longleaf pine (*Pinus palustris*) and slash pine (*P. elliottii*) communities to managed forests made up of slash pine and loblolly pine (*P. taeda*). The surrounding landscape is predominately rural and habitats are typical of the Gulf Coast Flatwoods ecoregion, consisting of slash pine and remnant longleaf pine with bottomland oak-gum-cypress forest in some low-lying areas along most rivers (EPA 2010l). The site terrain is generally level and gradually slopes west toward the Gulf of Mexico. At an elevation of about 9 ft above sea level, the site is located entirely within the 100-year floodplain. There are also vast coastal estuaries and numerous protected natural areas near the site.

The area immediately surrounding the proposed site is a mix of hardwood hammock forest, pine forest, salt marsh, and freshwater swamp (PEF 2008). Hardwood hammock habitats found on the proposed site are characterized by magnolia (*Magnolia grandiflora*), laurel oak (*Quercus laurifolia*), and blue-beech (*Carpinus caroliniana*), although species composition is varied (PEF 2008). Pine forests on the proposed site are dominated by slash pine and loblolly pine (PEF 2008). The salt marshes on the proposed site are dominated by smooth cordgrass *(Spartina alterniflora)* and black rush *(Juncus roemerianus)* and are typical of coastal marshes of Central western Florida (PEF 2008). Freshwater swamps on the Crystal River site are characterized by pond cypress (*Taxodium ascenduns*), swamp tupelo, (*Nyssa biflora*) and swamp ash (*Fraxinus pauciflora*) (PEF 2008).

Common wildlife, including important species, that are known to occur in the habitats present on the Crystal River site include American alligator (*Alligator mississippiensis*); Florida white-tailed

deer (*Odocoileus virginianus seminolus*); bobcat (*Lynx rufus*); feral hog (*Sus scrofa*); multiple squirrel species; northern bobwhite (*Colinus virginianus*); mourning dove (*Zenaida macroura*); several species of woodpecker, skunk, and river otter; and raccoon (*Procyon lotor*). Various bird, reptile, and amphibian species also reside on the Crystal River site (PEF 2008; USDA 2006; FNAI 2009).

The associated proposed transmission-line corridors begin in the Gulf Coast Flatwoods ecoregion and cross the Southwestern Florida Flatwoods and Central Florida Ridges and Uplands ecoregions. Vegetation community types in the Southwestern Florida Flatwoods ecoregion include slash pine, longleaf pine, cabbage palm (*Sabal palmetto*), and live oak (*Quercus virginiana*) with typical understory species of saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*), and grasses such as bluestems and wiregrasses (USDA 2006). Vegetation community types in the Central Florida Ridges and Uplands ecoregion include sand hill vegetation such as turkey oak (*Quercus laevis*), bluejack oak (*Quercus incana*), and longleaf pine for the dominant canopy species along with common understory species of running oak (*Quercus pumila*), gopher apple (*Licania michauxii*), and bluestem and panicum grasses (USDA 2006).

Important Species

Common wildlife, including important species, associated with the above-mentioned ecoregions that may occur in the associated transmission-line corridors includes recreationally important species such as Florida white-tailed deer, bobcat, feral hog, squirrel, northern bobwhite, mourning dove, as well as several woodpecker species, skunk, and raccoon. Various bird, reptile, and amphibian species also have the potential to reside on the Crystal River site and associated proposed transmission-line corridors (USDA 2006; FNAI 2009).

PEF consulted with the U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), and the Florida Fish and Wildlife Conservation Commission (FFWCC) in support of the CREC operating license renewal application, and determined that other than the Critical Habitat for the Florida manatee (*Trichechus manatus latirostris*) designated adjacent to the Crystal River site in King's Bay, there are no other areas designated as Critical Habitat for endangered species (PEF 2008). Table 9-7 lists all Federally and State-listed threatened and endangered species that could occur on the Crystal River site and in the vicinity, in the associated offsite facilities and corridors, as well as in the counties crossed by the associated proposed transmission-line corridors. Counties crossed by the proposed transmission-line corridors for the Crystal River site include Citrus, Marion, Hernando, Hillsborough, Pinellas, Pasco, and Sumter Counties. PEF has stated that on-the-ground field surveys would be conducted before commencement of ground-disturbing activities on the site or within transmission-line corridors (once final routes are determined) (PEF 2009a, CH2M Hill 2009).

Table 9-7. Federally and State-Listed Species That May Occur on and in the Vicinity of the Alternative Sites and Offsite Facilities and Corridors, and Associated Transmission-Line Corridors

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Mammals				
Eumops floridanus	Florida bonneted bat	SE	Roosts in palms and hollow trees and in buildings	Highlands
Trichechus manatus latirostris	West Indian (Florida) manatee	FE/SE	Marine and freshwater habitats; prefer warm-water sites	Crystal River, Dixie, Putnam
Microtus pennsylvanicus dukecampbelli	Florida salt marsh vole	FE/SE	Periodically flooded high salt marsh zone (FWS 2009)	Crystal River, Dixie
Peromyscus polionotus niveiventris	Southeastern beach mouse	FT/ST	Sea oats (Uniola paniculata) zone of primary coastal dunes	Putnam
Puma concolor coryi	Florida panther	FE/SE	Heavily vegetated mixed swamp forests and hammock forests	Crystal River, Dixie, Highlands, Putnam
Ursus americanus floridanus	Florida black bear	ST	Large areas of forested uplands and forested wetlands	Crystal River, Dixie, Highlands, Putnam
Birds				
Ammodramus savannarum floridanus	Florida grasshopper sparrow	FE/SE	Large (greater than 50 ha), treeless, relatively poorly-drained grasslands that have a history of frequent fires	Highlands
Aphelocoma coeruluscens	Florida scrub-jay	FT/ST	Low-growing oak scrub habitat	Crystal River, Dixie, Highlands, Putnam
Charadrius alexandrinus	Snowy plover	ST	Open, dry sand near dunes	Crystal River, Dixie

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Charadrius melodus	Piping plover	FT/ST	Tidal mudflats	Crystal River, Dixie, Putnam
Polyborus plancus audubonii	Audubon's crested caracara	FT/ST	Open country, dry prairies/pastures with cabbage palm/live oak hammocks, and shallow ponds and sloughs	Highlands, Putnam
Falco sparverius paulus	Southeastern American kestrel	ST	Open pine habitats, woodland edges, prairies, and pastures	Crystal River, Dixie, Highlands, Putnam
Grus americana	Whooping crane	ST	Along lake margins among rushes and sedges; estuarine marshes, shallow bays and tidal flats	Highlands
Grus canadensis pratensis	Florida sandhill crane	ST	Prairies, freshwater marshes, and pastures	Crystal River, Dixie, Highlands, Putnam
Mycteria americana	Wood stork	FE/SE	Cypress strands and domes, mixed hardwood swamps	Crystal River, Dixie, Highlands, Putnam
Picoides borealis	Red-cockaded woodpecker	FE	Mature longleaf and slash pine forests	Crystal River, Dixie, Highlands, Putnam
Rostrhamus sociabilis plumbeus	Snail kite	FE/SE	Freshwater marshes and shallow vegetated edges of lakes (natural and man-made)	Crystal River, Dixie, Highlands, Putnam
Sterna antillarum	Least tern	ST	Coastal areas, beaches, lagoons, bays, estuaries	Crystal River, Dixie, Highlands, Putnam

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Reptiles				
Alligator mississippiensis	American alligator	FT/SC	Most permanent bodies of fresh water, including marshes, swamps, lakes, and rivers	Crystal River, Dixie
Crocodylus acutus	American crocodile	FT/SE	Freshwater and brackish coastal habitats	Crystal River, Dixie
Dymarchon corais couperi	Eastern indigo snake	FT/ST	Broad range of habitats, from scrub and sandhill to wet prairies and mangrove swamps; often commensal with gopher tortoises	Crystal River, Dixie, Highlands, Putnam
Eumeces egregius lividus	Blue-tailed mole skink	FT/ST	Well-drained sandy uplands with loose sand for burrowing	Highlands
Gopherus polyhemus	Gopher tortoise	ST	Dry upland habitats, including sandhills, scrub, xeric oak hammock, and dry pine flatwoods; also pastures, old fields	Crystal River, Dixie, Highlands, Putnam
Neoseps reynoldsi	Sand skink	FT/ST	Rosemary scrub, sand pine and oak scrubs, scrubby flatwoods, turkey oak ridges within scrub, citrus groves occupying former scrub	Highlands, Putnam
Nerodia clarkii taeniata	Atlantic salt marsh snake	FT/ST	Coastal marshes and mangrove swamps along shallow tidal creeks and pools; often associated with fiddler crab burrows	Putnam
Stilosoma extenuatum	Short-tailed snake	ST	Sandhills, xeric hammock, and sand pine scrub	Crystal River, Dixie, Highlands, Putnam
Amphibians				
Ambystoma cingulatum	Flatwoods salamander	FT	Seasonally wet pine flatwoods near cypress ponds	Putnam
Vascular Plants				
Acrostichum aureum	Golden leather fern	ST	Brackish and freshwater marshes	Crystal River, Dixie, Putnam
Adiantum tenerum	Brittle maidenhair fern	SE	Limestone outcrops, grottoes, sinkholes	Crystal River, Dixie

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Agrimonia incisa	Incised groove-bur	SE	Sandhills and scrub	Crystal River, Dixie, Putnam
Andropogon arctatus	Pine-woods bluestem	ST	Wet pine flatwoods	Crystal River, Dixie, Highlands, Putnam
Arnoglossum diversifolium	Variable-leaf Indian plantain	ST	Freshwater and riparian habitats	Crystal River, Dixie
Asplenium dentatum	American toothed spleenwort	SE	Tropical hardwood hammock	Putnam
Asplenium erosum	Auricled spleenwort	SE	Pinelands	Crystal River, Dixie, Putnam
Asplenium pumilum	Dwarf spleenwort	SE	Pinelands	Crystal River, Dixie, Putnam
Asplenium verecundum	Modest spleenwort	SE	Rockland hammocks, limestone outcrops, grottoes, sinkholes	Crystal River, Dixie
Adiatum tenerum	Brittle maidenhair fern	SE		Crystal River, Dixie
Balduina atropurpurea	Purple honeycomb-head	SE		Putnam
Bigelowia nuttallii	Nuttall's rayless goldenrod	SE	Sand pine scrub in Pinellas County	Crystal River, Dixie
Blechnum occidentale	Sinkhole fern	SE	Moist woodlands, hammocks, rocky creek banks, woodlands with open shade	Crystal River, Dixie
Bonamia grandiflora	Florida bonamia	FT/SE	Openings or disturbed areas in white sand scrub	Crystal River, Dixie, Highlands, Putnam

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Calaminntha ashei	Ashe's savory	ST	Sandhills and scrub	Highlands, Putnam
Calopogon multiflirus	Many-flowered grasspink	SE	Dry to moist flatwoods with longleaf pine, wiregrass, saw palmetto	Highlands
Calydorea coelestina	Bartram's Ixia	SE		Putnam
Campanula robinsiae	Brooksville bellflower	FE/SE	Wet, grassy slopes and drying pond edges in vicinity of Chinsegut Hill in Hernando County	Crystal River, Dixie
Carex chapmanii	Chapman's sedge	SE	Grasslands, pinelands	Crystal River, Dixie, Highlands, Putnam
Centrosema arenicola	Sand butterfly pea	SE	Sandhill, scrubby flatwoods, dry upland woods	Crystal River, Dixie, Highlands, Putnam
Chamaesyce cumulicola	Sand-dune spurge	SE	Coastal scrub and stabilized dunes	Crystal River, Dixie, Putnam
Cheilanthes microphylla	Southern lip fern	SE	Coastal habitats	Crystal River, Dixie
Chionanthus pygmaeus	Pygmy fringe tree	SE	Scrub, sandhill, and xeric hammock	Highlands, Putnam
Chrysopsis (=Heterotheca) floridana	Florida golden aster	FE/SE	Sand pine scrub, sand ridges of excessively well-drained, fine sands, railroad and highway corridors	Crystal River, Dixie
Cladonia perforata	Perforate reinder lichen	FE/SE	High, xeric white sand rosemary scrub (FNAI 2010)	Highlands
Clitoria fragrans	Scrub pigeon-wing	FT/SE	Turkey oak barrens with wire grass, bluejack and turkey oak; scrubby high pine	Highlands, Putnam
Coelorachis tuberculosa	Piedmont jointgrass	ST	Freshwater habitats	Highlands, Putnam
Conradina brevifolia	Short-leaved rosemary	FE/SE	White sand scrub with sand pine and evergreen scrub oaks	Highlands
Conradina grandiflora	Large-flowered rosemary	ST	Deep, fine sandy soils on or in the vicinity of ancient dunes (CPC 2010)	Highlands, Putnam
Conradina etonia	Etonia rosemary	FE/SE	Deep, white-sand scrub with sand pine and oak shrubs in natural or artificial clearings	Putnam

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Crotalaria avonensis	Avon Park rabbit bells	FE/SE	White sand scrub dominated by rosemary and oaks and/or sand pine; mostly in open areas with bare sand.	Highlands
Ctenium floridanum	Florida toothache grass	SE	Sandhills and dry pinelands	Putnam
Cucurbita okeechobeensis	Okeechobee gourd	FE/SE	Pond apple swamps and mucky soils on Lake Okeechobee shores and islands and along the St. Johns River (CPC 2010)	Putnam
Deeringothamnus rugelii	Rugel's pawpaw	FE/SE	Poorly-drained slash pine/saw palmetto flatwoods (FWS 2009)	Putnam
Dennstaedtia bipinnata	Hay scented fern	SE	Hydric hammocks, wet woods (FNAI 2010)	Putnam
Dicerandra christmanii	Garrett's scrub balm	FE/SE	Exclusively on well-drained yellow sands in oak-dominate Florida scrub (ABS 2003a)	Highlands
Dicerandra cornutissima	Longspurred mint	FE/SE	Sand pine and oak scrub	Crystal River, Dixie, Putnam
Dicerandra frutescens	Scrub mint	FE/SE	Well-drained yellow soils (ABS 2003b)	Highlands
Drosera intermedia	Spoon-leaved sundew	ST	Freshwater habitats	Crystal River, Dixie, Highlands, Putnam
Eltroplectris calcarata	Spurred neottia	SE	Mesic hammock, rockland hammock (FNAI 2010)	Highlands
Eragrostis pectinacea var. *tracyi*	Sanibel lovegrass	SE	Disturbed beach dunes, maritime hammocks, coastal strands, coastal grasslands, old fields, clearings, and other disturbed sites	Crystal River, Dixie
Eryngium cuneifolium	Wedge-leaved button-snakeroot	FE/SE	Sand pine scrub, mostly in gaps on rosemary balds (FNAI 2010)	Highlands
Eriogonum logifolium var. *gnaphalifolium*	Scrub wild buckwheat	FT/SE	Sandhill, oak-hickory scrub	Crystal River, Dixie, Highlands, Putnam
Euphorbia coommutata	Wood spurge	SE	Riparian habitats	Crystal River, Dixie, Putnam

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Forestiera godfreyi	Godfrey's swampprivet	SE	Upland hardwood forests with limestone at or near the surface, often on slopes above lakes and rivers	Crystal River, Dixie, Putnam
Gladularia maritima	Coastal vervain	SE	Back dunes, dune swales, coastal hammocks	Crystal River, Dixie, Putnam
Gladularia tampensis	Tampa vervain	SE	Live oak–cabbage palm hammocks and pine-palmetto flatwoods	Crystal River, Dixie, Putnam
Gossypium hirsutum	Wild cotton	SE	Coastal strands and disturbed areas	Crystal River, Dixie
Harrisia fragrans	Fragrant prickly apple	FE/SE	Scrubby flatwoods and xeric hammocks with sand live oak, myrtle oak, cabbage palm, and prickly pear (FNAI 2010)	Putnam
Harrisia simpsonii	Simpson's prickly apple	SE	Mangroves and coastal thickets and strands (FNAI 2010)	Putnam
Hartwrightia floridana	Hartwrightia	ST	Seepage slopes, edges of baygalls and springheads, wet prairies, flatwoods	Highlands, Putnam
Hasteola robertiorum	Florida hasteola	SE	Saturated, peaty soils of river and creek floodplain swamps; hydric hammocks with cabbage palm, cypress, or hardwood canopy	Crystal River, Dixie, Putnam
Helianthus carnosus	Lake-side sunflower	SE	Wet flatwoods and prairies (FNAI 2010)	Putnam
Hypericum cumicola	Highlands scrub hypericum	FE/SE	Openings in white sand and rosemary scrubs; sometimes found in scrubby flatwoods and oak scrubs in yellow sands.	Highlands
Hypericum edisonianum	Edison's ascyrum	SE	Depressions in scrub, cutthroat seeps, flatwoods ponds, lake margins, wet prairie	Highlands
Illicium parviflorum	Star anise	SE	Banks of spring-run or seepage streams, bottomland forest, hydric	Highlands, Putnam
Justicia cooleyi	Cooley's water-willow	FE/SE	Mesic hardwood hammocks over limestone	Crystal River, Dixie
Justicia crassifolia	Thick-leaved water willow	SE		Highlands
Lantana depressa var. *floridana*	Atlantic coast Florida lantana	SE	Dunes and sandy inland ridges (FNAI 2010)	Putnam

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Lechea cernua	Nodding pinweed	ST	Usually ancient dunes with evergreen scrub oaks, mature scattered pine or oak forest	Crystal River, Dixie, Highlands, Putnam
Lechea divaricata	Pine pinweed	SE	Scrub and scrubby flatwoods	Crystal River, Dixie, Highlands
Leineria floridana	Corkwood	ST	Edges of marshy openings and along small drainages in coastal hydric hammocks; fresh or tidal marshes	Crystal River, Dixie
Liatris ohlingerae	Florida blazing star	SE	Rosemary balds, edges of oak scrub; scrubby flatwoods and disturbed scrub (FNAI 2010)	Highlands
Litsea aestivalis	Pondspice	SE	Edges of baygalls, flatwoods ponds, and cypress domes. May form thickets around edges of ponds	Crystal River, Dixie, Putnam
Lupinus aridorum	Scrub lupine	FE/SE		Highlands
Matalea floridana	Florida spiny-pod	SE	Pinelands and temperate forests	Crystal River, Dixie, Highlands, Putnam
Monotropa hypopithys	Pinesap	SE	Temperate forests	Putnam
Monotropsis reynoldsiae	Pygmy pipes	SE	Upland mixed hardwood forest, mesic and xeric hammock, sand pine and oak scrub	Crystal River, Dixie, Putnam
Najas filifolia	Narrowleaf naias	ST	Freshwater habitats	Highlands, Putnam
Nemastylis floridana	Celestial lily	SE	Freshwater habitats	Crystal River, Dixie, Highlands, Putnam
Nolina atopocarpa	Florida beargrass	ST	Grasslands, pinelands	Highlands, Putnam

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Nolina brittoniana	Britton's beargrass	FE/SE	Scrub, sandhill, scrubby flatwoods, and xeric hammock	Crystal River, Dixie, Highlands, Putnam
Ophioglossum palmatum	Hand fern	SE	Old leaf bases of cabbage palms in maritime and wet hammocks	Crystal River, Dixie, Highlands, Putnam
Panicum abscissum	Cutthroat grass	SE		Highlands, Putnam
Parnassia grandifolia	Large-leaved grass-of-parnassus	SE	Seepage slopes, wet prairies, edges of cypress strands	Putnam
Paronychia chartacea ssp. *chartacea*	Paper-like nailwort	FT/SE		Highlands, Putnam
Pecluma dispersa	Widespread polypody	SE	Tree branches and limestone outcrops in dry hammocks	Crystal River, Dixie, Putnam
Pecluma plumula	Plume polypody	SE	Tree branches or limestone in hammocks, wet woods, and limesinks	Crystal River, Dixie, Highlands, Putnam
Pecluma ptilodon	Swamp plume polypody	SE	Rockland hammocks, strand swamps, wet woods	Crystal River, Dixie, Highlands, Putnam
Phyllanthus leibmannianus	Pinewood dainties	SE	Hydric hammocks, floodplain and bottomland forests	Crystal River, Dixie
Peperomia humilis	Terrestrial pepperomia	SE	Shell mounds and limestone outcrops in mesic hammocks, coastal berms, cypress swamps	Crystal River, Dixie, Highlands
Platanthera integra	Yellow fringeless orchid	SE	Wet pine flatwoods, wet prairies, depressions within pinelands	Highlands
Polygala lewtonii	Lewton's polygala	FE/SE	Oak scrub, sandhill	Highlands, Putnam
Polygonella basiramia	Florida jointweed	FE/SE		Highlands

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Polygonella myriophylla	Small's jointweed	FE/SE	Open, sandy areas within scrub	Highlands, Putnam
Prunus geniculata	Scrub plum	FE/SE	Sandhill and oak scrub	Highlands, Putnam
Pteroglossaspis ecristata	Giant orchid	ST	Sandhill, scrub, pine flatwoods, pine rocklands	Crystal River, Dixie, Highlands, Putnam
Pycnanthemum floridanum	Florida mountain-mint	ST	Pinelands, sandhills, scrub	Crystal River, Dixie, Putnam
Rudbeckia triloba var. *pinnatiloba*	Pinnate-lobed coneflower	SE	Freshwater habitats, grasslands, pinelands	Crystal River, Dixie
Salix Floridana	Florida willow	SE	Springheads, edges of spring runs, hydric hammocks, floodplains	Highlands, Putnam
Schizachurium niveum	Scrub bluestem	SE	Rosemary, sand pine, and oak scrub	Crystal River, Dixie, Highlands
Schwalbea Americana	Chaffseed	FE/SE	Moist, grassy ecotones around ponds in longleaf pine sandhills and savannas (FNAI 2010)	Putnam
Sideroxylon alachuense	Silver buckthorn	SE	Upland hardwood forests around limesinks	Putnam
Sideroxylon lycioides	Buckthorn	SE	Wooded slopes, floodplains, and bluffs	Dixie, Putnam
Spigelia loganioides	Pinkroot	SE	Floodplain forests, upland and hydric hardwood hammocks over limestone	Crystal River, Dixie, Putnam
Spiranthes polyantha	Green ladies'-tresses	SE	Rock outcrops in mesic hammock, rockland hammock, maritime hammock	Crystal River, Dixie
Stylisma abdita	Scrub stylisma	SE	Pinelands, sandhills, scrub	Crystal River, Dixie, Highlands, Putnam

Table 9-7. (contd)

Scientific Name	Common Name	Legal Status	Suitable Habitat	Alternate Site
Thelypteris reptans	Creeping maiden fern	SE	Limestone grottoes and sinkholes	Crystal River, Dixie
Thelypteris serrata	Toothed maiden fern	SE	Cypress swamps, sloughs, floodplains	Crystal River, Dixie, Highlands
Trichomanes punctatum ssp. *Floridanum*	Florida filmy fern	SE	Rock outcrops	Crystal River, Dixie
Triphora amazonica	Broad-leaved nodding-caps	SE	Rich damp hardwood hammocks	Crystal River, Dixie
Triphora graigheadii	Craighead's nodding-caps	SE	Mesic hardwood hammocks	Crystal River, Dixie
Vicia ocalensis	Ocala vetch	SE	Open, wet thickets along margins of spring runs and streams	Putnam
Warea amplexifolia	Clasping warea	FE/SE	Sandhill with longleaf pine and wiregrass	Highlands, Putnam
Warea carteri	Carter's warea	FE/SE	Sandhill, scrubby flatwoods, scrub	Highlands, Putnam
Zephyranthes simpsonii	Redmargin zepyrlily	FE/SE	Wet flatwoods and meadows (FDACS 2004)	Highlands
Ziziphus celata	Scrub ziziphus	FE/SE		Highlands

Species list sources: FNAI (2009), FWS (2009)
FE = Federally listed as endangered; FT = Federally listed as threatened; SE = State listed as endangered; ST = State listed as threatened

Building Impacts

Impacts from building two nuclear units and supporting facilities on wildlife, including important species and habitats, would be unavoidable. Activities that would affect terrestrial resources include land clearing and grading (temporary and permanent), filling and or draining of wetlands, increased human presence, heavy equipment operation, traffic, noise, avian collisions, and fugitive dust. These activities would likely displace or destroy wildlife that inhabits the areas of disturbance. Some wildlife, including important species, would perish or be displaced during land clearing for any of the above activities as a consequence of habitat loss, fragmentation and competition for remaining resources. Less mobile animals, such as reptiles, amphibians, and small mammals, would be at greater risk of incurring mortality than more mobile animals, such as birds, many of which would be displaced to adjacent communities. Undisturbed land

adjacent to areas of disturbance could provide habitat to support displaced wildlife, but increased competition for available space and resources could affect population levels. Wildlife would also be subjected to impacts from noise and traffic, and birds could be injured if they collide with tall structures. The impact on wildlife from noise is expected to be temporary and minor. The creation of new transmission-line corridors could be beneficial for some important wildlife species, including those that inhabit early successional habitat or use edge environments, such as white-tailed deer (*Odocoileus virginianus*), northern bobwhite, eastern meadowlark (*Sturnella magna*), and the gopher tortoise (*Gopherus polyphemus*). Birds of prey, such as red-tailed hawks (*Buteo jamaicensis*) would likely exploit newly created hunting grounds. Forested wetlands within the corridors would be converted to and maintained in an herbaceous or scrub-shrub condition that could provide improved foraging habitat for waterfowl and wading birds. However, fragmentation of upland and wetland forests could adversely affect species that are dependent on large tracts of continuous forested habitat.

To accommodate the building of two nuclear units on the Crystal River site, PEF would need to clear approximately 442 ac of terrestrial habitats for the nuclear facility and approximately 61 ac for associated offsite structures and corridors; not including transmission lines, which are discussed in the paragraph below (see Table 9-2 and Table 9-3) (CH2M Hill 2009). The proposed facility footprint of approximately 442-ac parcel lies within the CREC boundary (CH2M Hill 2009). Based upon Florida Land Use, Cover and Forms Classification System (FLUCFCS) analysis, approximately 27 ac of wetlands on the site would be filled (CH2M Hill 2009). PEF states that the nuclear facility would be sited to avoid wetlands whenever possible and that potential impacts on wetlands would be minimized through the use of established BMPs (PEF 2009a). Approximately 6 ac of wetlands would be filled to build the associated offsite facilities (other than transmission lines)(CH2M Hill 2009).

New transmission system infrastructure would be needed to support a nuclear power facility at the Crystal River site and would include approximately 180 mi of transmission lines (estimates made by measuring the approximate distance of hypothetical corridors provided by CH2M Hill [2009]; see Section 9.3.2.1). The proposed transmission-line corridors are situated mostly in or adjacent to existing transmission lines; however, some new right-of-way would have to be created to accommodate the new lines (CH2M Hill 2009). The total acreage of transmission-line corridor for the Crystal River site is approximately 9038 ac, of which approximately 1516 ac are wetlands and approximately 1653 ac are forested habitat (see Table 9-8) (CH2M Hill 2009). Some portion of the total 1653 ac of forested habitat and 1516 ac of wetland habitat present in the corridors would be affected; however, because actual routes have not been determined, impacts on forests and wetlands cannot be quantified. Under Federal and State permitting requirements, PEF would be obligated to mitigate any unavoidable construction impacts on jurisdictional wetlands and listed species (PEF 2009a; FDEP 2010a).PEF stated that all land clearing associated with the nuclear facility, offsite structures, and transmission-line corridor

Table 9-8. Summary of Impacts by Land-Use Class for the Crystal River Site

Land-Use Class (FLUCFCS) (acreage)	Onsite	Offsite Corridors (Except Transmission)	Transmission Corridors[(a)]
Urban and Built Environment (percent of area)	9 (2%)	0 (0%)	1769 (19%)
Agriculture	129 (29%)	4 (7%)	1714(19%)
Upland Nonforested	0 (0%)	1 (2%)	172 (2%)
Upland Forested	277 (63%)	35 (57%)	1654 (18%)
Water	0 (0%)	1 (1%)	114 (1%)
Wetlands	27 (6%)	6 (10%)	1516 (16%)
Barren Lands	0 (0%)	0 (0%)	9 (<1%)
Transportation, Communication and Utilities	0 (0%)	14 (23%)	2091 (22%)

Source: CH2M Hill 2009
(a) Acreages are the total acres of each land-use class (FLUCFCS) cover type present in the transmission-line corridor, not acres affected.

development would be conducted according to Federal, State, and local regulations, permit requirements, existing procedures, and established BMPs (PEF 2009a).

Building two new nuclear reactors at the Crystal River site would result in the loss of approximately 503 ac of terrestrial habitat on the site and offsite corridors (excluding transmission-line corridors) (see Table 9-9).

Table 9-9. Total Terrestrial Habitat Impacts for the Crystal River Site

Impact Areas	Acres[(a)]
Onsite Impact Areas	442
Reservoir Impact Areas	Not applicable
Transmission-Line Corridor Areas	9038[(a)]
Offsite Impact Areas	61
Total Impact Areas	503 (plus portion of 9038 ac transmission corridor)

Source: CH2M Hill 2009
(a) Transmission-line acreages are the total acres available, not total acres affected. Only a portion of the total available would be affected.

Clearing land within the 9038-ac transmission-line corridor would further increase forested habitat losses and increase habitat fragmentation. Other sources of impacts on terrestrial resources such as noise, increased risk of collision and electrocution, and displacement of wildlife would likely be temporary and result in minimal impacts on the resource. Because of the

extent of unavoidable terrestrial habitat losses, building the two new units and associated offsite facilities, including transmission lines, would noticeably alter the available terrestrial habitat on and in the landscape surrounding the Crystal River Site.

Operational Impacts

Impacts on terrestrial ecological resources, including important species, from operation of two new nuclear units at the Crystal River site include those associated with transmission system structures, maintenance of transmission-line corridors, and operation of the cooling towers. Also, during plant operation, wildlife would be subjected to impacts from increased traffic.

Impacts on crops, ornamental vegetation, and native plants from cooling-tower drift cannot be evaluated in detail in the absence of information about the specific location of cooling towers at each alternative site. Similarly, bird collisions with cooling towers cannot be evaluated in the absence of information about the specific location of cooling towers at the site. The impacts of cooling-tower drift and bird collisions for existing power plants were evaluated in NUREG-1437 (NRC 1996) and found to be of minor significance for nuclear power plants in general, including those with various numbers and types of cooling towers. On this basis, the review team concludes, for the purpose of comparing the alternative sites, that the impacts of cooling-tower drift and bird collisions with cooling towers resulting from operation of new nuclear units would be minor.

Outdoor noise levels on the Crystal River site are predicted to range from 90 dBA near the loudest equipment to 65 dBA in areas more distant from major noise sources (CH2M Hill 2008). Noise modeling predicts not perceptible to slight increases in noise from plant operations at the site boundary (CH2M Hill 2008). Except in areas immediately adjacent to major noise sources, expected noise levels would be below the 60- to 65-dBA threshold at which birds and red foxes (a surrogate for small and medium-sized mammals) are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the Crystal River site would not be likely to disturb wildlife beyond the site boundary. Consequently, the review team concludes that the impacts of cooling-tower noise on wildlife would be minimal.

An evaluation of specific impacts resulting from building of transmission lines and transmission-line corridor maintenance cannot be conducted in any detail due to the lack of information, such as the specific locations of new corridors that could result from transmission system upgrades. However, in general, impacts associated with transmission-line operation consist of bird collisions with transmission lines, electromagnetic field (EMF) effects on flora and fauna, and habitat loss due to corridor maintenance. The impacts associated with transmission-line corridor maintenance activities include alteration of habitat, including but not limited to wetland and floodplain habitat, due to cutting and herbicide application.

Transmission lines and associated structures pose a potential avian collision hazard. Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al.

2005). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to their low, fast flight, and flocking behavior (EPRI 1993). Bird collisions with transmission lines are recognized as being of minor significance at operating nuclear power plants, including transmission-line corridors with variable numbers of power lines (NRC 1996). Although additional transmission lines would be required for new nuclear units at the alternative sites, increases in bird collisions would be minor and these would likely not be expected to cause a measurable reduction in local bird populations. PEF would also be required to have an Avian Protection Plan in compliance with State certification guidelines (FDEP 2010a). Consequently, the incremental number of bird collisions posed by the addition of new transmission lines for new nuclear units would be negligible.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). At a distance of 300 ft, the magnetic fields from many lines are similar to typical background levels in most homes. Thus, impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003). Therefore, the incremental EMF impact posed by addition of new transmission lines for new nuclear units would be negligible.

Existing roads providing access to the existing transmission-line corridors at the alternative sites would likely be sufficient for use in any expanded corridors; however, new roads would be required during the construction of new transmission-line corridors. Management activities (cutting and herbicide application) related to transmission-line corridors and related impacts on floodplains and wetlands in transmission-line corridors are recognized as being of minor significance at operating nuclear power plants, including those with transmission-line corridors of variable widths (NRC 1996). The review team assumes that the same vegetation and construction management of corridors currently used by PEF would be used in the establishment and maintenance of the new corridors. Under the Conditions of Certification for Levy County, PEF would also be required to retain existing vegetation whenever practicable and use BMPs that comply with the Florida State regulations (FDEP 2010a). Consequently, the incremental effects of the maintenance of transmission-line corridors and associated impacts on floodplains and wetlands posed by expanding existing corridors or the addition of a new transmission-line corridor for new nuclear units would be negligible.

To summarize, the potential effects of operating two new nuclear reactors at the Crystal River site would be primarily associated with the maintenance of transmission-line corridors and increased traffic. In general, operational impacts on terrestrial resources would be expected to be minimal.

Cumulative Impacts

Past and present actions in the geographic area of interest that have influenced terrestrial resources in a similar way to the proposed two new nuclear units at the Crystal River site include development and operation of the CREC, located adjacent to the Crystal River site; development and operation of the Crystal River Quarries, Inc. mine, approximately 3 mi east of the Crystal River site; and development and operation of the Inglis Limestone Quarry, which is part of the Citrus Mining and Timber Company, approximately 3 mi north of the Crystal River site. All of these projects have contributed to loss of terrestrial habitat in the area. Furthermore, terrestrial habitats throughout the geographic area of interest have been extensively altered by a history of forestry and agricultural practices as well as low density residential development.

Proposed reasonably foreseeable future actions that would affect terrestrial resources in a way similar to development at the Crystal River site include development and operation of the proposed Tarmac King Road Limestone Mine, as close as 8 mi north-northeast of the proposed Crystal River site. The proposed mine would occupy approximately 9400 ac including a quarry, processing plant, roads, and buffers. This proposed project would affect approximately 2700 ac of wetlands and uplands by incremental losses extending over approximately 100 years. In addition to its ongoing quarrying activities noted in the paragraph above, Citrus Mining and Timber Inc. is also proposing to develop a “Port District” approximately 2 mi north of the Crystal River site, which would include waterfront residential, commercial, and industrial development.

The Inglis Lock bypass channel spillway is a proposed project to construct an intake structure, intake and discharge channels, turbines and a transmission line located approximately 5 mi northeast of the Crystal River site. This project would contribute to terrestrial habitat loss and fragmentation within the ROI. The FDOT is planning an expansion of US-19 at the CFBC, approximately 3 mi north-northeast from the Crystal River site, which would include construction of a two-lane bridge and expansion of the existing roadway to a four-lane divided highway. Transmission-line creation and/or upgrading throughout the designated geographical ROI, and future urbanization would also be expected to occur. There are, however, several areas within the geographic ROI that are managed for the benefit of wildlife, including (but not limited to) Goethe State Forest, Crystal River National Wildlife Refuge, Waccasassa Bay Preserve State Park, Gulf Hammock Wildlife Management Area, and the Big Bend Seagrasses Preserve.

The other impact on terrestrial resources at the Crystal River site would be the effect of global climate change on plants and wildlife. The impact of global climate change on terrestrial wildlife and habitat in the geographic area of interest is not precisely known. Global climate change could result in a rise in sea level and may cause regional increases in the frequency of severe

weather, decreases in annual precipitation, increases in average temperature, and saltwater intrusion into freshwater wetlands (GCRP 2009). Such changes in climate could alter terrestrial community composition on or near the Crystal River site through changes in species diversity, abundance, and distribution. Elevated water temperatures, droughts, and severe weather phenomena may adversely affect or severely reduce terrestrial habitat. Specific predictions on habitat changes in this region due to global climate change are inconclusive at this time. However, because of the regional nature of climate change, the impacts related to global climate change would be similar for all of the alternative sites.

Summary Statement

Impacts on terrestrial ecology resources, including important species, are estimated based on the information provided by PEF and the review team's independent review. Past, present, and reasonably foreseeable future activities in the geographic area of interest could affect terrestrial ecology in ways similar to building and operation of the proposed two new units at the LNP site. The Crystal River site and some of the associated transmission-line corridors are natural habitats that would be substantially altered by development and maintenance activities, noticeably affecting the level and movement of terrestrial wildlife populations in the surrounding landscape. Other anticipated development projects would further alter wildlife habitats and migration patterns in the surrounding landscape. The review team therefore concludes that the cumulative impacts on baseline conditions for terrestrial ecological resources would be MODERATE.

This determination is based upon the extent of expected wetland loss and habitat fragmentation from ongoing and planned development projects, continued widespread manipulation of habitats for commercial forest management, and anticipated losses of habitat for important species. The incremental impacts from building and operating the Crystal River project would be a significant contributor to the moderate cumulative impact, primarily because of a loss or modification of habitats that support wildlife, wetlands, and important species. Although incremental impacts on terrestrial resources could be noticeable near the Crystal River project, these impacts would not be expected to destabilize the overall ecology of the regional landscape.

9.3.2.4 Aquatic Resources for the Crystal River Energy Complex Site

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources. The CREC site is located on Crystal Bay, which is a small embayment of the Gulf of Mexico. CREC has four fossil-fuel units and one nuclear unit, which draw a total of 1897 Mgd from May 1 to October 31, and 1613 Mgd from November 1 to April 30. Water from Crystal Bay is drawn in through three intakes on a common intake canal for Units 1, 2, and 3. Cooling water for Units 4 and 5 is provided from Units 1–3 effluent, and all effluents including blowdown from CREC Units 4 and 5 are ultimately discharged via a discharge canal to the Gulf of Mexico. Mechanical draft helper cooling towers cool the station discharge for thermal compliance (PEF 2008). A two-unit, closed-cycle plant would require

84,780 gpm (190 cfs) of cooling water, which would be obtained from the Gulf of Mexico, and station blowdown would be added to the existing discharge for CREC Units 1–5 (PEF 2009a). The geographic area of interest is considered to be hydrologically related water bodies surrounding the proposed Crystal River site, which encompasses Levy and Citrus Counties offshore areas of the Gulf of Mexico, including the mouth of the CFBC, and the mouth of the Withlacoochee River, and associated transmission-line corridors.

The CREC site is a coastal facility near a shallow inshore estuarine habitat in the Gulf of Mexico. Crystal River enters to the Gulf of Mexico 2 mi to the south, and the Withlacoochee River opens 2 mi to the north. The mouth of the CFBC in the Gulf of Mexico is between the CREC discharge and the Withlacoochee River. There are no sanctuaries or preserves that could be affected by the proposed action. The nearest managed areas are the Big Bend Seagrasses aquatic preserve to the north of the mouth of the Withlacoochee River (FDNR 1988), St. Martins Marsh that includes the estuarine coastal areas between Crystal River and Homosassa River (FDNR 1987), and the Crystal River National Wildlife Refuge (Buckingham 1989). Big Bend Seagrasses is managed by the FDEP and is approximately 5 mi to the north along the Gulf Coast of Florida from the mouth of the CFBC, and extends up along the coast and up to 8 mi offshore to the St. Marks National Wildlife Refuge to cover 945,000 ac. St. Martins Marsh is also managed by FDEP and encompasses 23,000 ac in the nearshore and offshore region due west of the city of Crystal River, 3.5 mi to the south of the CREC discharge location. Both aquatic preserves were established to protect seagrass bed habitats, which provide nursery areas for finfish and shellfish as well as foraging resources for local birds and aquatic vertebrates. The Crystal River National Wildlife Refuge is managed by the FWS and is the Kings Bay headwaters of Crystal River, which lies 10 mi inland from the mouth of Crystal River on the Gulf of Mexico. The Crystal River National Wildlife Refuge was designated to protect the West Indian (Florida) manatee and its habitat.

Historically, the construction and operation of CREC Units 1–5 have had some impact on fisheries in the Gulf of Mexico, which PEF mitigates by hatchery supplementation. The Crystal River Mariculture Center began operation in October 1991, with red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), and pink shrimp (*Farfantepenaeus duorarum*) among the primary species cultured. Other species such as pinfish (*Lagodon rhomboides*), pigfish (*Orthopristis chrysoptera*), stone crab (*Menippe mercenaria*), and blue crab (*Callinectes sapidus*) are also cultured and released in the Gulf of Mexico (PEF 2009c). Between 1999 and 2005, 8 loggerhead sea turtles (*Caretta caretta*), 38 green sea turtles (*Chelonia mydas*), 1 hawksbill sea turtle (*Eretmochelys imbricata*), and 92 Kemp's ridley sea turtles (*Lepidochelys kempii*) have been collected at CREC (Eaton et al. 2008). PEF currently has an incidental take permit from NMFS that allows an incidental live take of 75 sea turtles annually, 3 annual causal sea turtle mortalities, and a reporting requirement for non-causal related mortalities of 8 or more within a 12-month period (NMFS 2002). PEF has an ongoing program to monitor the intake canal for the presence of sea turtles, perform rescues for stranded individuals, provide rehabilitation, and release resources when possible. In 2000, NRC found no significant impact

on marine turtles from the operation of CREC Unit 3 (NMFS 2002). Aquatic species and habitats associated with the discharge from CREC have been characterized historically from CREC operations (Stone & Webster Engineering 1985), and were again sampled from April through November 2008. The extent of seagrass beds have been surveyed beginning in the early 1990s as a part of quantifying recovery of the CREC offshore Gulf of Mexico habitats following installation of helper cooling towers (MML 1993, 1994, 1995). Previously affected seagrass areas nearest the CREC discharge were observed to recover with 50-percent bottom coverage by colonization by shoal grass (*Halodule wrightii*), a dominant, quick-growing seagrass. However, between 1995 and 2001, overall seagrass abundance declined, likely from a number of environmental influences such as turbidity, salinity, and storm events (Marshall 2002).

The potential for impacts from construction and/or operation of two new CREC units on aquatic biota would be primarily to organisms inhabiting the Crystal Bay habitat of the Gulf of Mexico. Aquatic commercial, recreational, and indicator species of importance would include the same species described for the proposed LNP site.

Commercial and Recreational Species

The Crystal River site has the same species as those listed for the proposed LNP site (see Section 2.4.2). Commercial fisheries allowed in the Gulf of Mexico in offshore Florida waters for Citrus and Levy Counties include black mullet (*Mugil cephalus*), red grouper (*Epinephelus morio*), crevalle jack (*Caranx hippos*), ladyfish (*Elops saurus*), black grouper (*Epinephelus mystacinus*), gag grouper (*Mycteroperca microlepis*), grunts (family *Haemulidae*), porgies (family Sparidae), pink shrimp (*Farfantepenaeus duorarum*), blue crab, stone crab , and oysters (*Crassostrea viginica*). All of these species are also considered recreationally important and are described in detail in Section 2.4.2.

Important Species

Important species and species of concern listed for the Crystal River site are the same as those already described for the proposed LNP site. For species and habitat descriptions, refer to Table 2-13 in Section 2.4.2.

Critical Habitats

There are no critical habitats designated by the NMFS or FWS in the vicinity of the Crystal River site. Critical habitat for the gulf sturgeon (*Acipenser oxyrinchus desotoi*) occurs on the Gulf Coast of Florida in the Suwannee River over 29 mi to the northwest from the mouth of the CFBC, and immediate offshore area and is described further under the Federally and State-listed species subheading for gulf sturgeon (68 FR 13370). Critical habitat for the smalltooth sawfish (*Pristis pectinata*) is currently under review for designation of more than 220,000 ac of coastal habitat in the Charlotte Harbor estuary and more than 619 coastal ac in the Ten

Thousand Islands/Everglades region of Florida Bay and are described further under the Federally and State-listed species subheading for smalltooth sawfish (73 FR 70290). Critical habitat for the Florida manatee closest to the Crystal River site includes Crystal River and its Kings Bay headwaters in Citrus County (41 FR 41914).

Essential Fish Habitats

The CREC intake and discharge areas of the Gulf of Mexico are designated by the Gulf of Mexico Fisheries Management Council as Ecoregion 2, which is a management unit that extends from Tarpon Springs north to Pensacola Bay, Florida (GMFMC 2004). Estuarine essential fish habitat has been designated by NMFS for Crystal Bay for species listed in Table 2.14 in Section 2.4.2.3. There are no habitat areas of particular concern near the CREC.

Non-Native and Nuisance Species

No invasive aquatic species have been noted in the aquatic environments at the Crystal River site (PEF 2008).

Federally and State-Listed Species

Federally and State-listed aquatic species that may occur near the Crystal River site and along existing transmission-line corridors include the endangered Florida manatee, green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), smalltooth sawfish, and the threatened gulf sturgeon and loggerhead sea turtle (*Caretta caretta*). Detailed species information is provided in Section 2.4.2.3.

Building Impacts

No onsite waterbodies would be adversely affected by building activities on the CREC site. Installation of a new intake and discharge structure in the existing CREC discharge canal would result in the temporary displacement of aquatic biota within the vicinity of these structures. It is expected that these biota would return to the area after installation is complete. Impacts on aquatic organisms from installation activities in the discharge canal would be temporary and minor and largely mitigable through the use of BMPs. Installation activities for makeup water and discharge for two new units at CREC would have minimal impact on the aquatic ecology of Crystal Bay.

New transmission lines would be required to connect the facility to the existing load centers. The additional transmission lines could be installed in existing corridors when possible to avoid sensitive or critical habitat areas. Transmission-line corridors are assumed to follow those identified for LNP without the need for an LNP-to-CREC corridor (CH2M Hill 2009). PEF anticipates transmission-line corridors would cross 6 streams and 135 open waterbodies and should have minimal impact on aquatic resources (CH2M Hill 2009). Therefore, assuming that

no transmission towers are placed in waterbodies and the use of good management practices during construction, the staff concludes that the impacts associated with new transmission lines would be minimal.

Operational Impacts

Impingement and entrainment of organisms from Crystal Bay would be the most likely impacts on aquatic populations that could occur from operation of two new nuclear units at CREC. After submission of a Clean Water Act Section 316 (b) report by PEF (Stone and Webster 1985), the EPA found that entrainment and impingement of fish and shellfish was unacceptable at CREC due to use of once-through cooling for CREC Units 1–3. Mitigation for entrainment and impingement is currently met through seasonal flow reduction and a restocking program at CREC for red drum, spotted seatrout, pink shrimp, striped mullet, pigfish, silver perch, blue crab, and stone crab (PEF 2008).

The NMFS issued a Biological Opinion in 2002 allowing for an incidental take of 75 live sea turtles from CREC intake structures and 3 causally related lethal takes annually. The annual take and release of 75 live turtles annually was determined to have no impact on turtle populations, and the annual lethal take of 3 turtles was considered to represent a small percentage of total sea turtle take in the Southeast United States (NMFS 2002). Due to PEF's commitment to use best available technology, and the small incremental increase in cooling-water withdrawal for the two new units, it is expected that there will be no significant increase in sea turtle mortalities attributable to the operation of two additional closed-cycle units at the CREC site.

Assuming a closed-cycle cooling system and a maximum through-screen intake velocity of 0.5 ft/sec or less which meets the EPA's Phase I regulations for new facilities (66 FR 65256), the anticipated additional impacts on aquatic populations from entrainment and impingement are expected to be minimal.

The current NPDES permit for CREC requires that thermal effluents not exceed 96.5°F during the summer months. Helper cooling towers are used to comply with thermal limits, and reduction in power generation from coal-fired CREC Units 1 and 2 is sometimes used during the hottest summer months to ensure thermal compliance. The additional discharge associated with two new units (122 Mgd) would increase the total CREC site discharge volume by less than 5 percent. Thermal impacts could be mitigated by the addition of helper cooling towers as is proposed for the CREC Unit 3 uprate (PEF 2007a). The impact on aquatic populations from the additional discharge of water from two new closed-cycle units into Crystal Bay is expected to be minimal.

The review team concludes that operational impacts on aquatic biota from maintenance of the transmission-line corridors would also be minimal assuming that appropriate BMPs and transmission-line maintenance procedures are used.

Cumulative Impacts

Cumulative impacts on aquatic resources within Crystal Bay may include the operation of CREC Units 1–5 for impingement, entrainment effects, and chemical and thermal impacts from discharge. Two new units would require an additional 122 Mgd of makeup water that is likely to come from discharge effluent from CREC Units 1–5. It is therefore expected that intake operations would have no impact on impingement and entrainment rates. Discharge for two additional units would likely increase overall discharge to Crystal Bay by less than 5 percent (CH2M Hill 2009). Addition of helper cooling towers to control the temperature of discharge to Crystal Bay, and compliance with FDEP NPDES permitting requirements would minimize the potential for thermal and chemical discharge impacts, respectively. The proposed uprate of CREC Unit 3, when combined with existing CREC Units 1–5 discharge would result in no thermal increase with the operation of a new South Cooling Tower to augment the current modular helper cooling towers (PEF 2007a).

In addition, in the FDEP Conditions of Certification, there is a condition that PEF will retire its two oldest coal-fired plants (Units 1 and 2) when LNP Units 1 and 2 are licensed, built, and begin commercial operation (FDEP 2009). If this occurs, the two new units would still require 122 Mgd of makeup water that would likely come from the discharge effluent of CREC Units 3, 4, and 5. It is again expected that intake operations would have minimal impact on impingement and entrainment rates. The discharge for the two additional units, with CREC Units 1 and 2 shut down, would decrease the discharge volume to Crystal Bay. With the cessation of operations for CREC Units 1 and 2, the thermal and chemical discharge plume to Crystal Bay, even with the addition of the two new units, would likely not result in an increase in impacts over current operating conditions at CREC.

Anthropogenic activities such as residential or industrial development near the vicinity of the nuclear facility can present additional constraints on aquatic resources. Future activities may include shoreline development (i.e., removal of habitat), increased water needs, and increased discharge of effluents into the Gulf of Mexico near Crystal Bay. Shoreline development is currently proposed by Citrus Mining and Timber, Inc. for commercial, industrial, and residential waterfront development along the CFBC to the west of US-19 (Citrus County 2009). The effects of future development could result in additional habitat loss and/or degradation due to water use using surface waters and groundwater withdrawal, point and non-point source pollution, siltation, and bank erosion. The review team is also aware of the potential for global climate change affecting aquatic resources. The impact of global climate change on aquatic organisms and habitat in the geographic area of interest is not precisely known. Global climate change would result in a rise in sea level and may cause regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (GCRP 2009). Such changes in climate could alter aquatic community composition on or near the Crystal River site through changes in species diversity, abundance, and distribution. Elevated water temperatures, droughts, and severe weather phenomena may adversely affect or

severely reduce aquatic habitat, but specific predictions of aquatic habitat changes in this region due to global climate change are inconclusive at this time. The level of impact resulting from these events would depend on the intensity of the perturbation and the resiliency of the aquatic communities.

Summary Statement

Impacts on aquatic ecology resources are estimated based on the information provided by PEF, the State of Florida, and the review team's independent review. There are past and future activities in the geographic area of interest that could affect aquatic ecology resources in ways similar to the building and operation of two additional units at the Crystal River site. The use of Gulf of Mexico water for cooling eliminates much of the potential impact associated with water development needed for closed-cycle cooling for a new site. Proper siting of associated transmission lines, avoiding habitat for protected species, minimizing interactions with waterbodies and watercourses along the corridors, and the use of BMPs during corridor preparation and tower placement would minimize impacts related to the transmission system. Therefore, the review team concludes that the cumulative impacts of building and operating two new reactors on the Crystal River site combined with other past, present, and future activities on most aquatic resources in the Gulf of Mexico would be SMALL.

9.3.2.5 Socioeconomics

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affect socioeconomics, including the other Federal and non-Federal projects listed in Table 9-6. For the analysis of socioeconomic impacts at the Crystal River site, the geographic area of interest is considered to be the 50-mi radius (region) centered on the Crystal River site with special consideration of Citrus, Levy, and Marion Counties, because that is where the review team expects socioeconomic impacts to be the greatest. In evaluating the socioeconomic impacts of site development and operation at the Crystal River site in Citrus County, the review team undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources.

The Crystal River site is in Citrus County, approximately 5 mi south-southwest of Inglis and 8 mi northwest of the City of Crystal River. The review team drew upon U.S. Census Bureau (USCB) 2000 data to find the available total construction workforce within the host county, adjacent counties, and any nearby counties with a major population center within a reasonable commuting distance from the site. For the Crystal River site, this included Citrus, Levy, Marion, Hernando, Sumter, and Pasco Counties. The total construction workforce available in these counties in 2000 was 33,633. Based on this availability, the review team assumed that 50 percent of the 3300 construction workforce, or 1650 workers would migrate into the area.

The review team identified Citrus County and the immediately adjacent Levy and Marion Counties as a primary Economic Impact Area (EIA) for the two new nuclear units in Citrus County on the basis of expected effects of in-migrating construction workers and families. The review team expects that a few of the in-migrating workers would choose to reside in Alachua County, more than an hour's commute distance, because of the amenities available in the large city of Gainesville, but the county's economy and community infrastructure are sufficiently large that the review team expects the effects would not be noticeable. Hernando, Pasco, and Sumter Counties offer no attractions beyond those offered by the immediately adjacent counties that would encourage a longer commute; consequently, the review team expects few in-migrating construction workers would live in these counties and associated effects would not be noticeable. The review team focused on effects of the construction workforce because the operations workforce would be smaller, with expected smaller socioeconomic impacts. Table 9-10 provides some socioeconomic data for the EIA.

Table 9-10. Selected Socioeconomic Data for the EIA for the Crystal River Site

	Citrus	Levy	Marion	Data source
Population				
1980	54,703	19,870	122,488	(b)
1990	93,515	25,923,	194,833	(b)
2000	118,085	34,450	259,914	(c)
Projected 2010	147,311	40,694	348,610	(d)
Median Household Income (1999)	$31,001	$26,959	$31,944	(e)
Vacant Housing Units				
2000	9570	2703	15,908	(c)-(i)
2005	14,165	3360	24,860	(c)-(i)
Total Housing Units				
2000	62,204	16,570	122,663	(c)-(i)
2005	73,070	17,701	152,624	(c)-(i)
Workforce				
Employed	38,837	12,935	98,248	(e)
Construction	2105	1397	8803	(e)
Total schools[(a)]	0 A, 5B, 10 A-B, 4C, 1 A-C, 1 A-B-C	1 A, 1 A-B-C, 4 A-B, 3 B-C, 2 B, 2 C	2 A, 9 B, 29 A-B, 8 C, 1 B-C, 1 A-B-C	(f)
Number of Schools Failing Student-Teacher Ratio	4	0	4	(f)
Sheriff and Police	Crystal River	Inglis, Williston,	Dunnellon, Belleview,	(g)

		Chiefland, Cedar Key.	Ocala	
Emergency Services	23 fire stations; 29 paid and 98 volunteer firefighters	14 fire stations; 8 paid and 183 volunteer firefighters	27 fire stations; 351 paid and 100 volunteer firefighters	(h)
Population				(c)
White	96	87.1	85.3	
African American	2.6	11.2	12	
Hispanic	2.7	3.9	35.7	
Low-Income	11.7	18.6	13.1	(e)

(a) A = elementary school; B = middle school ;C = high school
(b) USCB 1990
(c) USCB 2000b
(d) 2010 projection assuming 2000-2008 growth rate (USCB 2009) extends to 2010
(e) USCB 2000c
(f) FDOE 2009a
(g) Section 2.5.2.6
(h) Citrus, Levy: Section 2.5.2.6, Marion: Marion EM (2009), Marion Fire (2009)
(i) USCB 2007

For purposes of this analysis the review team projected that about 15 percent, or 247, of the in-migrating workers would choose to reside outside the EIA, with the remaining 1403 in-migrating workers distributed in the remainder of the 50 mi region. The review team considered two key factors that would influence in-migrating worker housing patterns: vacant housing in the EIA (with Marion at 56 percent, Citrus at 34 percent, and Levy at 10 percent of the total vacant housing in this area), and commute time. From these factors, the review team assumed that in-migrating workers at peak construction-related employment would be distributed 45 percent in Marion County, 45 percent in Citrus, and 10 percent in Levy. The review team further assumed that all workers would bring families; this is unlikely but provides an upper bound to population increase associated with the project. The review team used the 2.49 average Florida family size to project the distribution of new jobs and population in the EIA due to in-migrating workers listed in Table 9-11.

Table 9-11. Projected Distribution of Workers and Associated Population Increase in the EIA for the Crystal River Site

County	Percent Population Increase 1990–2000(a)	Projected Percent Increase 2000–2010 (b)	Workers In-Migrating to Construct Two New Units at Crystal River Site	Employed Workforce in 2000	Population of In-Migrating Workers and Families	Population of Workers and Families (as a percent of projected 2010	Population of Workers and Families as a percent of projected 2010

						population	population + in-migrants)
Citrus	26.3	24.8	631	38,837	1572	1.07	1.06
Marion	32.9	34.1	631	98,248	1572	0.45	0.45
Levy	32.9	18.1	141	12,935	351	0.86	0.86

(a) Based on USCB data, as reported in PEF (2007b)
(b) Calculated as 1.25 times percent change 2000–2008 shown in USCB (2009), i.e., assumes rate of change for first 8 years would continue through last 2 years of the decade.

Physical and Aesthetics Impacts

The physical impacts on workers and the public of construction and operation at the Crystal River site would be similar to those described for the LNP site, with the primary differences due to the presence of the existing facilities and their workforces. People who work or live around the site could be exposed to noise, fugitive dust, and gaseous emissions from construction activities. Construction workers and personnel working onsite could be the most affected. Air-pollution emissions are expected to be controlled by applicable BMPs and Federal, State, and local regulations. During operation of the two units, standby diesel generators used for auxiliary power would have air-pollution emissions. It is expected that these generators would see limited use and, if used, would be used for only short time periods. Applicable Federal, State, and local air-pollution requirements would apply to all fuel-burning engines. The review team anticipated that the annual average exposure from gaseous emission sources at the site boundary would not exceed applicable regulations during normal operations. The impacts of operations on air quality are expected to be minimal. As with building impacts, potential offsite receptors during operations are generally located well away from the site boundaries.

Residential and commercial areas are located away from the site boundaries, applicable air-pollution regulations would have to be met by PEF, and applicable BMPs would be put in place. Therefore, based on information provided by PEF and the review team's independent review of reconnaissance-level information, the staff concludes that the physical impacts of station construction and operation on workers and the local public around the Crystal River site would be minimal.

Construction and operations activities are not expected to affect any offsite buildings. Most buildings not located onsite are well removed from the site boundaries. Buildings most vulnerable to shock and vibration from pile-driving and other related activities are those located on the site, which could suffer noticeable temporary and short-term effects. No long-term physical impacts on structures, including any residences near the site boundaries, would be expected. Therefore, based on consideration of reconnaissance-level information, the review team concludes that the physical impacts of building and operating the two units at the Crystal River site on onsite and offsite buildings would be minor.

Although transmission-line corridors already exist to serve the Crystal River site, approximately 180 mi of additional transmission system infrastructure would be needed (estimates made by measuring the approximate distance of hypothetical corridors provided by CH2M Hill [2009]). PEF has assumed that new transmission lines would be collocated within existing transmission-line corridors to the extent possible, thereby minimizing potential terrestrial impacts. In addition, transmission-line corridors, towers, and access road would be situated to avoid critical or sensitive habitats and species to the extent possible. The width of the transmission-line corridor would depend on the size, voltage, and whether or not existing corridors could be used, and would vary from 55 ft to 460 ft wide. The buildings, cooling towers, and transmission lines and corridors associated with the new reactors would add an increasingly industrial landscape visible to viewers, with a noticeable aesthetic impact.

Demographic Impacts

Table 9-10 shows that the population in Citrus and Marion Counties increased between 1990 and 2000 at about the same rate as is forecast between 2000 and 2010; for Levy County, about half the rate of increase is forecast for 2000–2010 than for the prior decade. Based on the projections that the peak in-migrating population associated with the proposed project would constitute less than a 2-percent increase over the estimated 2010 populations, the review team found that the in-migrating population associated with building two new nuclear generating units would have a minor demographic impact in the EIA.

Economic Impacts

The review team determined that the impact of jobs associated with construction and preconstruction would have a minor effect on total employment in the EIA. The projected in-migrating workers would account for less than 2 percent of the year 2000 employee base of the EIA. The impact of approximately 541 jobs (70 percent of operations jobs) filled by in-migrating operations workers within a 1-hour commute of the site and the associated 519 indirect jobs would be minor on employment levels in the EIA. See Section 4.4.3.1 for derivation of indirect labor.

The review team assumed that tax revenues generated from sales and use taxes associated with construction and operation of two additional units at the Crystal River site would be similar to those evaluated for the LNP site in Sections 4.4.3.3 and 5.4.3.3, with a similar minimal impact on revenues in the EIA and the region. The review team concluded that increased property taxes from two new operating units at the Crystal River site following reassessment for improvements and for its expanded use as a utility would have a noticeable and substantial beneficial impact on Citrus County. The review team found that additional property taxes on new houses built by in-migrating workers would constitute a small percentage increase in the local tax base in the EIA; thus the impact of operations on residential property tax revenues would be minor.

Housing

The review team compared the 2000 figures for vacant housing in the EIA listed in Table 9-10 with the number of in-migrating workers projected for peak workforce years listed in Table 9-11. Table 9-10 housing figures do not include recreational vehicle (RV) parks, campgrounds, or hotels, and thus provide a lower bound of what would be available to house workers. In the EIA, less than 7 percent of the year 2000 vacant housing units in each county would be needed to house in-migrating workers, assuming that each worker occupied a separate housing unit. To estimate the number of houses required to accommodate the increase in population without the project, the review team divided by 2.49 (Florida average family size). The review team examined estimated housing stock for 2005–2007, based on USCB American Community Survey data, shown in Table 9-10 as year 2005 vacant housing units. The review team considered that half of the projected 2000–2010 increase was housed at the time the American Community Survey data were collected. The review team considered the housing needs of the other half, against the vacant housing figures produced by the survey. This analysis indicated that the EIA could absorb the projected increase. Based on this analysis, the review team concluded that impacts on housing availability related to the building and operation of a plant at the Crystal River site would be minor in the EIA.

Public Services

As discussed in Section 2.5, Citrus County has the capacity in community infrastructure to absorb incoming populations; the review team concluded that the impacts of building and operating two new nuclear generating units at Crystal River would be minimal on public services. Some localized noticeable effects would be felt in Levy County (fire-protection services and schools serving Yankeetown and Inglis) and Marion County (Dunnellon schools, police, and emergency services) for the reasons discussed in Section 4.4.4.4.

Transportation

The review team considered that the primary roads used to access the Crystal River site would be US-19, County Road 40 (CR-40), State Route 44 (SR-44), and SR-121, with US-19 linking to the site access road. US-19 has a level of service (LOS) standard of “B,” and SR-44, CR-40, and SR-121 have an LOS standard of “C.” The review team considered the impact of project-related traffic in terms of the likelihood that it would lower the LOS along US-19 below the assigned standard “B.” One-way annual average daily traffic (AADT) counts for US-19 range from 1600 to 8600 vehicles per day in southern Levy County, 4600 in northern Citrus County, 9300 north of the intersection with SR-44, and 13,000 south of the intersection with SR-44 (FDOT 2008). The review team assumed 2281 trips daily (following the LNP site analysis in Section 4.4.4.1); split 30 percent to/from the north and 70 percent to/from the south, based on the split of in-migrating worker residence patterns discussed above. At morning shift change, this would add 1977 cars to the total flow on US-19, 397 incoming from the north, 1025 from the south; and 165 outgoing to the north, 385 to the south. This would add about 10 percent

volume to traffic coming south into the north of Citrus County and about 10 percent coming north from the intersection with SR-44. The review team found no evidence that the LOS for US-19 would change as a result of project-related traffic, and concluded that building two new units at the Crystal River site would have a minor transportation impact.

Education

Table 9-12 provides data about schools in the EIA. All schools met the State teacher-student ratio classroom requirements in 2007–2008 with the exception of four schools in Citrus County and four schools in Marion County. The review team assumed that school districts in the EIA, like those analyzed for the LNP site, would address short-term gains in student population with mobile classrooms. The review team assumed that students would accompany each in-migrating worker family in the same manner as indicated in Table 9-12.

Table 9-12. Educational System Impacts from In-Migrating Families at Peak Workforce Years

County	In-Migrating Worker Households	Grades PK–3 students	New Grades PK-3 Rooms (a)	Grades 4–8 Students	New Grades 4-8 Rooms (b)	Grades 9–12 Students	New Grades 9-12 Rooms (c)
Citrus	631	85	5	45	3	51	3
Marion	631	52	3	26	2	30	2
Levy	141	67	4	37	2	37	2

Source: Table 4-14 and Florida State Constitution Amendment of Section 1, Article IX (November 2002)
(a) 18 students per teacher required by State law
(b) 22 students per teacher required by State law
(c) 25 students per teacher required by State law
PK = preschool

The review team found that the addition of up to 11 classrooms in Citrus County, 7 classrooms in Marion County, and 8 classrooms in Levy County would amount to less than 1 additional classroom per school, a minor impact even during the period when the greatest number of project-related students would be present.

Summary of Socioeconomics

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. Based on information provided by PEF and its own independent evaluation, the review team finds that the socioeconomic effects of building of two additional nuclear units at Crystal River site would be minor for the EIA and region with the following exceptions. There could be possible short-term noticeable shock and vibration effects to onsite buildings during preconstruction and construction; and noticeable adverse effects on public services in Levy County (fire protection

and schools serving Yankeetown and Inglis) and Marion County (Dunnellon schools, police, and emergency services) until local funding is adjusted after the units are operating. In addition, the review team anticipates long-term noticeable aesthetic affects for viewers of the new structures and transmission lines/corridors; and noticeable and substantial beneficial tax impacts in Citrus County once the units are operational.

Cumulative Impacts

In addition to assessing the incremental socioeconomic impacts from the building and operation of two nuclear units on the Crystal River site, the cumulative impact assessment considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts on the region, including other Federal and non-federal projects and the projects listed in Table 9-6. As indicated in Table 9-6, the Crystal River site, the location of the CREC, contains four fossil-fuel units that began operating in 1966, 1969, 1982, and 1984 and a nuclear plant that began operating in 1977. This table also identifies other projects that might contribute to socioeconomic impacts.

Within the wider region, the resident population is concentrated around the cities of Gainesville to the north-northeast, Crystal River to the southeast, and Ocala to the east-northeast. In the EIA, Levy is the least populated and most rural county; followed by Citrus, which gained population and urban development after construction of the CREC; and then followed by Marion the most populated and least rural. All EIA school districts reported trends in school enrollments that indicated increasing populations of retired persons in the late 1990s and early 2000s, and all had projected a continuation of that trend before the recent economic downturn.

Within the region, the two reasonably foreseeable projects listed in Table 7-1 with the greatest potential to affect cumulative socioeconomic impacts would be the Tarmac King Road Limestone Mine during construction and preconstruction of the LNP and the closure of two coal-fired units at CREC that would possibly occur during operation of the LNP. The other projects involve continuation of restricted development in existing parkland and open space, little or no change in current levels of employment at existing establishments, or new development consistent with controls in existing county comprehensive plans. The effects of these projects have been included in population and demand projections in the county comprehensive plans and in other public agency planning processes referenced in Sections 4.4 and 5.4, and have therefore been taken into consideration in the discussion above.

Tarmac has applied for permits to begin construction of the Tarmac King Road Limestone Mine in 2010, with operations beginning in 2012. The 4900-ac mine site is located 1 mi west of the intersection of US-19 and King Road in Levy County, within about 10 mi of the Crystal River site. Tarmac estimates that at the height of mining activity, about 500 trucks would leave the mine site daily and enter US-19 (Tarmac America 2010). These 500 trucks would add to the approximately 800 new trips heading south along US-19 and to the approximately 2000 total new trips during morning shift changes while the new units are being built at the CREC. Given

the distance of the Tarmac site from the Crystal River site, the review team determined that this would not be sufficient to change the LOS of US-19, because the potential impacts from this increased traffic, coupled with increased traffic from the CREC during building of new units at the site, would be minor except during shift changes.

After construction, the EIA would experience reduced direct construction employment and related indirect jobs. This reduction would be somewhat offset by the introduction of new operations workers at the new units. The planned closure of two of the four coal-fired units at CREC that is expected to occur after the proposed two nuclear power units are operating would slightly increase the differential between peak construction and long-term employment. In addition, Citrus County would see a loss in tax revenue paid by PEF for the two coal-fired units at CREC, but the review team determined the loss in revenue would not be destabilizing given the new revenue from the two nuclear units and other remaining revenue sources. If the operating license for the existing nuclear unit at CREC were not renewed (it is currently valid through midnight December 3, 2016) and the unit closed, the loss of employment, income, and tax revenues would be larger.

In addition to socioeconomic effects directly related to building and operating the new units, cumulative socioeconomic impacts include economic, infrastructure, and community services impacts associated with the items listed in Table 9-6: operation of a new limestone mine, continued operation of a local quarry, continued and uprated operation of an existing nuclear unit at CREC, some expanded residential and commercial development consistent with county comprehensive plans, and some loss of employment and taxes associated with the potential shutdown of two coal-fired units at CREC.

The review team found that physical, demographic, economic, infrastructure, and community service impacts of construction, preconstruction, and operations of the new units at Crystal River would be generally minor. The review team identified noticeable short-term adverse effects on police, emergency, and fire-protection services and schools in specific local communities during peak employment years. The short-term adverse effects would be expected to become minor once local funding has been adjusted after a few years of operation. There would be long-term noticeable aesthetic effects for viewers of the new structures and Citrus County would see long-term noticeable and substantial beneficial tax impacts from two nuclear units.

The team determined that the cumulative socioeconomic effects of the Crystal River nuclear expansion and other past, present, and reasonably foreseeable projects would be SMALL with the following exceptions attributable to building and operating the two new nuclear units at the Crystal River site. There would be MODERATE short-term adverse effects on police, emergency service, fire protection, and schools in specific local communities during peak construction and preconstruction employment years. The short-term adverse effects would be expected to become SMALL once local funding has been adjusted after a few years of LNP operation. There would be long-term MODERATE adverse aesthetic effects for viewers of the

new structures at the Crystal River site. The review team determined that the impact on property tax in Citrus County would be MODERATE and beneficial. However, Citrus County might notice adverse tax impacts if two coal-fired units at CREC are closed after operations begins, with a net effect of SMALL and beneficial tax impacts because of the two new nuclear units.

9.3.2.6 Environmental Justice

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that could have environmental justice effects, including the other Federal and non-Federal projects listed in Table 9-6. The cumulative environmental justice impacts were assessed for a 50-mi radius centered on the Crystal River site (NRC 2000).

The review team used the distribution of minority and low-income populations around the proposed LNP site to consider distributions around the nearby Crystal River site, which is approximately 9 mi southwest of the LNP site. As shown in Figures 2-26 through Figure 2-29, all census block groups with minority and low-income populations that meet the criteria discussed in Section 2.6 are located 10 mi or farther away from the LNP site; they are even farther away from the Crystal River site. The closest minority populations (both aggregate and African American) are in Citrus County between Citrus Springs and Dunnellon, approximately 18 mi from the Crystal River site; and the closest low-income populations, near Otter Creek in Levy County, are almost 30 mi from the site. There are concentrations of block groups with African-American populations around the communities of Otter Creek, Usher, Chiefland, and Williston in Levy County between 25 and 35 mi from the site; around Ocala in Marion County, about 40 mi from the site; around Gainesville in Alachua County, about 55 mi from the site; as well as in the northwest corner of Sumter County, between 15 and 25 mi from the site. (Note: These are estimated linear distances from the Crystal River site; driving distances to all communities are greater.) There are concentrations of block groups with low-income populations that overlap with African-American populations around Otter Creek, Usher, and Chiefland in Levy County and around Ocala (Marion County) and Gainesville (Alachua County). As discussed in Section 2.6.2, the review team did not identify any evidence of unique characteristics or practices in minority or low-income communities that may result in different socioeconomic impacts for the LNP site compared to the general population. This conclusion holds for the Crystal River site.

As discussed in Section 9.3.3.5, the review team expects that building and operating two new nuclear units at the Crystal River site would have minimal physical impacts on all populations in Citrus and surrounding counties, including minority and low-income populations, because of their distance from the site, with the exception of long-term noticeable aesthetic affects for viewers of the new structures, including transmission lines and corridors. The adverse socioeconomic impacts on minority and low-income populations are also expected to be in

proportion with the impacts discussed in Section 9.3.3.5 and are therefore minor for most elements, and noticeable in the short term for education, police, emergency services, fire protection, and transportation in certain locations. In these locations, there is no evidence that impacts would be disproportionately high and adverse towards minority or low-income populations as compared to other populations. Therefore, the review team concludes that the adverse impacts on minority and low-income populations resulting from construction and operation of two new nuclear reactors at the Crystal River site would be minimal. Because the review team found no evidence of unique characteristics or practices among minority or low-income populations that would lead to a disproportionately high and adverse impact, the review team concludes that environmental justice impacts would be minor.

Cumulative Impacts

The review team concluded that, as for socioeconomics effects discussed in Section 9.3.3.5, within the region, the two reasonably foreseeable projects listed in Table 9-6 with the greatest potential to affect cumulative environmental justice impacts would be the proposed Tarmac King Road Limestone Mine during preconstruction and construction of LNP and the possible closure of two coal-fired units at CREC during operation of LNP. The other projects involve continuation of restricted development in existing parkland and open space, little or no change in current levels of employment at existing establishments, or new development consistent with controls in existing county comprehensive plans. The review team believes the effects of these projects have been included in population and demand projections in the county comprehensive plans and in other public agency planning processes.

The review team found no evidence that the minor traffic contribution of the new mine and the net minor employment and tax effects of the possible closure of two CREC coal-fired units could impose disproportionately high and adverse affects on minority or low-income populations. The review team concluded that, in addition to other past, present, and reasonably foreseeable future projects, building and operating two new nuclear units at Crystal River would impose only a minor impact on minorities or low-income populations. Therefore, the environmental justice impacts would be SMALL.

9.3.2.7 Historic and Cultural Resources

The following cumulative impact analysis includes building and operating two new nuclear generating units at the Crystal River site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect historic and cultural resources, including the other Federal and non-Federal projects listed in Table 9-6. For the analysis of cultural impacts at the Crystal River site, the geographic area of interest is considered to be the Area of Potential Effect (APE) that would be defined for this site. This includes the direct effects APE, defined as the area physically affected by the site-development and operation activities at the site and within transmission–line corridors. The indirect effects APE is defined as the area visually

affected and includes an additional 0.5-mi-radius APE around the transmission-line corridors and a 1-mi-radius APE around the cooling towers.

Reconnaissance activities in a cultural resource review have particular meaning. Typically, they include preliminary field investigations to confirm the presence or absence of cultural resources. However, in developing this EIS, the review team relied upon reconnaissance-level information to perform its alternative site evaluation in accordance with ESRP 9.3 (NRC 2000). Reconnaissance-level information is data that are readily available from agencies and other public sources. It can also include information obtained through visits to the site area. The following information was used to identify the historic and cultural resources at the Crystal River site:

- PEF ER (PEF 2009a)
- Atomic Energy Commission Final EIS for Crystal River Unit 3 (CREC Unit 3) (AEC 1973)
- PEF Crystal River Unit 3 License Renewal ER (PEF 2008)
- National Register of Historic Places database (NPS 2010)
- Florida Historical Markers Program (FDOS 2010)
- NRC Alternative Sites Visit October 14–17, 2008 (NRC 2009).

The Crystal River site is owned by PEF and is located adjacent to the CREC. Five existing power-generation units are located on the CREC site – four coal-fueled plants and one nuclear unit. Power generation at the CREC began in 1966. Historically, the site and vicinity were largely undisturbed and likely contained intact archaeological sites associated with the past 10,000 years of human settlement. Over time, the area has been disturbed by development associated with phosphate mining, cattle ranching, citrus farming, and timber production (PEF 2008). Cultural resource investigations, related to the initial construction and operation of CREC nuclear Unit 3, have been ongoing at the CREC since the 1970s.

A search of the Florida Historical Markers Program revealed that there is one historic marker located in Citrus County – the Historic Citrus County Courthouse, which was built in 1887 (FDOS 2010). The courthouse is also in the National Register of Historic Places (NRHP or National Register). A search of the NRHP database revealed that there are nine places in the NRHP, including the Floral City Historic District and the Crystal River Indian Mounds (NPS 2010). According to the Final EIS completed for the CREC Unit 3, the Crystal River Historical Memorial, a Native American ceremonial center and burial site is located near the CREC Unit 3 location (AEC 1973).

According to the ER for the license renewal of CREC Unit 3, the Florida Master Site File records list 37 archaeological studies that have been conducted in the vicinity of the CREC. Two of the studies appear to have been conducted in support of CREC Unit 3 projects and activities. Of particular interest is the archaeological survey of the CREC conducted in 1972 that included

some additional investigations within a 5-mi radius of the facility. As a result of this survey, 43 archaeological sites were inventoried, 20 within the boundary of the CREC. With regard to the 20 sites identified on the Crystal River property, 18 were prehistoric, one was prehistoric and historic, and one was unspecified. None of these sites has been evaluated by the State Historic Preservation Office (SHPO) for eligibility for listing in the National Register. Siting of the two proposed units at the Crystal River site has the potential to affect resources through visual impacts from buildings and transmission lines. If any of the 20 properties is subsequently listed in the National Register, the visual impacts from the proposed project may result in significant alterations to the visual landscape within the geographic area of interest.

Building Impacts

To accommodate building two new nuclear generating units on the Crystal River site, PEF would need to clear approximately 300 ac for the main power plant site – the same area needed for the LNP site (PEF 2009a). If the Crystal River site were chosen for the proposed project, identification of cultural resources would be accomplished through additional cultural resource surveys and consultation with the SHPO, Tribes, and interested parties. The results would be used in the site-planning process to avoid cultural resources impacts. If significant cultural resources were identified by these surveys, the review team assumes that PEF would use the same protective measures used at the LNP site, and therefore the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing, excavation, and grading activities could potentially destabilize important attributes of historic and cultural resources.

Section 9.3.2.1 describes the transmission-line corridors. While there are no existing transmission lines connecting directly to the Crystal River site, transmission-line corridors that connect to the CREC may be used to construct transmission lines for the Crystal River site (PEF 2009a). However, a new transmission-line corridor would be built to serve the Crystal River site. If the Crystal River site were chosen for the proposed project, the review team assumes that PEF would conduct its transmission line-related cultural resource surveys and procedures in a manner similar to that for the LNP site including Florida State site-certification conditions. In addition, the review team assumes the State of Florida's Conditions of Certification regarding transmission-line siting and building activities would also apply, and therefore the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing, excavation, and grading activities could potentially destabilize important attributes of historic and cultural resources.

Operations Impacts

Impacts on historic and cultural resources from operation of two new nuclear generating units at the Crystal River site would include those associated with the operation of new units and maintenance of transmission lines. The review team assumes that the same procedures currently used by PEF, including the State of Florida's Conditions of Certification (FDEP 2010a),

would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of the two new units and associated impacts on the cultural resources would be negligible for the physical and visual APEs.

Cumulative Impacts

Past actions in the geographic area of interest that have similarly affected historic and cultural resources include rural, agricultural, and industrial development and activities associated with these land-disturbing activities such as road development. Table 9-6 lists past, present, and reasonably foreseeable projects and other actions that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest. Projects from Table 9-6 that may fall within the geographic area of interest for cultural resources include operation of CREC Units 1–5, uprate at CREC Unit 3, Crystal River Mariculture Center, other aquaculture facilities, and future urbanization.

Long linear projects such as new or expanded roads and pipelines may intersect the proposed transmission-line corridors. Because cultural resources can likely be avoided by long linear projects, the impacts on cultural resources would be minimal. Future projects associated with the CREC would not result in increased significance of the current physical or visual alterations of cultural resources when considered in addition to past and present activities. If building associated with such activities results in significant alterations (both physical alteration and visual intrusion) of cultural resources in the transmission-line corridors, then cumulative impacts on cultural resources would be greater.

Cultural resources are nonrenewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that the cumulative impacts from building and operating two new nuclear generating units on the Crystal River site would be SMALL. This impact-level determination reflects the fact that the known cultural resources on the Crystal River site have not been evaluated by the SHPO for National Register eligibility, and if the Crystal River site were to be developed, then cultural resource surveys and evaluations would need to be conducted and PEF would assess and resolve adverse effects of the undertaking. Adverse effects could result in greater cumulative impacts.

9.3.2.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affect air quality, including the shutdown of two coal-fired units, and other Federal and non-Federal projects listed in Table 9-6. The geographic area of interest for the Crystal River site is

Citrus County, which is in the West Central Florida Intrastate Air Quality Control Region (40 CFR 81.96).

The emissions related to building and operating a nuclear plant at the Crystal River site would be similar to those at the LNP site. The air quality status for Citrus County as set forth in 40 CFR 81.310 reflects the effects of past and present emissions from all pollutant sources in the region. Citrus County is classified as being in attainment for all NAAQSs.

The atmospheric emissions related to building and operating a nuclear plant at the LNP site in Levy County, Florida, are described in Chapters 4 and 5. Emissions of criteria pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of criteria pollutant emissions at the LNP site were evaluated and also determined to have a SMALL impact.

Cumulative Impacts

Reflecting on the projects listed in Table 9-6, the most significant with regard to air quality within Citrus County are the operations of Units 1–5 at the CREC. Four of these units are fossil-fuel plants. Assuming a timely completion and startup of LNP Units 1 and 2, PEF has agreed to shut down coal-fired CREC Units 1 and 2 by December 31, 2020 (FDEP 2010a). In the period while the fossil-fuel plants are in operation, their effluents are typically released through stacks with significant vertical velocity. Other industrial projects listed in Table 9-6 would have *de minimis* impacts. Given that these projects would be subject to institutional controls, it is unlikely that the air quality in the region would degrade to the extent that the region would be declared to be in nonattainment for any of the NAAQSs.

The air quality impact of the Crystal River site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air quality impacts. There are no land uses or projects, including the aforementioned units at CREC, that would have emissions during site development that would, in combination with emissions from the Crystal River site, result in a degradation of air quality in the region.

Releases from the operation of two new units at the Crystal River site would be intermittent and made at low altitudes with little or no vertical velocity. The air quality impacts of the CREC are included in the baseline air quality status. The cumulative impacts from emissions of effluents from the Crystal River site and the aforementioned sources would be noticeable until 2020. After 2020, when the fossil-fuel units at CREC will likely be discontinued, the emissions from the Crystal River site and aforementioned sources would not be noticeable.

The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in Section 7.6. The impacts of the emissions are not sensitive to the location of the source. Consequently, the discussion in Section 7.6 is applicable to a nuclear power plant located at the Crystal River site. The review team concludes that the national and worldwide cumulative impacts of greenhouse gas emissions are noticeable. The review team further concludes that

the cumulative impacts would be noticeable with or without the greenhouse gas emissions of the project at the Crystal River site or the potential shutdown of the fossil-fuel units at CREC.

Cumulative impacts on air quality resources are estimated based on the information provided by PEF and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic area of interest (local for criteria pollutants and global for greenhouse gas emissions) that could affect air quality resources. The cumulative impacts on criteria pollutant air quality from emissions from the Crystal River site, other projects, and the CREC could be noticeable, principally as a result of the contribution of the fossil-fuel units at CREC. The national and worldwide cumulative impacts of greenhouse gas emissions are noticeable with or without the greenhouse gas emissions from the Crystal River site. The review team concludes that cumulative impacts from construction, preconstruction, and operations, as well as other past, present, and reasonably foreseeable future actions on air quality resources in the geographic area of interest would be SMALL to MODERATE for criteria pollutants (assuming the shutdown of the two coal units occurs) and MODERATE for greenhouse gas emissions. The incremental contribution of impacts on air quality resources from building and operating two new nuclear units at the Crystal River site would be insignificant for both criteria pollutants and greenhouse gas emissions.

9.3.2.9 Nonradiological Health

The following impact analysis includes impacts from building activities and operations for the Crystal River site. The analysis also considers other past, present, and reasonably foreseeable future actions that could affect nonradiological health, including the other Federal and non-Federal projects listed in Table 9-6. The building activities that have the potential to affect the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to affect the health of members of the public and workers include exposure to etiological agents, noise, EMFs, and impacts from the transport of workers to and from the site.

The nonradiological health impacts for the Crystal River alternative site would be similar to the impacts evaluated for the LNP site. For the same reasons discussed in Section 7.7, most of the nonradiological health impacts for building and operation (e.g., air emissions, noise, occupational injuries) would be limited to areas within approximately 2 mi from the site. Occupational injuries would occur only within the boundaries of the Crystal River site, and there would thus be no potential for cumulative impacts with other projects. Impacts of air and particulate pollutants released during building activities, and noise from construction and operation have likewise been assessed as minimal for the offsite receptors nearest to the Crystal River site.

For nonradiological health impacts associated with transmission lines, the geographic area of interest would be the transmission-line corridor. As was the case for operation at the LNP site, thermal discharge from two new units built at the Crystal River site would be discharged into the CREC outfall.

Building Impacts

Nonradiological health impacts on construction workers and members of the public from building two new nuclear units at the Crystal River site would be similar to those evaluated in Section 4.8 for the LNP site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air quality and noise would be complied with during the site-preparation and building phase. A detailed noise study has not been performed for the Crystal River site, but it is likely that noise impacts from building, except for rare, high-noise activities such as pile-driving, would comply with the Citrus County noise limit for industrial and agricultural areas of 75 dBA (Citrus County 2010). The incidence of construction worker accidents would be the same as the incidence of accidents estimated for the LNP site.

Analyses in Section 9.3.2.5 indicated that the traffic impacts in the vicinity of the Crystal River site would be minor and would not require mitigation. Interactions between the traffic destined for the Crystal River nuclear power plant project and the other power-generating plants are likely to increase the nonradiological health effects from traffic accidents in the vicinity of the Crystal River site. The additional injuries and fatalities from traffic accidents involving transportation of materials and personnel for building of a new nuclear power plant at the Crystal River site would be similar to those evaluated in Section 4.8.3 for the LNP site. Noise impacts from construction at the Crystal River site would be similar to those predicted for construction at the LNP site, although detailed noise modeling has not been performed. Noise levels would again be limited to comply with applicable Occupational Safety and Health Administration (OSHA) and local regulations.

The cumulative impacts of building two new units at the Crystal River site would, for the most part, be the same as for construction at the LNP site, because the bulk of the current and future projects are too distant from the Crystal River site for any interactions to occur. The exception is the Holcim Mine, which is approximately 1 mi from the CREC. Potential combined noise and particulate air emission impacts from quarry operations and nuclear plant construction activities might occur. The Crystal River Mariculture Center is also located adjacent to the Crystal River site, but combined nonradiological health impacts are unlikely to occur, given that the Mariculture center is already in operation and is unlikely to be a significant source of noise or air pollutant emissions. Combined impacts of building activities with other present and future projects in the area would be unlikely. The review team has concluded that cumulative nonradiological health impacts associated with construction at the Crystal River site and all current and foreseeable future projects would be minimal.

Operational Impacts

Occupational injuries and nonradiological health impacts on members of the public from operation of two new nuclear units at the Crystal River site would be similar to those evaluated in Section 5.8 for the LNP site. Occupational health impacts on workers (e.g., falls, electric shock or exposure to other hazards) at the Crystal River site are expected to be the same as those evaluated for workers at two new units at the LNP site. Exposure of the public to waterborne etiological agents at the Crystal River site would be limited by the current physical and administrative controls around the thermal discharge of the existing facility, and the exposures would be similar to those discussed in Section 5.8.1. The operation of the new units at the Crystal River site would not likely lead to an increase in waterborne diseases in the vicinity. Noise and EMF exposure would be monitored and controlled in accordance with applicable OSHA regulations. Noise impacts would be similar to those predicted for operations at the LNP site, although no detailed noise modeling has been performed for the Crystal River site. Effects of EMF on human health would be controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria and adherence to the standards for transmission systems regulated by the FDEP. Traffic impacts during facility operation would be less than the impacts during building (minor).

Current and future energy projects with the potential for combined impacts include the ongoing operation of the CREC; these activities include the license renewal and uprate of CREC nuclear Unit 3 and the retirement of two older coal-fired generation plants at CREC when LNP Units 1 and 2 come online. The review team has concluded that the cumulative nonradiological human health impact would be minimal for operation at the Crystal River site. Facility operations at Crystal River are unlikely to have any combined health impacts with other nearby projects (Crystal River Quarry and Crystal River Mariculture Center), and the other projects identified in Table 9-6 are too far away from the Crystal River site for cumulative impacts to be a concern. Thus, the cumulative nonradiological health impacts of these operations and the facility operations at the Crystal River alternative site would also be minimal.

The review team is also aware of the potential climate changes that could affect human health; recent analyses of these issues (GCRP 2009) have been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature and a decrease in precipitation, which may alter the presence of microorganisms and parasites in surface water. While the overall impacts of climate change may not be insignificant (Section 7.7), the effect of, or contribution to, these effects from operation at the Crystal River site is likely to be minor. The review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases.

Summary

Based on the information provided by PEF and the review team's independent evaluation, the review team expects that nonradiological health impacts from building and operation of two new units at the Crystal River alternative site would be similar to the impacts predicted for the LNP site. While past, present, and future activities in the geographic area of interest could affect nonradiological health in ways similar to the building and operation of two units at the Crystal River site, the impacts would be localized and managed through adherence to existing regulatory requirements. The review team concludes, therefore, that cumulative impacts of nonradiological health associated with building activities and operations at the Crystal River site would be SMALL.

9.3.2.10 Radiological Impacts of Normal Operations

The following impact analysis includes radiological impacts from building activities and operation for two additional nuclear units at the Crystal River site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects listed in Table 9-6. As described in Table 9-6 (Section 9.3.2), the Crystal River site consists of five power-generating plants operated by PEF, four fossil-fuel plants and one nuclear plant, CREC Unit 3. The geographic area of interest is the area within a 50-mi radius of the Crystal River site. Other than CREC Unit 3, there are no major facilities that result in regulated exposures to the public or biota within 50 mi of the Crystal River site. However, there are likely to be hospitals and industrial facilities with 50 mi of the Crystal River site that use radioactive materials.

The radiological impacts of building and operating the proposed two AP1000 reactors at the Crystal River site include direct radiation and liquid and gaseous radioactive effluents. Releases of radioactive materials and all pathways of exposure would produce low doses to people and biota offsite, well below regulatory limits. The impacts are expected to be similar to those estimated for the LNP. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Crystal River site. This conclusion is based on the radiological monitoring program conducted for the currently operating CREC Unit 3.

Based on the information provided by PEF and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the two proposed AP1000 units and other past, present, and reasonably foreseeable projects and actions in the geographic area of interest around the Crystal River site would be SMALL.

9.3.2.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for two additional nuclear units at the Crystal River site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including the other Federal and non-Federal projects and the projects listed in Table 9-6. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Crystal River site. As described in Section 9.3.2, the Crystal River site is adjacent to an existing power plant site; there is currently one nuclear facility on the adjacent site. There are no proposed reactors that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Crystal River site.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of design basis accidents (DBAs) at the LNP site would be minimal for AP1000 reactors. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria. The AP1000 design is independent of site conditions, and the meteorological conditions of the Crystal River and LNP sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Crystal River site would be minimal.

Because the meteorology, population distribution, and land use for the Crystal River site are similar to the LNP site, risks from a severe accident for an AP1000 reactor located at the Crystal River site are expected to be similar to those analyzed for the LNP site. The risks for the LNP site are presented in Tables 5-17 and 5-18 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For the existing plant within the geographic area of interest, namely CREC Unit 3, the Commission has determined that the probability-weighted consequences of severe accidents are SMALL (10 CFR Part 51, Appendix B, Table B-1). The planned 20-percent power uprate at CREC Unit 3 will only be approved by the NRC if the probability-weighted consequences of severe accidents would continue to meet NRC's regulatory requirements. Therefore, the impact would continue to be SMALL. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Crystal River site would be SMALL.

9.3.3 Dixie Site

This section covers the review team's evaluation of the potential environmental impacts of siting a new two-unit nuclear power plant at the Dixie alternative site (hereafter Dixie site) in northern Florida. The site is located in a rural area of Dixie County northwest of the Suwannee River. The Suwannee River would be the source for water for plant cooling and other plant uses, and construction of a new water-storage reservoir would be required. Dixie is a greenfield site not

currently owned by PEF (PEF 2009a). Conceptual routes of the transmission lines necessary to connect the Dixie site to the electrical grid are located in Taylor, Lafayette, Suwannee, Columbia, Gilchrist, Dixie, Levy, Citrus, Ocala, Sumter, Lake, and Hernando Counties.

The following sections include a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the Dixie site and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction and operations and impacts of preconstruction activities. Also included in the assessment are past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Dixie site. Other actions and projects considered in this cumulative analysis are described in Table 9-13.

The geographic area of interest for cumulative impacts considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Dixie site. An accident at a nuclear plant within 100 mi of the Dixie site could increase this risk. The CREC is within 50 mi of the Dixie site and is included in Table 9-13. Other nuclear plants in Florida, Alabama, and Georgia that are more than 100 mi from the Dixie site are not included in the cumulative impact analysis.

9.3.3.1 Land Use and Transmission Lines

The following analysis includes impacts from building and operating two nuclear units at the Dixie site, along with the necessary transmission lines to connect them to the electrical grid. The analysis also considers other past, present, and reasonably foreseeable future actions that affect land use, including the other Federal and non-Federal projects listed in Table 9-13. For this analysis, the geographic area of interest for considering cumulative impacts is the area within the 20-mi radius of the Dixie site and within the transmission-line corridors. The review team determined that the 20-mi radius would represent the smallest area that would be directly affected because it includes the primary communities (such as Trenton, Chiefland, and Fanning Springs) that would be affected by the proposed project if it were located at the Dixie site.

Historically, Dixie County was known for commercial fishing, agriculture, and timber operations. Existing land uses in the vicinity of the Dixie site include agriculture, forestry, and low-density residential development. Several subdivisions are located along the Suwannee River. The area around the site is relatively flat, but prone to flooding (PEF 2009a). The Dixie site is subject to the Coastal Zone Management Act because the site is located within one of the designated Florida coastal zone counties. Manatee Springs State Park, Yellow Jacket Conservation Area, Fowlers Bluff Conservation Area, Lower Coastal Creeks Conservation Area, and Steinhatchee Wildlife Management Area lie within the region.

Table 9-13. Past, Present, and Reasonably Foreseeable Future Projects and Other Actions Considered in the Cumulative Analysis of the Dixie Site

Project Name	Summary of Project	Location	Status
Energy Projects			
Operation and Decommissioning of CREC Units 1–5	The CREC consists of five power-generating plants operated by PEF – four fossil-fuel plants and one nuclear plant. The fossil-fuel plants began operations in 1966, 1969, 1982, and 1984. The nuclear plant began operations in 1977.	Within 50 mi of the Dixie site in northern Citrus County	Operational. The State of Florida Siting Board's Conditions of Certification for LNP would require PEF to discontinue the operations of the two fossil-fuel units by December 31, 2020, assuming licensing, construction, and commencement of operation of LNP occurs in a timely manner (DOE/EIA 2010; FDEP 2010a).
Renewal of the operating license for the CREC nuclear Unit 3	Extension of operations of CREC Unit 3 for an additional 20-year period beyond the end of the current license term, which is valid through midnight on December 3, 2016.	Within 50 mi of the Dixie site in northern Citrus County	Proposed. If granted, the license renewal would provide PEF the authority to continue operations through 2036. The draft Supplemental EIS for the license renewal is scheduled to be issued in 2010 (NRC 2010a).
Uprate at CREC Unit 3	CREC Unit 3 is planning to request a power uprate, or increase in the maximum power level at which the nuclear power plant may operate. The project would also include construction of a new helper cooling tower.	Within 50 mi of the Dixie site in northern Citrus County	Proposed. The application submitted to the State of Florida was approved in August 2008. USACE issued a public notice on May 25, 2010 (USACE, 2010). An application is expected to be submitted to NRC in 2010 (PEF 2009f).
Florida Gas Transmission Company, LLC (FGT) Phase VIII Expansion Project	Construct natural-gas pipelines, new compressor , meter, regulator stations, and other appurtenant facilities	Various Counties in Alabama and Florida, including Levy, Citrus, and Hernando	Completion expected in 2011 (FERC 2010; Panhandle Energy 2010).

Table 9-13. (contd)

Project Name	Summary of Project	Location	Status
Parks and Conservation Areas			
Parks, forests, and reserves	Several parks, recreation, and conservation areas are located within the 50-mi region. Examples of such areas include Goethe State Forest, Cedar Keys National Wildlife Refuge; Cummer Sanctuary, Crystal River National Wildlife Refuge, Lower Suwannee National Wildlife Refuge; Crystal River Preserve State Park, Manatee Springs State Park, Yellow Jacket Conservation Area, Fowlers Bluff Conservation Area, Lower Coastal Creeks Conservation Area, and Steinhatchee Wildlife Management Area	Throughout region	Currently managed by various local, State, and Federal agencies and organizations. Development likely limited in these areas.
Other Actions/Projects			
Commercial forest management	Managed forests for timber production.	Throughout region	Operational
Commercial dairies	Several dairies are located within the 50-mi region, including the Levy County Dairy, Alliance, and Piedmont Dairies, Hill Top Dairy, Aurora Dairy, Dairy Production Systems, and Oak Grove Dairy, Inc.	Throughout region	Operational
Minor water dischargers and wastewater-treatment plants	NPDES-permitted dischargers in Fanning Springs, Trenton, Blitchville, Bell, Chiefland, Cedar Key, Suwannee, and other locations.	Throughout region	Operational
Concrete companies	Two ready-mixed concrete suppliers.	Within 10 mi	Operational (EPA 2010e, f)
Bryan Farms	Animal aquaculture	Within 10 mi	Operational (EPA 2010g)

Table 9-13. (contd)

Project Name	Summary of Project	Location	Status
Crystal River Mariculture Center	Multi-species marine hatchery adjacent to the CREC.	Within 50 mi	Operational (FFWCC 2010)
Kaiser Agricultural Chemicals	RCRA site on Suwannee River in Branford, Florida	Within 40 mi	Operational (EPA 2010h)
Other Actions/Projects			
Various hospitals and industrial facilities that use radioactive materials	Medical and other industrial isotopes	Within 50 mi	Operational in nearby cities and towns
Future urbanization	Construction of housing units and associated commercial buildings; roads, such as widening, bridges, and railroads; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region	Construction would occur in the future, as described in State and local land-use planning documents (FDOT 2010a; Dixie County 2006).

Zoning changes would likely be needed to accommodate construction and operation of a nuclear power plant at the Dixie site. Like the LNP site, the footprint of new power-generating units would be approximately 627 ac, with about 150 ac of additional land needed for temporary facilities and laydown yards. In addition, PEF indicates that a 1291-ac reservoir would be needed at the Dixie site to provide cooling water during periods of low flow of the Suwannee River (PEF 2009d; CH2M Hill 2009). Construction of these facilities would result in a permanent land-use change from the existing land uses described in the previous paragraph to a transportation, communications, and utilities land-use category.

Additional land-use impacts include possible additional growth and land conversions to accommodate new workers and services. Because the workforce would be dispersed over larger geographic areas in the labor supply region, the impacts from land conversion for residential and commercial buildings induced by new workers relocating to the local area can be absorbed into the wider region. Therefore, the review team concludes that such impacts would be minimal. There are no existing transmission lines or transmission-line corridors in the geographic area of interest around the Dixie site. New transmission lines would need to be constructed to connect the site to existing transmission lines. The transmission lines would run through counties designated under the Florida Coastal Management Program. Any expansion of these transmission-line corridors would require review under the procedures established

under the Florida Coastal Management Program. Procedures for siting new transmission lines in Florida are discussed in Section 4.1.2. The review team assumes that the conditions of certification issued to PEF by the FDEP would apply at all of the alternative sites.

The review team estimated the linear run of the expected transmission-line corridors by referring to PEF Figure 3.3.3-9 (PEF 2010), which depicts the potential routing of corridors needed to connect the Dixie units to the grid. That figure suggests that 340 mi of transmission-line corridor would be needed. For purposes of land-use impact analysis, the review team made the assumption that 10 ac/mi would be disturbed, based on the LNP case where 1790 ac are expected to be disturbed over the 180 mi of corridor, as discussed in Section 4.1.2. The review team concludes that this assumption is not unreasonable because siting in Florida is a relatively rigorous process (Site Certification Application process), and the applicant would be bound by permit conditions resulting from that process, which would require it to use existing corridors to the extent practicable. The review team expects that the Site Certification Application (SCA) process would be consistently applied anywhere transmission lines are proposed in Florida. Therefore, the review team concludes that about 3400 ac of land would be disturbed to construct the transmission-line corridors for the Dixie site. Similar to the case at the LNP site, the review team concludes that land-use impacts from developing about 340 mi of new transmission-line corridor to connect new units at the Dixie site would be noticeable, but not destabilizing, and additional mitigation beyond the measures and conditions identified would not be warranted.

Cumulative Impacts

Future urbanization in the review area could contribute to additional decreases in open areas, forests, and wetlands and generally result in some increased residential and industrialized areas. Currently, the area around the Dixie site consists of farmland, forests, and low-density rural residential land uses, but local land-use planning documents describe potential future construction of residential and commercial buildings. The population of Dixie County grew by 30.6 percent between 1990 and 2000 (USCB 2000d), so it seems reasonable to expect that an increase of 3 percent per year might continue into the foreseeable future. Increased urbanization, especially long linear projects such as new or expanded roads or pipelines also would contribute to the loss of open or forested areas and increase fragmentation of habitats along or near the transmission lines. Due to the extent of new transmission lines that would be built, the review team expects that the corridors would have a noticeable impact on the local area. These projects would have limited impacts on land use because a small incremental amount of land would be converted to a new land use, and it would be adjacent to the current roads or pipelines. Development would likely be limited in the nearby parks and recreational areas. Therefore, the incremental impacts associated with increased urbanization would be minimal.

Global climate change could increase temperature and reduce precipitation, which could result in reduced crop yields and livestock productivity (GCRP 2009), which, in turn, may change

portions of agricultural and ranching land uses in the geographic area of interest. In addition, global climate change could increase sea level and storm surges in the geographic area of interest (GCRP 2009), thereby changing land use through inundation and loss of coastal wetlands and other low-lying areas. However, existing State and national forests, parks, reserves, and managed areas would help preserve wetlands and forested areas to the extent that they are not affected by sea-level rise. Because other projects identified in Table 9-13 that are within the geographic area of interest would be consistent with applicable land-use plans and control policies and would occur in dispersed locations, the review team considers their contribution to the cumulative land-use impacts to be relatively minor and manageable.

In the State of Florida's Conditions of Certification (FDEP 2010a), CREC Unit 1 and 2, two coal-fired plants, would stop operating by December 31, 2020, as long as PEF completes the licensing process, construction activities, and commences commercial operation of LNP Units 1 and 2 within a timely manner. If the Dixie site were selected, the review team expects the same condition would apply. If CREC Units 1 and 2 are shut down, land use at the units likely would remain industrial. Depending on economic conditions, PEF sells 60 to 95 percent of the coal plant ash to cement and building materials manufacturers, with the remainder going to Citrus Central Landfill in Lecanto, Florida. With the closure of CREC Units 1 and 2, this source of ash no longer would be available locally. The review team expects land-use impacts associated with the shutdown of CREC Units 1 and 2 would be minimal.

Because detailed information about the routing of the possible new transmission-line corridors is not known at this time, a complete evaluation of potential land-use impacts cannot be made. Based on the information provided by PEF and the review team's own independent review, the review team concludes that the cumulative land-use impacts of building and operating two new nuclear reactor units at the Dixie site and other projects would be MODERATE. The proposed project would be a significant contributor to the MODERATE impacts because of the substantial amount of land that would be needed for the proposed power plant, reservoir, and transmission infrastructure.

9.3.3.2 Water Use and Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that could affect water use and quality, including the other Federal and non-Federal projects listed in Table 9-13. PEF has indicated that the development of this site for two nuclear units would require the building of a water reservoir on the Dixie site supplied with water from the Suwannee River (PEF 2009a). PEF has indicated that the site is located in an area considered to be low-lying and flood prone, and the construction of flood protection structures may be required (PEF 2009a).

The geographic area of interest for surface water at the Dixie site is considered to be the drainage basin of the Suwannee River upstream and downstream of the site, because the water

resource in this area that could be affected if the proposed project were located at the Dixie site. For groundwater, the geographic area of interest is limited to the alternative site because PEF has indicated no plans for use of groundwater to build or operate the plant (PEF 2009a).

Historical flow data for water years 1941–2008 are available for Suwannee River near Wilcox and for the Suwannee River above the Gopher River near Suwannee, Florida (USGS 2010a, b). The Suwannee River near the Wilcox streamflow gauge is upstream of the Dixie site and the Suwannee River above the Gopher River streamflow gauge is downstream of the Dixie site. Minimum flows and levels for the Suwannee River are summarized by the Suwannee River Water Management District (SRWMD) (SRWMD 2005).

The average streamflow reported by the SRWMD is approximately 10,000 cfs based on historic data from the gauge at Wilcox (SRWMD 2005). Mean annual flow for the past 10 years in the Suwannee River above Gopher River is reported as 7440 cfs (USGS 2009a). Minimum flow and level objectives are established by the SRWMD for the Suwannee River (SRWMD 2005). For the Suwannee River near the Wilcox streamflow gauge, the recommended minimum flow is 6600 cfs from May to October and 7600 cfs from November to April (PEF 2007b). These minimum flows provide an indication of the water potentially available for use in building and operating two units at the site. During the 2008 water year, these minimum flows were equaled or exceeded only during the months of March and September. SRWMD would determine the actual yield available for consumption that exceeds recommended minimum flow. Based on the available information, the review team determined that the Suwannee River occasionally does not meet the SRWMD recommendation for minimum flow for extended periods during a water year.

The Lower Suwannee River was identified as being impaired by nutrients and was included on Florida's Verified List of Impaired Waters (Hallas and Magley 2008). A USGS report on the condition of the river states, "human health and ecological concerns have arisen recently because of the large nitrogen inputs to the land surface from fertilizers, animal wastes and atmospheric deposition. This problem occurs primarily in the middle and lower Suwannee and lower Santa Fe Rivers in Florida, where spring water and diffuse upward leakage of groundwater contribute substantial loads of nitrate-N" (USGS 2004). Based on available information, the review team determined that the waters of the Lower Suwannee River are impaired because of historical activities in the basin.

Building Impacts

Because the building activities at the Dixie site would be similar to those at the LNP site, the review team determined that the amount of surface water needed for building activities at the Dixie site would be similar to the proposed amount of groundwater use for building at the LNP site. During building activities at the LNP site, the total maximum usage is projected to be 550,000 gpd (0.85 cfs) and the projected average estimated groundwater usage is 275,000 gpd (0.43 cfs) (see Table 3-2). The review team assumed that surface water from the Suwannee

River would be used at the Dixie site for potable and sanitary use as well as for various building-related activities. This surface-water withdrawal rate is minor when compared to the average annual flow in the Suwannee River (10,000 cfs). However, as mentioned above, recommended minimum flows were met only during March and October of the 2008 water year. The applicant would need to obtain an approval from the SRWMD to use surface water from the river for building activities. Because the surface-water withdrawal would be minor compared to the average annual flow and because the withdrawal from the river would be temporary and limited to the building period, the review team concludes that the impact of surface-water use for building the potential units at the Dixie site would be minimal.

As stated above, the review team assumed that no groundwater would be used to build the units at the Dixie site. The review team also assumed that the impact of dewatering the excavations needed for building two units at the site would be managed through the installation of diaphragm walls and grouting as is proposed for the LNP site. Therefore, because there would be no groundwater use and the impact of dewatering would be controlled, the review team determined that there would be minimal impact on groundwater resources.

Surface-water quality would most likely be affected by surface-water runoff during site preparation and the building of the facilities. The FDEP would require PEF to develop an E&SCP and a SWPPP (PEF 2009a). The plan would identify BMPs to control the impacts of stormwater runoff. The review team anticipates that PEF would construct new detention and infiltration ponds and drainage ditches to control delivery of sediment from the disturbed area to nearby waterbodies. Sediment carried with stormwater from the disturbed area would settle in the detention ponds and the stormwater would infiltrate into the shallow aquifer. While stormwater runoff is anticipated to contain nitrogen in low concentrations (Table 3-3) it is not anticipated to contribute significantly to the nutrient concentrations in the river and implementation of BMPs should minimize impacts on the Suwannee River near the Dixie site. Therefore, during building activities, the surface-water-quality impacts near the Dixie site would be temporary and minimal.

While building new nuclear units at the Dixie site, impacts on groundwater quality may occur from leaching of spilled effluents into the subsurface. The review team assumes that the BMPs PEF has proposed for the LNP site would also be in place during building activities at the Dixie site, and therefore the review team concludes that any spills would be quickly detected and remediated. In addition, groundwater impacts would be limited to the duration of these activities, and therefore would be temporary. The review team examined the BMPs that could be implemented at such a site (FDEP 2010a). Because any spills related to building activities would be quickly remediated under BMPs, and the activities would be temporary, the review team concludes that the groundwater-quality impacts from building at the Dixie site would be minimal.

Operational Impacts

PEF determined that a cooling-water reservoir would be needed at the Dixie alternative site. The review team assumed that the cooling water system for the proposed plant, if built and operated at the Dixie alternative site, would be similar to that proposed at the LNP site; specifically, the cooling water system would use cooling towers and blowdown would be discharged to the Suwannee River. The cooling-water reservoir would provide capacity for times when adequate water from the river may not be available. PEF did not provide details of the cooling-water intake and effluent discharge locations. However, it is standard practice for power plants to design cooling-water intake and effluent discharge locations such that recirculation of discharged effluent to the intake does not occur. The reservoir was sized assuming the plant would operate on four cycles of concentration, and that the total cooling-water requirements would be 45 Mgd (31,250 gpm). The reservoir was sized so that the storage is sufficient for a 90-day supply of cooling (PEF 2009d; CH2M Hill 2009).

PEF determined that the total amount of water required to operate two units would be approximately 40,000 gpm (89 cfs). As indicated in Chapter 3, evaporative losses from cooling two units would be approximately 28,000 gpm (62 cfs). As described above, minimum flows were equaled or exceeded for only 2 months during the 2008 water year, suggesting that even with a reservoir, alternative sources of water or other water-saving strategies may be required for operation of two units at the Dixie site. Monthly mean streamflow lower than the recommended minimum flows have occurred in other recent water years, most notably in 2000 (12 of 12 months were below recommended minimum flow), 2001 (10 of 12 months), 2002 (12 of 12 months), 2004 (9 of 12 months), 2006 (9 of 12 months), 2007 (12 of 12 months), 2008 (10 of 12 months), and 2009 (9 of 12 months). The review team determined that out of 69 water years of available streamflow record at Wilcox, mean monthly streamflow at Wilcox was less than the recommended minimum at least six months during the water year in 26 water years. Of these 26 water years, mean monthly streamflow was less than the recommended minimum at least nine months during the water year for 16 water years. The review team also determined that based on established minimum flows, the discharge in the Suwannee River at Wilcox does not exceed 22 and 16 percent of the months during the periods November through April and May through October, respectively. The cooling water withdrawal needed for the proposed plant is 89 cfs, which is less than 2 percent of the smallest recommended minimum streamflow at Wilcox in the Suwannee River. Based on the minimum flow requirements for the Suwannee River and the recent extended periods when these low flows have not been met, the review team determined that the operational impact of the proposed plant at the Dixie alternative site on surface water would be noticeable but not destabilizing.

As stated above, the review team assumed that no groundwater would be used to operate the units at the Dixie site. Therefore, because there would be no groundwater use, the review team determined that there would be no impact on groundwater resources.

During the operation of the proposed plant at the Dixie site, impacts on surface-water quality could result from stormwater runoff, discharges of treated sanitary and other wastewater, and blowdown from cooling towers into the receiving waterbody. PEF did not provide the blowdown rate at the Dixie site. The review team conservatively assumed that the blowdown rate would be the same as that at the LNP site, 57,923 gpm (129 cfs). This assumption is conservative because the proposed plant at the Dixie site would use freshwater from the Suwannee River rather than more saline water at the LNP site, requiring less frequent and smaller blowdown discharge. The FDEP would require PEF to develop a SWPPP (PEF 2009a). The plan would identify measures to be used to control stormwater runoff (PEF 2009a). The blowdown would be regulated by FDEP pursuant to 40 CFR Part 423 and all discharges would be required to comply with limits established by FDEP in an NPDES permit.

During the operation of new nuclear units at the Dixie site, impacts on groundwater quality could result from potential spills. Spills that might affect the quality of groundwater would be prevented or remediated by using BMPs. Because BMPs would be used to quickly remediate spills and no intentional discharge to groundwater should occur, the review team concludes that the impacts on groundwater quality from operation of two nuclear units at the Dixie site would be minimal.

Cumulative Impacts

In addition to water-use and water-quality impacts from building and operation activities, the cumulative impacts analysis considers past, present, and reasonably foreseeable future actions that affect the same water resources.

For the cumulative analysis of impacts on surface water, the geographic area of interest for the Dixie site is considered to be the drainage basin of the Suwannee River upstream and downstream of the site because this is the water resource in the river basin could be affected by the proposed project. For groundwater, the geographic area of interest is limited to 20 mi from the Dixie site because it is sufficiently large to characterize the cumulative groundwater-use impacts. Actions that have past, present, and future potential impacts on water supply and water quality near the Dixie site include existing agriculture and existing and future urbanization in the region.

The U.S. Global Change Research Program (GCRP) has compiled the state of knowledge in climate change (GCRP 2009). This compilation has been considered in the preparation of this EIS. The projections for changes in temperature, precipitation, droughts, and increasing reliance on aquifers within the Suwannee Basin are similar to those at the LNP site. Such significant changes in climate would necessitate adaptations to both surface-water and groundwater management practices and policies that are unknown at this time.

Cumulative Water Use

The water use during operation of the two units at the Dixie site (89 cfs) would significantly exceed the amount of water use during building activities (less than 1 cfs). The amount of water needed for plant operation, 89 cfs, is less than 1 percent of the long-term average flow of the Suwannee River at the site (10,000 cfs). Extended periods when flows in the Suwannee River are below the minimum flow levels set by the SRWMD have been observed. Reasonably foreseeable future actions in the Suwannee River basin (see Table 9-13) would also use additional waters. Based on the minimum flow requirements for the Suwannee River and the recent extended periods when these low flows have not been met, the review team determined that the surface-water-use impact of the proposed plant at the Dixie site would be minor but alternative sources of water or other water-saving strategies may be needed to support operation of two units at this site because the river discharge is frequently less than the recommended minimum flow.

Other projects listed in Table 9-13 are considered in the analysis included above or would have little or no impact on surface-water use. Therefore, the review team concludes that cumulative impacts on surface-water use would be MODERATE. Building and operating the proposed plant at the Dixie site would not be a significant contributor to these water-use impacts.

As stated above, the review team assumed that no groundwater would be used to build or operate the units at the Dixie site and that groundwater impacts from dewatering would be controlled with diaphragm walls and grouting. Therefore, the review team determined that there would be minimal impact on groundwater resources.

Other projects listed in Table 9-13 are considered in this analysis or would have little or no impact on groundwater use. Therefore, the review team concludes that cumulative impacts on groundwater use would be SMALL.

Cumulative Water Quality

Point and non-point sources have affected the water quality of the Suwannee River upstream and downstream of the site. As mentioned above, the Lower Suwannee River was identified as being impaired by nutrients and was included on Florida's Verified List of Impaired Waters. Water-quality information presented for the impacts of building and operating the new units at the Dixie site would also apply to evaluation of cumulative impacts. The State of Florida would require PEF to develop a SWPPP (PEF 2009a), which would identify measures to be used to control stormwater runoff (PEF 2009a). The blowdown would be regulated by FDEP pursuant to 40 CFR Part 423 and all discharges would be required to comply with limits established by FDEP in an NPDES permit. Such permits are designed to protect water quality, and while stormwater runoff and plant discharge are anticipated to contain nitrogen in low concentrations

(Table 3-3), they are not anticipated to contribute significantly to the nutrient concentrations in the river.

The lower Suwannee River appears on Florida's list of impaired waters because of the presence of nutrients, fecal coliform, iron, and mercury in fish tissue (FDEP 2009g); therefore, the review team concluded that the cumulative impact on surface-water quality of the receiving waterbody would be MODERATE. Building and operating the proposed units at the Dixie site would not be a significant contributor to these impacts on surface-water quality because industrial and wastewater discharges from the proposed units would comply with NPDES permit limitations and any stormwater runoff from the site during operations would comply with the SWPPP (PEF 2009a).

As stated in Section 7.2.1.1, global climate change can result in a rise in sea level that may induce saltwater intrusion in the surficial and Floridan aquifers. Projected changes in the climate for the region during the life of the proposed units include an increase in average temperature and a decrease in precipitation. These changes are likely to result in changes in agriculture including crops, pests, and the associated changes in application of nutrients, pesticides, and herbicides that may reach groundwater. As a result, groundwater quality may be altered by the infiltration of chemicals. While the changes in groundwater quality that are indirectly attributable to climate change may not be insignificant, the review team did not identify anything that would alter its conclusion regarding groundwater quality above. The review team also concluded that with the implementation of BMPs, the impacts on groundwater quality from building and operating two new nuclear units at the Dixie site would likely be minimal. Therefore, the cumulative impact on groundwater quality would be SMALL.

Other projects listed in Table 9-13 are either considered in the analysis included above or would have little or no impact on surface-water and groundwater quality.

9.3.3.3 Terrestrial and Wetland Resources

Site Description

The following impact analysis includes direct, indirect, and cumulative impacts from construction and preconstruction activities and operations on terrestrial and wetland resources. The analysis also considers past, present, and reasonably foreseeable future actions that affect those resources, including the other Federal and non-Federal projects and the projects listed in Table 9-13. For the analysis of terrestrial ecological impacts at the Dixie site, the geographic area of interest is considered to be a 20-mi-wide area centered on the Dixie site and the associated offsite and transmission-line corridors. This 20-mi radius and corridor around each proposed transmission-line is expected to encompass the locations of possible development projects potentially capable of substantially influencing terrestrial ecological resources on and close to the Dixie project site. This geographical area of interest generally coincides with those defined for hydrology and aquatic ecology, both of which are closely interrelated with the terrestrial

ecology of this setting. This area includes watersheds providing direct runoff from the Dixie site to the Suwannee River and other river basins, as well as the watersheds through which the transmission lines would be routed.

The Dixie site is a greenfield site located in the Gulf Coast Flatwoods ecoregion. It is situated in a remote rural area on the Lower Suwannee River, which is classified by the FDEP as an Outstanding Florida Water. The Suwannee River is considered one of the largest and most ecologically unique blackwater river systems in the southeastern United States. Land uses in the Lower Suwannee River basin generally include agriculture, commercial forestry, and low-density residential development. Vegetation communities present on the site and in the vicinity, including offsite corridors, are typical of those found in the Gulf Coast Flatwoods ecoregion consisting of slash pine and remnant longleaf pine with bottomland oak-gum-cypress forests in low-lying areas along most rivers (FWS 2010). Predominant cover types on the site include managed pine forestland and scrub vegetation. The topography is relatively flat with only minor relief (approximately 2 ft).

The proposed associated transmission-line corridors would begin in the Gulf Coast Flatwoods ecoregion and cross the Southwestern Florida Flatwoods and Central Florida Ridges and Uplands ecoregions. Vegetation community types in the Southwestern Florida Flatwoods ecoregion include forests dominated by slash pine, longleaf pine, cabbage palm, and live oak with typical understory species of sawpalmetto, gallberry, and grasses such as bluestems and wiregrasses (USDA 2006). Vegetation community types in the Central Florida Ridges and Uplands ecoregion include sandhill vegetation such as turkey oak, bluejack oak, and longleaf pine for the dominant canopy species along with common understory species of running oak, gopher apple, and bluestem and panicum grasses (USDA 2006).

Important Species

Common wildlife, including important species, associated with the above-mentioned ecoregions that may occur on the Dixie site, associated offsite corridors, and transmission-line corridors, includes recreationally important species such as Florida white-tailed deer, bobcat, feral hog, squirrel, northern bobwhite, and mourning dove, as well as skunk, raccoon and several species of woodpecker. Various bird, reptile, and amphibian species also have the potential to reside on the Dixie site and within the associated transmission-line corridors (USDA 2006; FNAI 2009).

Federal and State-listed threatened and endangered terrestrial species occur in Dixie County and all counties crossed by the transmission-line corridors. Some of these species may at times be found on or in vicinity of the Dixie site or within associated offsite corridors and transmission-line corridors. No critical habitat for these listed species has been designated by the FWS in Dixie County; however, no field studies have been conducted on the site and in vicinity offsite corridors or the associated transmission-line corridors. Table 9-13 lists all Federally and State-listed species that could occur on the Dixie site and in the vicinity, offsite corridors, and in the counties crossed by the likely transmission-line corridors. Counties that

would be crossed by the transmission-line corridors include Citrus, Dixie, Levy, Marion, Hernando, Hillsborough, Pinellas, Pasco, and Sumter Counties. PEF has stated that on-the-ground field surveys would be conducted before commencement of ground-disturbing activities on the site and in the offsite corridors and transmission-line corridors as required by the FDEP (PEF 2009a; CH2M Hill 2009; FDEP 2010a).

Building Impacts

Some impacts from building two nuclear units and supporting facilities on wildlife habitat would be unavoidable. Activities that would affect wildlife include land clearing and grading (temporary and permanent), filling and or draining of wetlands, increased human presence, heavy equipment operation, traffic, noise, avian collisions, and fugitive dust. These activities would likely displace or destroy wildlife that inhabits the areas of disturbance. Some wildlife, including important species, would perish or be displaced during land clearing for any of the above projects as a consequence of habitat loss, fragmentation, and competition for remaining resources. Less mobile animals, such as reptiles, amphibians, and small mammals, would be at greater risk of incurring mortality than more mobile animals, such as birds, many of which would be displaced to adjacent communities.

Undisturbed land adjacent to the areas of disturbance could provide habitat to support displaced wildlife, but increased competition for available space and resources could affect population levels. Wildlife would also be subjected to impacts from noise and traffic, and birds could be injured if they collide with tall structures. The impact on wildlife from noise is expected to be temporary and minor. The creation of new transmission-line corridors could be beneficial for some important species, including those that inhabit early successional habitat or use edge environments, such as white-tailed deer, northern bobwhite, eastern meadowlark, and the gopher tortoise. Birds of prey, such as red-tailed hawks would likely exploit newly created hunting grounds. Forested wetlands within the corridors would be converted to and maintained in an herbaceous or scrub-shrub condition that could provide improved foraging habitat for waterfowl and wading birds. However, fragmentation of upland and wetland forests could adversely affect species that are dependent on large tracts of continuous forested habitat.

To accommodate the building of two nuclear units on the Dixie site, PEF would need to clear approximately 441 ac of terrestrial habitats for the nuclear facility and approximately 579 ac for associated offsite structures and corridors, and an additional 1292 ac of land would need to be cleared and excavated to accommodate a reservoir (see Table 9-14 and Table 9-15) (CH2M Hill 2009).

Based upon FLUCFCS land-use data, approximately 8 ac of wetlands would be affected on the site during building (CH2M Hill 2009). Approximately 38 ac of wetlands would be affected in the offsite corridors (CH2M Hill 2009). Approximately 90 ac of wetlands would be affected to excavate the reservoir (CH2M Hill 2009). PEF states that the nuclear facility would be sited to avoid wetlands whenever possible and potential impacts on wetlands near building zones would

Table 9-14. Summary of Impacts by Land-Use Class for the Dixie Alternative Site

Land-Use Class (FLUCFCS) (acreage)	Onsite	Reservoir	Offsite Corridors (Except Transmission)	Transmission Corridors[(a)]
Urban and Built Environment (percent of area)	0 (0%)	0 (0%)	95 (16%)	2518 (19%)
Agriculture	0 (0%)	0 (0%)	172 (30%)	2147 (16%)
Upland Nonforested	0 (0%)	32 (2%)	16 (3%)	265 (2%)
Upland Forested	433 (98%)	1170 (91%)	254 (44%)	3180 (24%)
Water	0 (0%)	0 (0%)	3 (1%)	149 (1%)
Wetlands	8 (2%)	90 (7%)	38 (7%)	2163 (16%)
Barren Lands	0 (0%)	0 (0%)	0 (0%)	18 (<1%)
Transportation, Communication and Utilities	0 (0%)	0 (0%)	2 (<1%)	2849 (21%)

Source: CH2M Hill 2009
(a) Acreages shown in table for transmission-line corridors are total acres available, not total acres affected.

Table 9-15. Total Terrestrial Habitat Impacts on the Dixie Site

Impact Areas	Acres
Onsite Impact Areas	441
Reservoir Impact Areas	1292
Transmission-Line Corridor Areas	13,288[(a)]
Offsite Impact Areas	579
Total Impact Areas	2312 (plus portion of 13,288 ac transmission corridor)

Source: CH2M Hill 2009
(a) Acreages for transmission lines are total acres available, not total acres affected.

be minimized through the use of established BMPs (PEF 2009a). Under Federal and State permitting requirements, PEF would be obligated to mitigate any unavoidable construction impacts on jurisdictional wetlands and listed species (FDEP 2010a).

New transmission system infrastructure would be needed to support a nuclear power facility at the Dixie site and would include approximately 340 mi of transmission lines (estimates made by measuring the approximate distance of hypothetical corridors provided by CH2M Hill [2009]; see Section 9.3.3.1). There are no existing transmission lines or transmission-line corridors present on the site. PEF has assumed that new transmission lines would be collocated within existing transmission-line corridors to the extent possible to minimize potential terrestrial impacts. In addition, transmission-line corridors, towers, and access road would be situated to avoid critical or sensitive habitats and species to the extent possible. Transmission-line corridor width would vary from 55 ft to 460 ft wide, depending on size, voltage, and whether or not existing corridors could be used. These widths were used in the analysis of the hypothetical routes for each

alternative site to determine land-use cover types (CH2M Hill 2009). The likely transmission-line corridors for the Dixie site consist of approximately 13,288 ac, of which approximately 2163 ac are wetlands (CH2M Hill 2009). Some portion of the total 3180 ac of upland forested habitat and 2163 ac of wetland habitat present in the corridors would be affected; however, because actual routes have not been determined, the impacts on forests and wetlands cannot be quantified (see Table 9-14). Under Federal and State permitting requirements, PEF would be obligated to mitigate any unavoidable construction impacts on jurisdictional wetlands and listed species. PEF stated that all land clearing associated with nuclear facility, offsite structures, and transmission-line creation would be conducted according to Federal, State, and local regulations, permit requirements, existing procedures, and established BMPs (PEF 2009a).

Building two new nuclear reactors at the Dixie site, including offsite corridors (excluding transmission line corridors) and a reservoir, would result in the loss of approximately 2312 ac of terrestrial habitat (Table 9-15). Clearing land within the 13, 288-ac transmission-line corridor would also result in a loss of an undetermined additional amount of forested terrestrial habitat and increase habitat fragmentation along the corridor. Other sources of impacts on terrestrial resources such as noise, increased risk of collision and electrocution, and displacement of wildlife would likely be temporary and result in minimal impacts on the resource. Because of the extent of unavoidable terrestrial habitat losses, building the two new units and associated facilities (including transmission lines) would noticeably alter the available terrestrial habitat on and in the landscape surrounding the Dixie site.

Operational Impacts

Impacts on terrestrial ecological resources, including important species, from operation of two new nuclear units at the Dixie site include those associated with transmission system structures, maintenance of transmission-line corridors, and operation of the cooling towers. Also, during plant operation, wildlife would be subjected to impacts from increased traffic.

Impacts on crops, ornamental vegetation, and native plants from cooling-tower drift cannot be evaluated in detail in the absence of information about the specific location of cooling towers at each alternative site. Similarly, bird collisions with cooling towers cannot be evaluated in the absence of information about the specific location of cooling towers at the site. The impacts of cooling-tower drift and bird collisions for existing power plants were evaluated in NUREG-1437 (NRC 1996) and found to be of minor significance for nuclear power plants in general, including those with various numbers and types of cooling towers. On this basis, the review team concludes, for the purpose of comparing the alternative sites, that the impacts of cooling-tower drift and bird collisions with cooling towers resulting from operation of new nuclear units would be minor.

Outdoor noise levels on the Dixie site are predicted to range from 90 dBA near the loudest equipment to 65 dBA in areas more distant from major noise sources (CH2M Hill 2008). Noise

modeling predicts not perceptible to slight increases in noise from plant operations at the site boundary (CH2M Hill 2008). Except in areas immediately adjacent to major noise sources, expected noise levels would be below the 60- to 65-dBA threshold at which birds and red foxes (a surrogate for small and medium-sized mammals) are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the Dixie site would not be likely to disturb wildlife beyond the site boundary. Consequently, the review team concludes that the impacts of cooling-tower noise on wildlife would be minimal.

An evaluation of specific impacts resulting from building of transmission lines and transmission-line corridor maintenance cannot be conducted in any detail due to the lack of information, such as the specific locations of new rights of way that could result from transmission system upgrades. However, in general, impacts associated with transmission-line operation consist of bird collisions with transmission lines, EMF effects on flora and fauna, and habitat loss due to corridor maintenance. The impacts associated with transmission-line corridor maintenance activities include alteration of habitat, including but not limited to wetland and floodplain habitat, due to cutting and herbicide application.

Transmission lines and associated structures pose a potential avian collision hazard. Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to their low, fast flight and flocking behavior (EPRI 1993). Bird collisions with transmission lines are recognized as being of minor significance at operating nuclear power plants, including those with transmission-line corridors with variable numbers of power lines (NRC 1996). Accordingly, although additional transmission lines would be required for new nuclear units at the alternative sites, increases in bird collisions would be minor and these would likely not be expected to cause a measurable reduction in local bird populations. PEF would also be required to have an Avian Protection Plan in compliance with State certification guidelines (FDEP 2010a). Consequently, the incremental number of bird collisions posed by the addition of new transmission lines for new nuclear units would be negligible.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). At a distance of 300 ft, the magnetic fields from many lines are similar to typical background levels in most homes. Thus, impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines (NRC 1996). Since 1997, more than a dozen studies have been published that looked at

cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003). Therefore, the incremental EMF impact posed by addition of new transmission lines for new nuclear units would be negligible.

Existing roads providing access to the proposed transmission-line corridors at the alternative sites would likely be sufficient for use in any expanded corridors; however, new roads would be required during the construction of new transmission-line corridors. Management activities (cutting and herbicide application) related to transmission-line corridors and related impacts on floodplains and wetlands in transmission-line corridors are recognized as being of minor significance at operating nuclear power plants, including those with transmission-line corridors of variable widths (NRC 1996). The review team assumes that the same vegetation and construction management of corridors currently used by PEF would be used in the establishment and maintenance of the new corridors. Under the Conditions of Certification for the State, PEF would also be required to retain existing vegetation whenever practicable and use BMPs that comply with the Florida State regulations (FDEP 2010a). Consequently, the incremental effects of the maintenance of transmission-line corridors and associated impacts on floodplains and wetlands posed by expanding existing corridors or the addition of a new transmission-line corridor for new nuclear units would be negligible.

To summarize, the potential effects of operating two new nuclear reactors at the Dixie site would be primarily associated with the maintenance of transmission-line corridors and increased traffic. In general, operational impacts on terrestrial resources would be expected to be minimal.

Cumulative Impacts

There are no past or current actions in the geographic area of interest that have influenced terrestrial resources in a way exactly similar to the building and operation of the proposed two new nuclear units at the Dixie site. However, terrestrial habitats throughout the geographic area of interest have been extensively altered by a history of forestry and agricultural practices as well as low density residential development.

Proposed future actions that could affect terrestrial resources in a way similar to development at the Dixie site would include the proposed expansion of SR-26 from US-19 in Gilchrist County to CR-26A in Alachua County (22 mi), located within 10-mi northeast of the Dixie site that would include expansion of the existing two-lane roadway to a four-lane divided highway. Transmission-line creation and/or upgrading throughout the designated geographical ROI and future urbanization would also be expected to occur. However, there are several areas within the geographical ROI that are managed for the benefit of wildlife, including but not limited to Manatee Springs State Park, Yellow Jacket Conservation Area, and Fowlers Bluff Conservation Area.

The other impact on terrestrial resources at the Dixie site would be the effect of global climate change on plants and wildlife. The impact of global climate change on terrestrial wildlife and habitat in the geographic area of interest is not precisely known. Global climate change would result in a rise in sea level and may cause regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (GCRP 2009). Such changes in climate could alter terrestrial community composition on or near the Dixie site through changes in species diversity, abundance, and distribution. Elevated water temperatures, droughts, and severe weather phenomena may adversely affect or severely reduce terrestrial habitat. Specific predictions of habitat changes in this region due to global climate change are inconclusive at this time. However, because of the regional nature of climate change, the impacts related to global climate change would be similar for all of the alternative sites.

Summary Statement

Impacts on terrestrial ecology resources are estimated based on the information provided by PEF and the review team's independent review. Past, present, and reasonably foreseeable future activities in the geographic area of interest could affect terrestrial ecology in ways similar to the building of the proposed two units at the LNP site. The Dixie site and some of the associated transmission-line corridors are natural habitats that would be substantially altered by development and maintenance activities, noticeably affecting the level and movement of terrestrial wildlife populations in the surrounding landscape. Other anticipated development projects would further alter wildlife habitats and migration patterns in the surrounding landscape. The review team therefore concludes that the cumulative impacts on baseline conditions for terrestrial ecological resources would be MODERATE. This determination is based upon the extent of expected wetland loss and habitat fragmentation from ongoing and planned development projects, continued widespread manipulation of habitats for commercial forest management, and anticipated losses of habitat for important species. The incremental impacts from building and operating the Dixie project would be a significant contributor to the moderate cumulative impact, primarily because of a loss or modification of habitats that support wildlife, wetlands, and important species. Although incremental impacts on terrestrial resources could be noticeable near the Dixie project site, these impacts would not be expected to destabilize the overall ecology of the regional landscape.

9.3.3.4 Aquatic Resources for the Dixie Site

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources. The proposed Dixie County alternative site has no existing infrastructure associated with development of a nuclear power plant. This greenfield site is adjacent to the Suwannee River, which is proposed as the water source for cooling and discharge. Water flow in the Suwannee River is managed by the SRWMD and has a multi-tiered minimum-flow-level program designed to maintain the quality of the unique freshwater

springs system throughout the middle and Lower Suwannee River basin. The recommended minimum flow for the Lower Suwannee River is 6600 cfs for May–October, and 7600 cfs from November–April. PEF maintains that there would be adequate flow to supply water through a closed-cycle cooling design for a two-unit plant. However, under drought conditions, the Suwannee River may not be able to provide sufficient water, and PEF acknowledges that building of a reservoir would be required to ensure consistent water supply (PEF 2009a). The geographic area of interest considered includes the Suwannee River watershed from the Gulf of Mexico up to Fanning Springs, Florida, because it and the associated transmission-line corridors are the area most likely to be affected by new nuclear units.

The Suwannee River is classified by the State of Florida as an Outstanding Florida Water system. There are several State parks that could be affected by the proposed action. Dixie County natural areas include Fanning Springs State Park and Manatee Springs State Park, both of which have freshwater habitat used by Florida manatees seeking freshwater refuge. The offshore area from the mouth of the Suwannee River is part of the Big Bend Seagrasses Aquatic Preserve, which extends from the St. Marks River in Wakulla County to the mouth of the Withlacoochee River in Levy County. The preserve includes more than 55,000 ac of uplands in Taylor and Dixie Counties, referred to as the Big Bend marsh buffer (FDNR 1988).

The potential impacts on aquatic biota from building and operation of the proposed units at the Dixie site are assumed to be primarily to organisms inhabiting the Suwannee River and the immediate offshore habitat of the Gulf of Mexico.

Commercially and Recreationally Important Species

While no commercial fisheries exist for the Suwannee River, commercial fisheries allowed near the mouth of the Suwannee in the Gulf of Mexico include black mullet, red grouper, sea bass (*Centropristis* sp.), gag grouper (*Mycteroperca microlepis*), grunts, blue crab, and stone crab. Recreational species include these commercial species as well as sunfish species, catfish species, and largemouth bass (*Micropterus salmoides*) (Save our Suwannee, Inc., no date). Commercial species not previously described in Section 2.4.2 are described here.

<u>Sea Bass</u> (*Centropristis* sp.) are in the same family as groupers, and they spawn offshore from January through July. Larvae develop offshore, then move to onshore habitats and begin feeding on small fish, crustaceans, and shellfish. Sea bass associate with bottom structures such as reefs and rubble (ASMFC 2005). Landings of this species for Dixie County in 2008 exceeded 35,000 lb (FFWCC 2009a).

Non-Native and Nuisance Species

Water hyacinth (*Eichhornia crassipes*) and hydrilla (*Hydrilla verticillata*) are two common invasive aquatic plant species that have been noted in the Suwannee River, but are largely

under control (Hoyer et al. 2005; FDEP 2002a). These species are managed by the State of Florida and should not be affected by power plant operations.

Critical Habitats

Critical habitats for the threatened gulf sturgeon occurs on the Gulf Coast of Florida in the Suwannee River and immediate offshore area and are described further under the Federally and State-listed species subheading for gulf sturgeon (68 FR 13370). The nearshore areas off Dixie County in the Gulf of Mexico are designated by the Gulf of Mexico Fisheries Management Council as essential fish habitat Ecoregion 2, which extends from Tarpon Springs north to Pensacola Bay, Florida (GMFMC 2004). Essential fish habitat has been designated by NMFS for the nearshore Gulf of Mexico area at the mouth of the Suwannee River, upstream to Little Lake City, Florida, for species and life stages listed in Section 2.4.2, Table 2-15. There are no habitat areas of particular concern near the Dixie site.

Federally and State-Listed Species

Federally and State-listed aquatic species that may occur near the Dixie County site and along existing transmission-line corridors include the endangered Florida manatee, green sea turtle, leatherback sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, smalltooth sawfish, and the threatened gulf sturgeon and loggerhead sea turtle. Detailed species information is provided in Section 2.4.2.3.

<u>Florida Manatee</u> (Trichechus manatus latirostris)

The Florida manatee northwest Florida population, which includes Citrus and Levy Counties, constitutes approximately 12 percent of the total manatee population. This subpopulation of manatees has the greatest concentration in the Crystal River area, where they are protected under the Endangered Species Act, Marine Mammal Protection Act, and the Florida Manatee Sanctuary Act. In the winter, manatees migrate to warmer waters near the coast and are known to occur in the Suwannee River in Manatee Springs State Park (FDEP 2002b) and Fanning Springs State Park (FDEP 2009c).

<u>Sea Turtles</u>

Four species of sea turtle are listed as Federally and State endangered, with the loggerhead sea turtle listed at both Federal and State levels as threatened. All sea turtles have certain life-history similarities in that females swim ashore to sandy beaches and deposit eggs in nesting pits that are covered to allow incubation. Juveniles hatch, struggle out of the sandy nest and make their way to their respective ocean habitats. Although there are no sandy coastline habitats in the area of the Suwannee River, juvenile and adult sea turtle life stages have been found in the offshore Gulf of Mexico area. Sea turtle sightings offshore of the Suwannee River have been documented since 1999.

Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

The current range of the gulf sturgeon is limited to the Mississippi River east to the Suwannee River, Florida, where the Suwannee River supports the largest subpopulation of gulf sturgeon (Carr et al. 1996). Critical habitat for Florida is designated for 182 mi of the Suwannee River, 12 mi of the northern Withlacoochee River where it branches off to the north of the Suwannee River, and 211 mi^2 of estuarine/marine area of Suwannee Sound that is north of Cedar Key (68 FR 13370). Gulf sturgeon show a high homing fidelity (site-specific) spawning behavior based on gene flow between river drainages (Stabile et al. 1996). Male gulf sturgeon mature in 7 to 9 years and females in 8 to 12 (Huff 1975). Adults spend 8 to 9 months in river habitat, near springs in the Suwannee River, and move to estuarine or Gulf of Mexico waters during the coolest months to feed (FWS and GSMFC 1995). Spawning occurs in the Suwannee River when temperatures range between 17 to 22°C in late March to mid-April and the substrate is characterized as clean gravel-cobble mix over rock with strong, persistent laminar flows and eddies that created reversed or diminished bottom currents (Sulak and Clugston 1998). Young-of-the-year sturgeon disperse widely downstream of spawning habitats within the river inhabiting open sandy areas away from shorelines and vegetation (Sulak and Clugston 1998). Timing and location of spawning grounds in the Suwannee River are not well documented, but it is believed that females seek out gravel or rock bottom habitats associated with freshwater springs (FWS and GSMFC 1995). Because specific spawning locations and habitat usage by gulf sturgeon within the Suwannee River are largely unknown, the critical habitat designation includes the entire Suwannee River.

Smalltooth Sawfish (*Pristis pectinata*)

Observations of smalltooth sawfish north of Port Charlotte are rare, but three sightings along the coastal Dixie County region have been documented since 2002, notably in the mouth of the Suwannee River (FMNH 2009c). However, adverse impacts are unlikely because these fish would avoid activities occurring in these areas.

Building Impacts

Cooling-water intake and discharge structures on the Swannee River in addition to a cooling-water reservoir would be required at the Dixie County site. Installation of a new intake and discharge would result in the temporary displacement of aquatic biota within the vicinity of both structures. It is expected that these biota would return to the area after installation is complete. Sedimentation due to disturbances of the river bank and bottom during installation activities could affect local benthic populations. Impacts on aquatic organisms would be temporary and largely mitigable through the use of BMPs. However, as the Suwannee River is considered critical habitat for the gulf sturgeon, some loss of critical habitat may occur through dredging or installation activities associated with intake and discharge structures. Building impacts of a cooling-water reservoir may be significant depending on the siting of the reservoir. During the review team's site visit, observations of the proposed site via public roads indicated that there

are streams present that are either perennial or seasonal. Offsite transmission-line corridors would cross two streams, and one open waterbody (CH2M Hill 2009). These aquatic resources have not been examined for diversity of aquatic biota, but nonetheless, still represent aquatic habitat that would likely be affected by the building of facilities for the site. The use of good management practices and BMPs during building activities could result in minimal impacts on the gulf sturgeon, which occurs in the vicinity of the proposed intake and discharge locations for the Dixie County site in the Suwannee River (CH2M Hill 2009). Consultation with FDEP and FWS would likely be required for in-water work associated with designated critical habitat for the gulf sturgeon and presence of manatees. PEF would comply with the Standard Manatee Conditions for In-Water Work (FDEP 2010a) for building activities in the Suwannee River to prevent impacts on manatees in the vicinity of intake and discharge installation activities. Due to the upriver location of the Dixie site, it is unlikely that there would be impacts on the smalltooth sawfish or sea turtles.

New transmission-line infrastructure would be required for a new two-unit facility. Currently no existing transmission-line corridors are located within the immediate vicinity of the Dixie greenfield site, and new corridors would need to be established. Likely transmission-line corridors identified by PEF appear to follow those identified for LNP without the need for an LNP-to-CREC corridor, and additional corridors in Columbia, Dixie, Gilchrist, Madison, and Suwannee Counties (CH2M Hill 2009). PEF anticipates transmission-line corridors would cross 13 streams and 140 open waterbodies and should have minimal impact on aquatic resources (CH2M Hill 2009).

Operational Impacts

Impingement and entrainment of organisms from the Suwannee River and inshore Gulf of Mexico and from a manmade reservoir would be the most likely impacts on aquatic populations that could occur from operation of two new nuclear units at the Dixie County site. Assuming a closed-cycle cooling system, a maximum through-screen intake velocity of 0.5 ft/sec or less, and an intake flow of less than or equal to 5 percent of the mean annual flow which meets the EPA's Phase I regulations for new facilities (66 FR 65256), the anticipated impacts on aquatic populations from entrainment and impingement are expected to be minimal. Thermal discharges from operations may result in increased use of habitat by manatees near the point of discharge to the Suwannee River and decrease some habitat suitable for Gulf sturgeon. Plant outages that result in cold shock could affect manatees and other aquatic biota that become habituated to power plant thermal discharges. However, it is unlikely that both units would be shut down at the same time. Operational impacts associated with water quality and discharge cannot be determined without additional detailed analysis. However, based on the review team's experience with other facilities, the review concludes that with proper design the impacts on aquatic resources from operation of two new nuclear units at the Dixie County site would likely be minimal with FDEP NPDES compliance.

The review team also concludes that operational impacts on aquatic biota from maintenance of the transmission-line corridors would also be minimal assuming that appropriate BMPs are used.

Cumulative Impacts

Cumulative impacts on aquatic resources within the Suwannee River basin include the operation of dairy farms and small businesses that discharge wastewater to the Suwannee River watershed within 10 mi of the Dixie site. These dairy operators and businesses have active NPDES permits for discharge.

Anthropogenic activities such as residential or industrial development near the vicinity of the nuclear facility can present additional constraints on aquatic resources. Future activities may include shoreline development (i.e., removal of habitat), increased water needs, and increased discharge of effluents into the Suwannee River. The effects of continued dairy practices could result in additional habitat loss and/or degradation due to water use using surface waters and groundwater withdrawal, point and non-point source pollution, siltation, and bank erosion. The review team is also aware of the potential for global climate change affecting aquatic resources. The impact of global climate change on aquatic organisms and habitat in the geographic area of interest is not precisely known. Global climate change would result in a rise in sea level and may cause regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (GCRP 2009). Such changes in climate could alter aquatic community composition on or near the Dixie site through changes in species diversity, abundance and distribution. Elevated water temperatures, droughts, and severe weather phenomena may adversely affect or severely reduce aquatic habitat, but specific predictions on aquatic habitat changes in this region due to global climate change are inconclusive at this time. The level of impact resulting from these events would depend on the intensity of the perturbation and the resiliency of the aquatic communities.

Summary Statement

Impacts on aquatic ecology resources are estimated based on the information provided by PEF, the State of Florida, and the review team's independent review. The review team concludes that the impacts from building intake and discharge structures for two new nuclear units at the Dixie site would be noticeable but not destabilizing to the critical habitat within the Suwannee River for the threatened gulf sturgeon. The review team also concludes that the aquatic impacts from operation of two new units would be minimal. Therefore, the review team concludes that the cumulative impacts of building and operating two new reactors on the Dixie site combined with other past, present, and future activities on most aquatic resources in the Suwannee River would be MODERATE. This is because of the potential for impact on gulf sturgeon and on designated critical habitat for gulf sturgeon, the loss of aquatic habitat, particularly during low flow conditions in the river due to the consumptive loss of water from closed-cycle cooling, and unspecified impacts related to the construction and operation of a cooling reservoir. Impacts

related to the cooling reservoir could be minimized through proper siting and the use of BMPs during construction. The use of a cooling reservoir would partially mitigate the effects of consumptive water loss on aquatic habitat during low river flow. The incremental contribution of building and operating the two new reactors at the Dixie site to the cumulative impacts within the ROI would not likely result in destabilization of aquatic resources or populations but would significantly contribute to noticeable impacts on aquatic resources and populations.

9.3.3.5 Socioeconomics

The following impact analysis includes direct, indirect, and cumulative impacts from building activities and operations at the Dixie site, which is located in a remote rural area on the lower Suwannee River in Dixie County, Florida. The analysis considers other past, present, and reasonably foreseeable future actions that affect socioeconomics, including other Federal and non-Federal projects listed in Table 9-13 and approximately 340 mi of transmission lines. For the analysis of socioeconomic impacts at the Dixie site, the geographic area of interest is considered to be the region described by a 50-mi radius centered on the Dixie site. The review team gave special consideration to Dixie, Gilchrist, Lafayette, and Levy Counties, because that is where the review team expects socioeconomic impacts to be the greatest. In evaluating the socioeconomic impacts of site development and operation at the Dixie site, the review team undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources.

The Dixie site is a greenfield site in eastern Dixie County. The review team drew upon USCB 2000 data to find the available total construction workforce within the host county, adjacent counties, and any nearby counties with a major population center within a reasonable commuting distance from the site. For the Dixie site, this included Dixie, Gilchrist, Lafayette, Taylor, Levy, Suwannee, and Alachua Counties. In 2000 the total construction workforce in these counties was 10,035 workers. Based on this availability, the review team assumed that 75 percent of the 3300-person workforce involved in building the two-unit plant, or 2475 workers, would migrate into the area.

The review team identified Dixie County and four counties near Dixie County (Gilchrist, Lafayette, Alachua, and Levy) as the primary Economic Impact Area (EIA) for the Dixie County site on the basis of expected effects of in-migrating workers and families. All of these counties, except Alachua, are rural, with populations in 2000 ranging between about 7000 people in Lafayette County to about 35,500 people in Levy County. Much of the population in Alachua County resides in the greater Gainesville metropolitan area (2000 population of 95,447 people). The majority of the population in the remaining four counties resides in unincorporated settlements or rural areas. The largest incorporated communities in the four rural counties of the EIA are Williston and Chiefland in Levy County and Cross City in Dixie County; each with a population of close to 3000 people in 2008. Large portions of Dixie, Lafayette, and Levy

Counties are year-round or seasonal marshland or commercial forests, which are generally only sparsely populated.

The review team expects that some of the in-migrating workers would choose to reside in Alachua County because of the amenities available in the large city of Gainesville. Because Suwannee and Taylor Counties offer no attractions that would encourage a longer commute, the review team expects few in-migrating workers would locate in Suwannee or Taylor County. The review team focused on effects of the building-phase workforce because the operations workforce would be smaller and, following after the larger building-related workforce cause expected smaller socioeconomic impacts. Table 9-16 provides some socioeconomic data for the five counties.

Table 9-16. Socioeconomic Data for the Dixie Site EIA

Data Category	Dixie	Gilchrist	Lafayette	Levy	Alachua	Data source
Population						
1980	7751	5767	4035	19,870	151,369	(1a)
1990	10,585	9667	5578	25,923,	181,596	(1a)
2000	13,827	14,437	7022	34,450	217,955	(1)
Projected 2010	15,244	17,866	8260	40,694	243,916	(2)
Median Household Income (1999)	$26,082	$30,328	$30,651	$26,959	$31,426	(3)
Vacant Housing Units	2157	885	518	2703	7604	(1)
Total Housing Units	7362	5906	2660	16,570	95,113	(3)
Workforce						
Employed	4612	5756	2540	12,935	105,293	(3)
Construction	492	682	184	1397	5234	(1)
Total Schools[(a)]	2 A-B, 1 B, 1 C	2 A-B, 2 C	1 A-B-C, 1 A-B	1 A, 1 A-B-C, 4 A-B, 3 B-C, 2 B, 2 C	2 A, 7 B, 3 A-B-C, 24 A-B, 2 B-C, 5 C	(4)(
Number of Schools Failing Student-	0	0	0	0	0	(4)

Teacher Ratio						
Police	Sheriff Dept – 13 positions	Sheriff Dept – 9 positions	Sheriff Dept – # positions	Sheriff Dept and police depts. in Inglis, Williston, Chiefland, Cedar Key	Sheriff Dept and police depts. in Gainesville, Alachua, High Springs, Santa Fe Comm. College, and Univ of Florida	(5)(4)
Emergency Services	6 fire stations; 2 EMS stations	EMS department	County rescue 24/7; 1-4 units	EMS from the 14 fire stations; 8 paid and 183 volunteer firefighters	EMS and fire rescue departments	(6)
Population						
White	89.7	91.6	80.1	87.1	73.5	
African-American	9.2	7.3	14.7	11.2	19.3	
Hispanic	1.7	2.8	9.1	3.9	5.7	
Low-Income	19.1	14.1	17.5	18.6	22.8	(3)

(a) A-elementary school; B-middle school ;C-high school
Sources:
(1a) USCB 1990
(1) USCB 2000b
(2) 2010 projection assuming 2000-2008 growth rate (from USCB 2009) extends to 2010
(3) USCB 2000c
(4) FDOE 2009a
(5) Dixie: Dixie Sheriff 2009
Gilchrist: Gilchrist Sheriff 2009
Lafayette: Lafayette Sheriff 2009
Levy: Section 2.5.2.6
Alachua: Alachua Police and EM 2009 (Alachua County Florida 2010)
(6) Dixie: Dixie EM 2009
Gilchrist – Gilchrist EM 2009
Lafayette: Lafayette EM 2009
Levy: Section 2.5.2.6

Alachua: Alachua Police and EM 2009 (Alachua County Florida 2010)
EMS = emergency management services

For purposes of this analysis the review team assumed there would be 619 in-migrants into Alachua County and the remaining 1856 in-migrating workers would be distributed among the four rural counties of the EIA as follows: 34 percent to Dixie County (639 workers); 14 percent to Gilchrist County (262 workers); 8 percent to Lafayette County (154 workers); and 43 percent to Levy County (801 workers). The review team further assumed that all in-migrating workers would bring families; this is unlikely but contributes to the provision of an upper bound on the population increase associated with the project. The review team used the 2.49-person average Florida family size in 2000 to project the distribution of new jobs and population in the EIA due to in-migrating workers, as listed in Table 9-16.

Physical and Aesthetics Impacts

With the exception of the need to construct a new access road to the Dixie site, many of the physical impacts of building and operation on workers and the public would be the same as those described for the LNP site. People who work or live around the site could be exposed to noise, fugitive dust, and gaseous emissions from building activities. Building workers and personnel working onsite could be the most affected. Air-pollution emissions are expected to be controlled by applicable BMPs and Federal, State, and local regulations. During station operation, standby diesel generators used for auxiliary power would have air-pollution emissions. It is expected that these generators would see limited use and, if used, would be used for only short time periods. Applicable Federal, State, and local air-pollution requirements would apply to all fuel-burning engines. At the site boundary for most sites, the annual average exposure from gaseous emission sources is anticipated to not exceed applicable regulations during normal operations. The impacts of station operations on air quality are expected to be minimal. As with building impacts, potential offsite receptors during operations are generally located well away from the site boundaries.

Residential and commercial areas are located away from the site boundaries, applicable air-pollution regulations would have to be met by PEF, and applicable BMPs would be put in place, including during the construction and use of the site access road. Therefore, based on information provided by PEF and the review team's independent review of reconnaissance-level information, the review team concludes that the physical impacts of building and operating the station would have minimal impact on workers and the local public around the Dixie site.

Building activities and station operations are not expected to affect any offsite buildings. Most buildings are well removed from the site boundaries. Because this is a greenfield site, there are no onsite buildings to be affected by shock and vibration from pile-driving and other related activities. No long-term physical impacts on structures, including any residences near the site boundaries, would be expected. Therefore, based on consideration of reconnaissance-level

information, the review team concludes that the physical impacts of station building and operation on offsite buildings would be minor.

As the estimated 340 mi of transmission lines are put in place and the buildings and cooling towers associated with the new reactors reach their final heights and begin operating, they would add an industrial landscape that is visible to viewers, with a noticeable aesthetic impact. In places requiring the clearing of new transmission-line corridors, aesthetic impacts would be noticeable but not destabilizing, depending on the proximity of viewers and the nature of vegetation remaining between them and the corridors. Given the general characteristics of the area, there would likely be vegetative screening around the site that would potentially mitigate the aesthetic impacts at the reactor site.

Demographic Impacts

Table 9-17 lists the estimated project-related population migrating into the EIA at peak workforce levels and the population increase in each county between 1990 and 2000 and between 2000 and 2010. As seen in Table 9-17, the EIA has experienced population growth at least as large as the predicted increase from the proposed new units.

Table 9-17. Projected Distribution of Workers and Associated Population Increase in the EIA

County	Percent Population Increase 1990-2000[(a)]	Projected Percent Increase 2000–2010[(b)]	Workers In-Migrating to Construct Dixie Plant	Civilian Workforce in 2007[(c)]	Population of In-Migrating Workers and Family Members	Population of Workers and Families: as a Percent of Projected 2010 Population	Population of Workers and Families: as a Percent of Projected 2010 Population + In-Migrants
Dixie	30.6	10.3	639	5547	1592	10.4	9.5
Gilchrist	49.3	23.8	262	7810	653	3.7	3.5
Lafayette	25.9	17.6	154	2879	382	4.6	4.4
Levy	32.9	18.1	801	16,744	1995	4.7	4.5
Alachua	20	11.8	619	126,432	1541	0.6	0.6

(a) Based on USCB data, as reported in PEF 2007b

(b) Calculated as 1.25 times percent change 2000-2008 shown in USCB 2009, i.e., assumes rate of change for first eight years would continue through last two years of the decade.

(c) Fedstats for Florida and Florida Counties. Compiled from the Bureau of Economic Analysis (BEA 2010)

For instance, Dixie County experienced a 30.6-percent increase in population between 1990 and 2000. The review team estimates that the proposed project would add an additional 9.5 percent to the projected 2010 population for Dixie County, or less than 1 percent per year over the decade of construction. Therefore the review team determined that the project related demographic impacts for the five counties would be minor.

Economic Impacts

The review team determined that the impact of jobs associated with building the plant would have no noticeable effect on total employment and income in Alachua County. However, the review team determined that the impact of jobs associated with building the plant would have a noticeable beneficial effect on total employment in the four rural counties, with likely short-term noticeable effects in Dixie County during the period of peak workforce when the in-migrating workers are projected to be about 11.5 percent of the 2007 civilian workforce in the county. The direct jobs filled by local residents would add to the project's effect on employment, as would the indirect jobs created as a result of the multiplier effect, as described in Sections 4.4.3 and 5.4.3. This peak in employment would be temporary, transitioning to the lower employment effects of plant operations, when approximately 541 operations jobs (70 percent of operations jobs) are expected to be filled by in-migrating operations workers and a smaller number of local residents are expected to fill the associated indirect jobs. Consequently, the review team concludes that the proposed project would have a noticeable, beneficial, but temporary impact on employment in the four rural counties of the EIA during the years of peak workforce, followed by a minor, beneficial long-term impact during operations.

State and local taxes would be governed by Florida law. The review team assumed that tax revenues generated from sales and use taxes associated with the building and operation of a plant at the Dixie site would be approximately the same as those evaluated for the LNP site in Sections 4.4.3.3 and 5.4.3.3, with a similar minor impact on revenues for the EIA and the region, along with a similar delay in substantial property tax payments to Dixie County until the commencement of operations. The review team concluded that increased property taxes from the two units following reassessment for improvements and for its use as a utility would have a substantial beneficial impact on Dixie County. The review team found that additional property taxes on new houses built by in-migrating workers would constitute a small percentage increase in the local tax base in the EIA; thus the impact of both building and operations on residential property tax revenues would be minor.

Housing

The review team compared the 2000 figures for vacant housing in the EIA listed in Table 9-16 with the number of in-migrating workers projected for peak building years listed in Table 9-17. The housing figures do not include RV parks, campgrounds, or hotels, and thus provide a lower bound of what would be available to construction workers. The review team divided the projected increase in population without the project between 2000 and 2010 by 2.49 (Florida average family size) to estimate the number of housing units required to accommodate that population increase.

The U.S. Census Housing Profile (USCB 2000b; BEA 2010) for each of the five counties in the EIA estimated the following:

- Dixie County – a total housing stock of 7362 units with a rental vacancy rate of 29 percent (approximately 2157 housing units were unoccupied at the time of the survey).
- Gilchrist County – a total housing stock of 5906 units with a rental vacancy rate of 15 percent (approximately 885 housing units were unoccupied at the time of the survey).
- Lafayette County –a total housing stock of 2660 units with a rental vacancy rate of 19 percent (approximately 518 housing units were unoccupied at the time of the survey).
- Levy County – a total housing stock of 16,570 units with a rental vacancy rate of 16 percent (approximately 2703 housing units were unoccupied at the time of the survey).
- Alachua County – a total housing stock of 95,113 units with a rental vacancy rate of 8 percent (approximately 7604 housing units were unoccupied at the time of the survey).

The review team expects that the in-migrating workforce could be absorbed into the existing housing stock in the EIA without a measureable impact. Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that housing impacts of building and operating two nuclear units at the Dixie site would not be noticeable.

Public Services

In discussions with county personnel (Dixie County 2009a, b; Gilchrist County 2009; Lafayette County 2009; Taylor County 2009), the review team learned that, while all counties welcome additional development and expect that they could manage it, some public services in the four rural counties of the EIA are currently over, at, or near capacity. Levy County is over capacity for fire-protection services. Dixie County is near or at capacity at the sheriff's department, but has plans to expand for future growth, as in the past, and the department is about to add another deputy. Dixie County is also near or at capacity in the management of roads and streets. There are no capacity issues for fire protection or emergency medical response. For general healthcare, Dixie County residents use resources in Gainesville for serious medical problems, and this practice is expected to continue. Water and wastewater are generally

handled through wells and residential septic systems in Dixie County, with no capacity issues. Gilchrist County can handle present demands for police and emergency services, but might need to add a deputy and another emergency management service (EMS) station and vehicle if 200 families were to move in; capacity is adequate for healthcare, with people using primary care providers within the county and going to Gainesville or Chiefland for other needs; water and wastewater are generally provided with wells and septic systems, with no capacity issues currently. Lafayette County is not at capacity for any services presently, and would add to law enforcement, fire-protection services (all volunteer currently), and EMS as needed; the county is currently seeing development of a new prison that will bring in 150 people, which will be an exercise in responding to new growth. Demands on the planning and permitting infrastructure in these four counties may increase substantially for a short period in response to efforts to rapidly expand housing availability.

The review team assumed that the counties and communities in the EIA for the Dixie site, like those for the LNP site, have planned to meet needs for public services based on forecast population increases that did not include the presence of a workforce associated with constructing and operating a nuclear plant. The review team based its analysis of potential impacts on public services on the level of population increase represented by in-migrant workers during peak building years added to forecasted population growth without the proposed project. In addition, the review team took into consideration that the EIA would not receive a significant increase in property tax revenues during the period of peak demand, and that Dixie County would be the only major property tax recipient once the proposed units went into operation. Consequently, the review team expects impacts on public services during peak building years would be noticeable and adverse in Dixie County, particularly on law enforcement and road management, and all of the communities near the proposed site and minor in the rest of the EIA, with the exception of Levy County, where a noticeable adverse impact on fire-protection services is expected. Once the project transitions to operations, the impacts on public services are expected to moderate, in part because of the reduction in in-migrant population and in part because the counties and communities will have expanded capacity to address peak building-phase demand. The public service providers in the four rural counties of the EIA may find it more difficult to respond effectively because the demand for service would increase rapidly and substantially, persist for several years, but then decline substantially as the project-related workforce rises and falls.

Transportation

Roads closest to the proposed Dixie site include US-19/98/27A/SR55 (US-19), SR-349, and SR-51. US-19 is a four-lane divided rural highway that crosses Dixie County from northwest to east-southeast, providing access to the metropolitan areas of Tallahassee (northwest) and Tampa (south). SR-349, extending from US-19 to the north county boundary in the northeast part of the county and SR-51, running north-south along the Steinhatchee River, are two-lane, undivided minor arterials. Dixie County has assigned a LOS standard of “B” to US-19 and “D” to

the State routes and its county roads (Dixie County 2006). CR-349 extends south and southwest from the intersection of SR-349 and US-19 to the coast at Suwannee; other county roads extend northeast and southwest from US-19 farther west along the highway. Dixie County classifies the county roads as undivided minor arterials or undivided major collectors. Traffic volumes in 2008 on SR-349 ranged from 2111 to 6400; volumes on SR-51 in Taylor and Lafayette Counties ranged from 309 to 3000; and volumes on US-19 ranged from 4700 to 12200 (FDOT 2008). PEF has indicated that an access road would need to be constructed at the Dixie site.

US-19 would be the main artery carrying workers from western Dixie County and the three adjacent counties, as well as from Gainesville and Taylor Counties and other places in nonadjacent counties. The review team considered the impact of building-related traffic in terms of the likelihood that it would reduce the LOS along US-19 to be lower than the assigned standard "B." The review team assumed 2281 trips daily (following LNP site analysis in Section 4.4.4.1), split 65 percent to/from the southeast and 35 percent to/from the northwest, based on the assumed distribution of in-migrating worker residence discussed in Table 9-17. At morning shift change, this would add an additional 1977 cars to the total flow on US-19, 499 incoming from northwest, 926 from southeast; and 359 outgoing to the southeast, 193 to the northwest. The highest 2008 AADT count on US-19 in Dixie County was at the eastern county line, at the bridge over the Suwannee River, with 6200 cars going northwest and 6000 cars going southeast. Morning flow of building workers would add 926 cars to those going northwest from the county line toward the plant site and 359 cars leaving the county toward the southeast. This increase of about 15 percent of current flow to the northwest could change LOS at the bridge. In addition, there are five road intersections with US-19 within 2 mi of the bridge and additional traffic on these roads feeding into US-19 might affect LOS at the intersections. While additional analysis would be needed, the review team concludes that building-related traffic during peak workforce years could have a noticeable adverse effect on segments of US-19 and at intersections with State and county roads within Dixie County, especially during the period of peak onsite workforce.

Education

Table 9-16 provides data about schools in the four rural counties of the EIA. All schools met the State teacher-student ratio classroom requirements in 2007–2008. The review team assumed that school districts in these counties, like those for the LNP site, would address short-term gains in student population with mobile classrooms and that the preschool through 12th grade (PK–12) public schools would be funded according to the Florida equalized funding formula (FDOE 2009b). The review team assumed that students would accompany each in-migrating worker family in the average of the ratios of students per household from counties in the LNP site listed in Table 2-35. The estimated numbers of new students in each of the four rural counties of the EIA during peak workforce years are listed in Table 9-18.

Table 9-18. Students from In-Migrating Families at Peak Workforce Years

County	In-Migrating Worker Households	Grades PK–3 Students[(a)]	New Rooms	Grades 4–8 Students[(b)]	New Rooms	Grades 9–12 Students[(c)]	New Rooms
Dixie	639	101	6	52	2	58	2
Gilchrist	262	41	2	21	1	24	1
Lafayette	154	24	1	12	1	14	1
Levy	801	127	7	65	3	73	3
Alachua	619	98	6	50	2	56	2

Source: Table 4-14 and Florida State Constitution Amendment of Section 1, Article IX (November 2002)
(a) 0.158 per household; 18 students per teacher required by State law
(b) 0.081 per household; 22 students per teacher required by State law
(c) 0.091 per household; 25 students per teacher required by State law
PK = preschool

The review team found that the impact on the four Dixie County schools would require up to 10 additional classrooms in total, an average of over 2 classrooms for each of the 4 schools (note that the affected schools cover different ranges of grades). The review team found that the addition of up to13 classrooms in Levy County, 4 classrooms in Gilchrist County, and 3 classrooms in Lafayette County would amount to an average of about 1 additional classroom per school. For Alachua County, 10 additional classrooms among 43 schools would mean less than one-quarter of the schools would require an additional classroom. These school districts would also need to be adding capacity to deal with the students associated with the increase in population that is forecast to occur even without the proposed project, as discussed previously in the section on population. The review team concluded that the impact on public schools at peak impact would be more noticeable in Dixie County than in the other rural counties where the impact would be minor. As with public service impacts, the schools may find it more difficult to respond effectively to the demand for student services when it increases rapidly and substantially, persists for several years, but then decline as it does with the proposed project.

Recreation and Aesthetics

PEF notes that much of the economy of Dixie County is dependent on ecotourism by users of a national wildlife refuge (the Lower Suwannee National Wildlife Refuge), Manatee Springs State Park, the Fanning Springs State Park, and numerous other State and local parks and trails (PEF 2009a). Because the exact footprint of the site is not determined, specific impacts on specific recreational facilities from site structures and the intake and discharge structures are not known but, based on the considerations discussed for the LNP site, the review team anticipates that adverse impacts of building units at the Dixie site would have minor to noticeable impacts on use of the recreational facilities from which activities would be visible or audible. The increased population in the four rural counties of the EIA may increase use of local recreational areas, which is expected to have negligible impact on either the sites or the recreational experience, given the number, geographic distribution, and variety of recreational locations available. The

impact of the transmission lines and corridors is expected to have a noticeable aesthetic impact in places where vegetation does not screen them from viewers.

Summary of Socioeconomics

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. Based on information provided by PEF and its own independent evaluation, the review team finds that the socioeconomic effects of building two units at the Dixie site would be minor with the following exceptions. There would be noticeable adverse, but not destabilizing, effects on transportation, education, and public services (law enforcement and road management) in Dixie County and on fire-protection services and transportation in Levy County during the peak building phase that would persist until the community has responded to the growth and local funding is adjusted after the units are operating, after which the tax effects are expected to be noticeable/substantial and positive on Dixie County and minor elsewhere in the five-county local area. Traffic congestion is expected to have a noticeable, though intermittent and temporary, impact on US-19 near the Dixie/Levy County border. The transmission lines and corridors would have a noticeable adverse impact on aesthetics.

Cumulative Impacts

In addition to assessing the incremental socioeconomic impacts from the building and operation of two nuclear units on the Dixie site, the review team considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts on the region, including other Federal and non-Federal projects. For the analysis of cumulative socioeconomic impacts at the Dixie site, the geographic area of interest is considered to be the 50-mi region centered on the Dixie site (the region) with special consideration of Alachua, Dixie, Gilchrist, Lafayette, and Levy Counties because that is where the review team expects socioeconomic impacts to be the greatest (Economic Impact Area, or EIA). Table 9-13 identifies the projects that have contributed and will continue to contribute to the demographics, economic climate, and community infrastructure of the region. Collectively these projects will contribute to an overall trend toward urbanization and generally will result in increased populations and economic activities.

Within the wider region, the residential population is concentrated around the city of Gainesville to the east, which serves as the area's economic center. Lafayette County has the smallest population of the four rural counties of the EIA (Dixie, Gilchrist, Lafayette, and Levy Counties). Within the region, the planned expansion of SR-26, the proposed Tarmac King Road Limestone Mine, the potential closing of coal-fired units at CREC, and continued urbanization are the future actions identified for the region that would have the most noticeable socioeconomic effects on the four rural counties of the EIA.

The review team expects that improved road access to the regional urban center of Gainesville would contribute to and accelerate the population and economic growth in Dixie, Gilchrist, Lafayette, and northwestern Levy Counties, adding to the ongoing gradual urbanization trends evident in the region. This road expansion project has not been scheduled and is not expected to be completed during the building of the proposed nuclear units.

The potential closure of coal-fired units at CREC and subsequent loss of operations jobs would moderate these growth effects. Considering this combination of ongoing and proposed projects and project terminations, the review team determined that cumulative socioeconomic effects of building new units at the Dixie site and the actions identified in Table 9-13 would not differ noticeably from the project effects analyzed above. Thus, the review team determined that cumulative socioeconomic impacts of the proposed project and other past, present, and reasonably foreseeable projects would be SMALL, with the following exceptions attributable to building and operating the Dixie site: Dixie County would experience MODERATE, but temporary and not destabilizing, effects on transportation, education, and public services (law enforcement and road management) during the peak building phase that would persist until operations commence, when these impacts would be SMALL and the tax impacts are expected to be LARGE and positive on Dixie County and minor elsewhere among the four rural counties of the EIA. Finally, the aesthetic impacts of the transmission lines and corridors are expected to be MODERATE and long-term along their viewsheds. The Dixie nuclear project would be a significant contributor to the MODERATE effect and LARGE beneficial effect identified.

9.3.3.6 Environmental Justice

The following impact analysis includes environmental justice impacts from building activities and operations as well as the cumulative impacts from other past, present, and reasonably foreseeable future actions that could have environmental justice effects, including other Federal and non-Federal actions listed in Table 9-13. For the analysis of environmental justice impacts at the Dixie site, the geographic area of interest is the region within a 50-mi radius centered on the Dixie site. The region includes the urban area of Gainesville in Alachua County and four rural counties: Dixie, Gilchrist, Lafayette, and Levy. The land use in the vicinity of the site is scattered residential, farming, and commercial forestry.

The review team determined that from an environmental justice perspective there is a potential for minority and low-income populations to experience disproportionately high and adverse impacts. The review team used the approach in identifying minority and low-income populations of interest and assessing environmental justice impacts described in Sections 2.6, 4.5, and 5.5. Figure 9-2 shows the distribution of minority populations by census block group within the region. The closest block group with an aggregate minority population of interest is approximately 12 mi to the southeast in Levy County. Several additional block groups with aggregate minority populations of interest are more distant from the proposed site but still within the region. Figure 9-3 shows the distribution of block groups with low-income populations of interest within the region. The closest block group with a low-income population of interest is

located approximately 12 mi to the southeast of the proposed site (this is the same block group with an aggregate minority population of interest discussed above). Some additional block groups with low-income populations of interest are at a farther distance from the proposed site. There is some overlap in the block groups with minority and low-income populations of interest.

The review team investigated the presence of unique characteristics or practices in minority or low-income communities that could result in different socioeconomic impacts from the building and operating of the Dixie site compared to the general population. Dixie County Environmental Health Division personnel informed the review team that they are not aware of subsistence use of resources in the county, and think that they would know if such behavior were present (Dixie County 2009c). Likewise, the County Manager indicated there was no need for county residents to fish or hunt for subsistence (Dixie County 2009d). During their independent review of environmental justice impacts at the Dixie site, the review team determined that some subsistence fishing or hunting could take place outside the national wildlife refuge mentioned above, because this area of Florida is well known for its hunting, fishing, and agricultural resources and for its high levels of participation in these activities by residents and visitors alike. Such subsistence activities would possibly be affected during the building phase. The review team determined that an area south of US-19 with a significant low-income population parallels the Suwannee River and is north of the protected refuge (EPA 2009b). This area was not revealed by the census block group analysis but its population may rely on subsistence fishing and be affected by building or operation activities.

Physical effects from building activities (noise, fugitive dust, air emissions, traffic) would not affect any populations at the distances of the closest populations of interest because physical effects attenuate with distance, topography, and intervening foliage. None of the minority or low-income populations of interest is located within 12 mi of the site, which is primarily woodland.

In places requiring the clearing of new transmission-line corridors, aesthetic impacts would be noticeable but not destabilizing, depending on the proximity of viewers and the nature of vegetation remaining between them and the corridors. Given the general characteristics of the area, there would likely be vegetative screening around the site that would potentially mitigate the aesthetic impacts at the reactor site. The review team determined that the minority and low-income populations would not experience disproportionately high and adverse aesthetic impacts from the project.

Minority and low-income populations would experience the noticeable, but relatively short-term and localized adverse effects on public services, transportation, and education, as discussed in Section 9.3.3.5. As shown on Figure 9-2 and Figure 9-3, the closest minority and low-income populations of interest are well to the southeast of the affected commuting routes and therefore would not receive a disproportionately high and adverse transportation impact. For other socioeconomic categories, the review team found no evidence of unique characteristics or practices among minority or low-income populations that would result in disproportionately high and adverse impacts when compared to the general public.

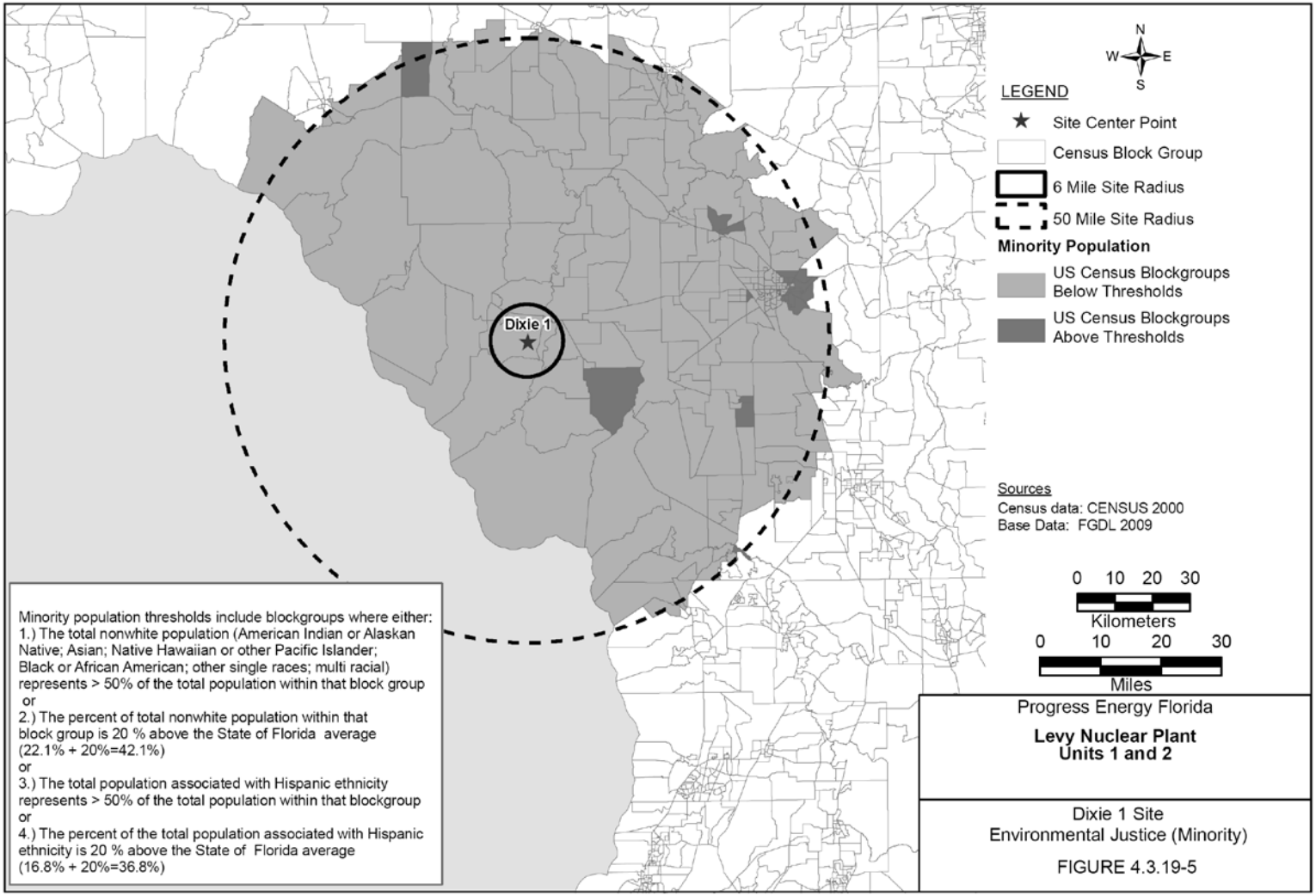

Figure 9-2. Dixie County Minority Populations (PEF 2009d)

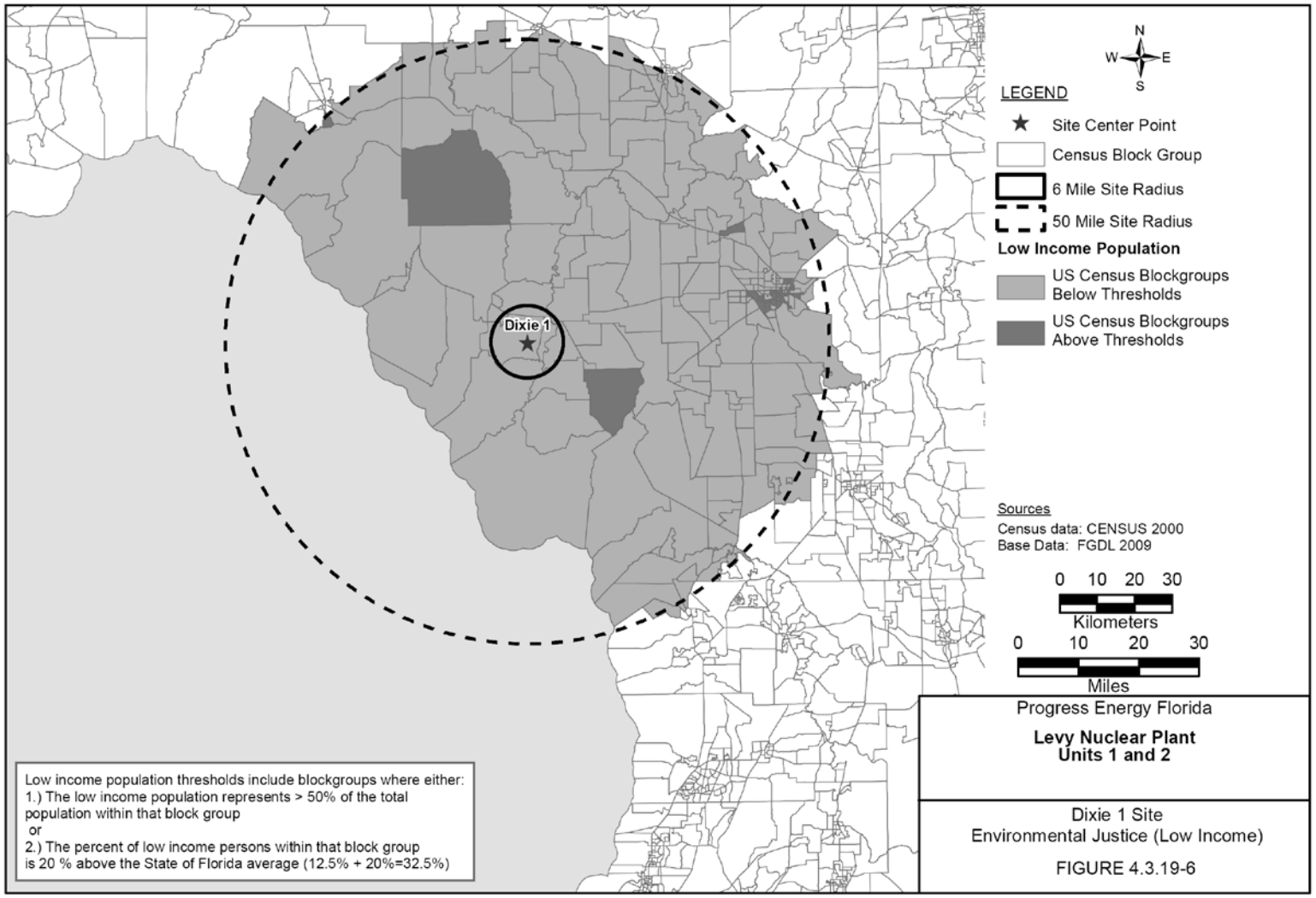

Figure 9-3. Dixie County Low-Income Populations (PEF 2009d)

The operation of the proposed nuclear power plant at the Dixie site would have no physical impact on minority or low-income populations because of their distance from the site. The review team found no evidence of unique characteristics or practices among minority or low-income populations that would result in their receiving disproportionately high and adverse impacts to demographics, economics, community services and infrastructure, or transportation when compared to the general public.

Because the review team found no disproportionate adverse impacts on minority or low-income populations from building and operating the Dixie project, the review team concludes that environmental justice impacts would be minor.

Cumulative Impacts

The review team did not identify any environmental pathways by which disproportionately high and adverse impacts could affect minority or low-income populations or communities. Therefore the review team concludes that the environmental justice impacts on minority and low-income populations associated with the building and operation of two new units at Dixie in combination with the other projects and activities identified in Table 9-13 would range from minor tonoticeable as discussed above, in proportion to the effects on majority populations, and would not be disproportionately high and adverse for the minority and low-income populations. Therefore, the review team concluded that the environmental justice impacts would be SMALL.

9.3.3.7 Historic and Cultural Resources

The following cumulative impact analysis includes building and operating two new nuclear generating units at the Dixie site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect historic and cultural resources, including the other Federal and non-Federal projects listed in Table 9-13. For the analysis of cultural impacts at the Dixie site, the geographic area of interest is considered to be the APE for this site. This includes the direct effects APE, defined as the area physically affected by the site-development and operation activities at the site and transmission lines. The indirect effects APE is defined as the area visually affected and includes an additional 0.5-mi radius APE around the transmission-line corridors and a 1-mi radius APE around the cooling towers.

Reconnaissance activities in a cultural resource review have particular meaning. Typically, the activities include preliminary field investigations to confirm the presence or absence of cultural resources. However, in developing this EIS, the review team relied upon reconnaissance-level information to perform its alternative site evaluation in accordance with ESRP 9.3 (NRC 2000). Reconnaissance-level information is data that are readily available from agencies and other public sources. It can also include information obtained through visits to the site area. To identify the historic and cultural resources at the Dixie site, the following information was used:

- PEF ER (2009a)
- National Register of Historic Places database (NPS 2010)
- Florida Historical Markers Program (FDOS 2010)
- NRC Alternative Sites Visit October 14–17, 2008 (NRC 2009).

Historically, the Dixie site and vicinity were largely undisturbed and likely contained intact archaeological sites associated with the past 10,000 years of human settlement. Over time, the area has been disturbed by low-impact development, including agriculture, commercial forestry, and low-density residential development (PEF 2009a). In its ER, PEF states that potentially significant cultural resources are located within Dixie County and that cultural resource investigations would be required before siting a new reactor at this location. PEF also states that consultation with the SHPO would occur if any significant historic, cultural, or archaeological resources are identified and that appropriate mitigation measures would be put in place before construction and operation (PEF 2009a).

A search of the National Register revealed two sites listed in the Dixie County, including the City of Hawkinsville shipwreck and the Garden Patch Archaeological Site (NPS 2010). A search of the Florida Historical Markers Program revealed seven historical markers listed in Dixie County, including Old Town – one of the largest Native American villages in Florida – and Fort Duval (FDOS 2010).

Building Impacts

To accommodate building two new nuclear generating units on the Dixie site, PEF would need to clear approximately 300 ac for the main power plant site as would be needed for the LNP site and 1282 ac for the reservoir (PEF 2009a). If the Dixie site were chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the SHPO, Tribes, and interested parties. The results would be used in the site-planning process to avoid cultural resources impacts. If significant cultural resources were identified by these surveys, the review team assumes that PEF would develop protective measures in a manner similar to that for the LNP site, and therefore the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing, excavation, and grading activities could potentially destabilize important attributes of historic and cultural resources.

There are no existing transmission-line corridors connecting to the Dixie site. Section 9.3.3.1 describes the proposed transmission-line corridors associated with this site. Visual impacts from transmission lines may result in significant alterations of the visual landscape within the geographic area of interest. If the Dixie site were chosen for the proposed project, the review team assumes that PEF would conduct its transmission-line-related cultural resource surveys and procedures in a manner similar to that for the LNP site described in Section 4.6. In

addition, the review team assumes the State of Florida's Conditions of Certification regarding transmission-line siting and building activities would apply, and therefore the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing, excavation, and grading activities could potentially destabilize important attributes of historic and cultural resources.

Operations Impacts

Impacts on historic and cultural resources from the operation of two new nuclear generating units at the Dixie site would include those associated with the operation of new units and maintenance of transmission lines. The review team assumes that the same procedures currently used by PEF, including the State of Florida's Conditions of Certification, would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of the two new units and associated impacts on the cultural resources would be negligible for the physical and visual APEs.

Cumulative Impacts

Past actions in the geographic area of interest that have similarly affected historic and cultural resources include rural development and agricultural development and activities associated with these land-disturbing activities such as road development. Table 9-13 lists past, present, and reasonably foreseeable projects and other actions that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest. Projects from Table 9-13 that may fall within the geographic area of interest for cultural resources include future urbanization, such as new or expanded roads.

Long linear projects such as new or expanded roads may intersect the proposed transmission-line corridors. Because cultural resources can likely be avoided by long linear projects, impacts on cultural resources would be minimal. If building associated with such activities results in significant alterations (both physical alteration and visual intrusion) of cultural resources in the transmission-line corridors, then cumulative impacts on cultural resources would be greater.

Cultural resources are nonrenewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that the cumulative impacts from building and operating two new nuclear generating units on the Dixie site and other projects would be SMALL. This impact-level determination reflects no known cultural resources that could be affected; however, if the Dixie site were to be developed then cultural resource surveys and evaluations would need to be conducted and PEF would assess and resolve adverse effects of the undertaking. Adverse effects could result in greater cumulative impacts.

9.3.3.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affect air quality, including the shutdown of two coal-fired units at CREC, and other Federal and non-Federal projects listed in Table 9-13. The geographic area of interest for the Dixie site is Dixie County, which is in the Jacksonville (Florida)-Brunswick (Georgia) Interstate Air Quality Control Region (40 CFR 81.91).

The emissions related to building and operating a nuclear plant at the Dixie site would be similar to those at the LNP site. The air quality status for Dixie County as set forth in 40 CFR 81.310 reflects the effects of past and present emissions from all pollutant sources in the region. Dixie County is classified as being in attainment for all NAAQSs.

The atmospheric emission related to building and operating a nuclear plant at the LNP site in Levy County, Florida, are described in Chapters 4 and 5. Emissions of criteria pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of criteria pollutant emissions at the LNP site were evaluated and also determined to have a SMALL impact.

Cumulative Impacts

Reflecting on the projects listed in Table 9-13, all industrial projects listed in the table would have *de minimis* impacts. The impact of closing two coal-fired units at CREC on criteria pollutants at the Dixie site are not considered because the CREC is located outside of the geographic area of interest for this site. Given the small amount of emissions from the projects, it is unlikely that the air quality in the region would degrade to the extent that the region would be declared to be in nonattainment for any of the NAAQSs.

The air quality impact of the Dixie site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air quality impacts. There are no land uses or projects, including the aforementioned sources, that would have emissions during site development that would, in combination with emissions from the Dixie site, result in a degradation of air quality in the region.

Releases from the operation of two new units at the Dixie site would be intermittent and made at low altitudes with little or no vertical velocity. The air quality impacts of current emissions near the Dixie site are included in the baseline air quality status. The cumulative impacts from emissions of effluents from the Dixie site and other sources would not be noticeable.

The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in Section 7.6. The impacts of the emissions are not sensitive to the location of the source. Consequently, the discussion in Section 7.6.2 is applicable to a nuclear power plant located at the Dixie site. The review team concludes that the national and worldwide cumulative impacts

of greenhouse gas emissions are noticeable. The review team further concludes that the cumulative impacts would be noticeable, with or without the greenhouse gas emissions of the project at the Dixie site or the potential shutdown of the fossil-fuel units at CREC.

Cumulative impacts on air quality resources are estimated based on the information provided by PEF and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for greenhouse gas emissions) that could affect air quality resources. The cumulative impacts on criteria pollutants from emissions from the Dixie site and other projects would not be noticeable. The national and worldwide cumulative impacts of greenhouse gas emissions are noticeable, with or without the greenhouse gas emissions from the Dixie site. The review team concludes that cumulative impacts from construction, preconstruction, and operations, and other past, present, and reasonably foreseeable future actions on air quality resources in the geographic area of interest would be SMALL for criteria pollutants and MODERATE for greenhouse gas emissions. The incremental contribution of impacts on air quality resources from building and operating two new units at the Dixie site would be insignificant for both criteria pollutants and greenhouse gas emissions.

9.3.3.9 Nonradiological Health

The following analysis assesses impacts from building activities and operations for the Dixie site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect nonradiological health, including the other Federal and non-Federal projects listed in Table 9-13. Impacts from building activities that have the potential to affect the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and increased traffic associated with the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to affect the health of members of the public and workers include exposure to etiological agents, noise, EMFs, and impacts from the transport of workers to and from the site.

Most of the nonradiological health impacts of building and operation (e.g., air emissions, noise, occupational injuries) would be limited to areas within approximately 2 mi from the site, which applies to the analysis for the Dixie site. Occupational injuries would occur only within the boundaries of the site, and noise from construction and operation has likewise been assessed as minimal for offsite receptors beyond a 2-mi radius. For nonradiological health impacts associated with transmission lines, the geographic area of interest would be the transmission-line corridor. If the facility were built and operated at the Dixie alternative site, the Suwannee River would serve as the source and discharge receptor of cooling water. In addition, a reservoir would need to be built to assure an adequate cooling-water supply.

Building Impacts

Nonradiological health impacts on construction workers and members of the public from building two new nuclear units at the Dixie site would be similar to those evaluated in Section 4.8 for the LNP site. The impacts include noise, construction vehicle exhaust, dust, occupational injuries, and transportation accidents, injuries, and fatalities. A detailed noise study has not been performed for the Dixie site, but it is likely that noise from building at the site, except for rare, high-noise activities such as pile-driving, would comply with State and local noise ordinances and that the overall noise impact associated with building would be minimal. Fugitive dust and vehicle emissions during building would be controlled by good management practices and compliance with Federal, State, and local air quality regulations. The incidence of construction worker accidents would be the same as that for the LNP site, the only difference being potential injuries associated with cooling-water reservoir construction.

Analyses described in Section 9.3.3.5 indicate that the traffic impacts in the vicinity of the Dixie site would be noticeable during peak building activities and could be mitigated by implementation of a suitable traffic-management plan. Owing to the rural nature of the Dixie site, there is little potential for cumulative traffic impacts with other projects, and additional injuries and fatalities from traffic accidents involving transportation of materials and personnel for building of a new nuclear power plant at the Dixie site would be similar to those estimated in Section 4.8.3 for building at the LNP site.

Because all of the past, present, or potential future construction projects identified in Table 9-13 are relatively distant (greater than 10 mi) from the Dixie site, it does not appear that combined nonradiological health impacts from construction at the Dixie site and other projects would occur. Cumulative impacts of building at the Dixie site would therefore be minimal.

Operational Impacts

Noise, air emissions, and occupational injuries from the operation of two new nuclear units at the Dixie site would be similar to those evaluated in Section 5.8 for the LNP site. Occupational health impacts on workers (e.g., falls, electric shock or exposure to other hazards) at the Dixie site would be the same as those evaluated for workers at two new units operating at the LNP site. The cooling-system discharge from the facility could encourage the growth of etiologic organisms in the Suwannee River. Etiological agent growth could be reduced by the use of biocides in the cooling systems, thermal discharge would be restricted by NPDES permit limitations, and exposure to impaired water would be limited by controls on access to the discharge zone (fencing, signage, and other security measures). However, because discharge may amount to a significant proportion of minimum flows in the river, and because the Suwannee River is already impaired due to contamination with nitrates and other pollutants (Hallas and Magley 2008, USGS 2004), the effect of blowdown discharge to the river could have a noticeable effect on the growth of etiological agents. Exposure to etiological agents in the

cooling-water reservoir would not pose an additional health risk as long as access to the reservoir is limited by virtue of its being within the controlled and fenced site boundaries.

Noise and EMF exposure from operations would be monitored and controlled in accordance with applicable OSHA regulations. Although no detailed noise modeling has been performed for the Dixie site, it is likely that noise impacts would be similar to those predicted for operations at the LNP site. The effects of EMF on human health in the transmission-line corridors would be controlled and minimized by conformance with NESC criteria and adherence to the standards for transmission systems regulated by the FDEP. Nonradiological impacts of traffic associated with the operations workforce would therefore be less than the impacts during building (minimal).

A number of the projects and activities identified in Table 9-13 (commercial farms and dairies, minor permitted municipal discharges) might also affect water quality in the Suwannee River, which has been identified as being impaired by nutrients and was included on Florida's Verified List of Impaired Waters (Hallas and Magley 2008). The impairment is due to nitrate contamination from fertilizers, animal wastes, and atmospheric deposition (USGS 2004). Releases from the two new nuclear units at the Dixie site (which would be limited by NPDES permits) would have little impact on nitrate levels in the river. Although, as noted above, blowdown discharge may result in increased water temperature that could facilitate the growth of etiological agents.

The review team is also aware of the potential climate changes that could affect human health; recent analyses of these issues (Karl et al. 2009) have been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature and a decrease in precipitation, which may alter the presence of microorganisms and parasites in surface water. While the overall impacts of climate change may not be insignificant (see Section 7.7), the effect of, or contribution to, climate change impacts by the operation of two new units at the Dixie site is likely to be minor. In its analysis of climate change impacts the review team did not identify additional data that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases associated with operation of a nuclear facility at the Dixie site.

Summary

The assessment of impacts on nonradiological health from building and operation of the two new units at the Dixie alternative site is based on the information provided by PEF and the review team's independent evaluation. The review team concludes that nonradiological health impacts on workers and the public resulting from building two new units and associated transmission lines at the Dixie alternative site would be minimal. The review team also expects that the nonradiological health impacts to workers and the public from the operation of two new nuclear units at the Dixie site would be minimal, except for potential growth of etiological agents in the Suwannee River from the influence of thecooling-system blowdown discharges during

droughts or low-flow periods. These effects could be reduced if the blowdown were discharged to the cooling reservoir, rather than directly to the river. Exposure to etiological agents could be increased if access to the cooling reservoir is not limited by physical and administrative controls. Based on these findings, the review team concludes that cumulative impacts on nonradiological health from related past, present, and future actions in the geographic area of interest and building and operations of two nuclear units at the Dixie alternative site risks would be SMALL to MODERATE. The severity of impacts would depend on the design characteristics of the facility, which have not been fully defined. If exposure to water heated by thermal discharge is not limited by administrative of physical controls, the contribution from building and operations at the Dixie site could be a significant contributor to the nonradiological health impacts.

9.3.3.10 Radiological Impacts of Normal Operations

The following impact analysis includes radiological impacts from building activities and operation for two additional nuclear units at the Dixie site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects listed in Table 9-13. As described in Section 9.3.3, the Dixie site is a greenfield site. The geographic area of interest is the area within the 50-mi radius of the Dixie site. There are no major facilities that result in regulated exposures to the public or biota within 50 mi of the Dixie site. However, there are likely to be hospitals and industrial facilities with 50 mi of the Dixie site that use radioactive materials.

The radiological impacts of building and operating two AP1000 units at the Dixie site include direct radiation and liquid and gaseous radioactive effluents. These pathways produce low doses to people and biota offsite, well below regulatory limits. The impacts are expected to be similar to those estimated for the LNP site. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Dixie site. This conclusion is based on the radiological monitoring programs conducted around currently operating nuclear power plants.

Based on the information provided by PEF and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the two proposed AP1000 units and other past, present, and reasonably foreseeable projects and actions in the geographic area of interest around the Dixie site would be SMALL.

9.3.3.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for two nuclear units at the Dixie site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including the other Federal and non-Federal projects listed in Table 9-13.

The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Dixie site. As described in Section 9.3.3, the Dixie site is a greenfield site within 50 mi of the existing CREC power plant site; there is one nuclear facility at the CREC site. There are no proposed reactors that have the potential to increase the probability-weighted consequences from a severe accident at any location within 50 mi of the Dixie site.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the LNP site would be minimal for AP1000 reactors. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet the NRC safety criteria. The AP1000 design is independent of site conditions and the meteorological conditions of the Dixie and LNP sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Dixie site would be minimal.

Assuming the meteorology, population distribution, and land use for the Dixie site are similar to the LNP site, risks from a severe accident for an AP1000 reactor located at the Dixie site are expected to be similar to those analyzed for the LNP site. These risks for the LNP site are presented in Tables 5-17 and 5-18 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For the existing plant within the geographic area of interest, namely CREC Unit 3, the Commission has determined that the probability-weighted consequences of severe accidents are SMALL (10 CFR Part 51, Appendix B, Table B-1). The planned 20-percent power uprate at CREC Unit 3 will only be approved by the NRC if the probability-weighted consequences of severe accidents would continue to meet NRC's regulatory requirements. Therefore, the impact would continue to be SMALL. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Dixie site would be SMALL.

9.3.4 Highlands Site

This section covers the review team's evaluation of the potential environmental impacts of siting a new two-unit nuclear power plant at the Highlands alternative site (hereafter Highlands site) in central Florida. The site is located in a rural area in Highlands and Glades Counties southwest of the Kissimmee River. The Kissimmee River would be the source for water for plant cooling and other plant uses, and construction of a new water-storage reservoir would likely be required. Highlands is a greenfield site not currently owned by PEF (PEF 2009a). Conceptual routes of the transmission lines necessary to connect the Highlands site to the electrical grid are located in Osceola, Polk, Hardee, Highlands, and Glades Counties.

The following sections include a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the Highlands site and other

actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction and operations and impacts of preconstruction activities. Also included in the assessment are past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Highlands site. Other actions and projects considered in this cumulative analysis are described in Table 9-19.

9.3.4.1 Land Use and Transmission Lines

The following analysis includes impacts from building and operating two nuclear units at the Highlands site, along with the necessary transmission lines to connect them to the grid. The analysis also considers other past, present, and reasonably foreseeable future actions that affect land use, including the other Federal and non-Federal projects listed in Table 9-19.

Table 9-19. Past, Present, and Reasonably Foreseeable Future Projects and Other Actions Considered in the Cumulative Analysis of the Highlands Site

Project Name	Summary of Project	Location	Status
Energy Projects			
Operation and decommissioning of St. Lucie Plant Units 1 and 2	Two 839-MW(e) combustion engineering reactors	Within 50 mi	Operational (NRC 2010b). In 2003, the operating licenses were renewed for an additional 20 years, or to 2036 for Unit 1 and 2043 for Unit 2.
Florida Gas Transmission Company, LLC (FGT) Phase VIII Expansion Project	Construction and expansion of natural-gas pipelines, new compressor, meter, regulator stations, and other appurtenant facilities	Various Counties in Alabama and Florida, including Highlands County. Route passes within 5 mi of the Highlands site and collocated with U.S. Highway 70.	Completion expected by 2011 (FERC 2010; Panhandle Energy 2010).

Project Name	Summary of Project	Location	Status
Other Actions/Projects			
Transportation Projects			
Florida High-Speed Rail	Construction of a high-speed rail corridor. Phase 1 of Florida's High Speed Rail Program.	Along U.S. Highway 4 corridor from Tampa to Orlando	Proposed (FDOT 2010c)
Mining Projects			
Daniel Shell Pit	Excavation pit.	Within 20 mi	Operational (EPA 2010i)
Parks, Forests and Reserves			
Commercial forest management	Managed forests for timber production.	Throughout region	Operational
Parks, forests, and reserves	Several parks, recreation, and conservation areas are located within the 50-mi region. Examples of such areas include Kissimmee Prairie Preserve State Park, and Paradise Run.	Throughout region	Currently managed by various local, State, and Federal agencies and organizations. Development likely limited in these areas.
Everglades Restoration	Multi-agency Comprehensive Plan for multiple restoration projects	Central and Southern Florida	Multiple projects underway (CERP 2010).
Lake Okeechobee Regulation	USACE management of Okeechobee Lake levels.	Lake Okeechobee and estuaries	Revised regulation schedule implemented in 2008 (USACE 2010b).
Brighton Reservation	35,280-ac reservation managed by Seminole Indian Tribe	Within 20 mi	Operational (Seminole Tribe of Florida 2010)
Taylor Creek Nubbins Slough Conservation Area	A reservoir-assisted stormwater-treatment area as part of the Comprehensive Everglades Restoration Plan.	Within 40 mi	Operational. Managed by SFWMD (FDEP 2010c; SFWMD 2010)
Lake Okeechobee Water Retention/Phosphorus Removal	Critical restoration consists of two components, the Isolated Wetlands Restoration and two constructed treatment wetlands known as Stormwater Treatment Areas.	Within 40 mi	Operational. Managed by SFWMD and USACE (FDEP 2010d)
Minor water dischargers	NPDES permitted dischargers including in the town of Okeechobee, Kissimmee Oaks Ranch, Butler Oaks Farm, B-4 Dairy, and other locations.	Throughout region.	Operational

Project Name	Summary of Project	Location	Status
Other Actions/Projects			
Various hospitals and industrial facilities that use radioactive materials	Medical isotopes	Within 50 mi	Operational in nearby cities and towns
Future urbanization	Construction of housing units and associated commercial buildings; roads (such as the proposed widening of SR-70 and SR-710), bridges, and railroads; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region.	Construction would occur in the future, as described in State and local land-use planning documents (FDOT 2010d, e).

For this analysis, the geographic area of interest for considering cumulative impacts is the area within a 25-mi radius of the Highlands site and the transmission-line corridors. The review team determined that a 25-mi radius would represent the smallest area that would be directly affected because it includes the primary communities (such as Okeechobee, Lake Placid, Parker Island, and Placid Lakes) that would be affected by the proposed project if it were located at the Highlands site.

The Highlands site is located in two Florida counties – Highlands County and Glades County. Historically, both Highlands and Glades Counties were known for agriculture. Existing land use in the geographic area of interest is mostly agriculture, including both citrus orchards and cattle ranches. The area is relatively flat, but has the potential for flooding (PEF 2009a). The Highlands site is not subject to the Coastal Zone Management Act because the site is not located within one of the designated Florida coastal zone counties. There are many parks and conservation areas in the region, as well as a Seminole Indian reservation.

Zoning changes would be needed to accommodate building and operation of a nuclear power plant at the Highlands site. Like the LNP site, the footprint of new power-generating units would be approximately 627 ac, with about 150 ac of additional land needed for temporary facilities and laydown yards. In addition, PEF indicates that a 1291-ac reservoir would be needed at the Highlands site to provide cooling water during periods of low flow of the Kissimmee River (PEF 2009d; CH2M Hill 2009). Construction of these facilities would result in a permanent land-use change from agriculture to a transportation, communications, and utilities land-use category. Additional land-use impacts include possible additional growth and land conversions to accommodate new workers and services. Because the workforce would be dispersed over larger geographic areas in the labor supply region, the impacts from land conversion for residential and commercial buildings induced by new workers relocating to the local area can be

absorbed into the wider region. Therefore, the review team concludes that such impacts would be minimal.

There are no existing transmission lines or transmission-line corridors in the geographic area of interest around the Highlands site. New transmission lines would need to be constructed to connect the site to existing transmission lines. The transmission lines would run through counties designated under the Florida Coastal Management Program. Any expansion of these transmission-line corridors would require review under the procedures established under the Florida Coastal Management Program. Procedures for siting new transmission lines in Florida are discussed in Section 4.1.2. The review team assumes that the conditions of certification issued to PEF by the FDEP would apply at all of the alternative sites.

The review team estimated the linear run of the expected transmission-line corridors by referring to PEF Figure 3.3.3-12 (PEF 2010), which depicts the potential routing of corridors needed to connect the Highland units to the grid. The figure suggests that 200 mi of transmission-line corridor would be needed. For purposes of land-use impact analysis, the review team made the assumption that 10 ac/mi would be disturbed, based on the LNP case where 1790 ac are expected to be disturbed over the 180 mi of corridor, as discussed in Section 4.1.2. The review team concludes that this assumption is reasonable because siting in Florida is a relatively rigorous process (Site Certification Application process), and the applicant would be bound by permit conditions resulting from that process, which would force it to use existing corridors to the extent practicable. The review team expects the SCA process would be consistently applied anywhere transmission lines are proposed in Florida. Therefore, the review team concludes that about 2000 ac of land would be disturbed to construct the transmission-line corridors for the Highlands site. Similar to the case at the LNP site, the review team concludes that land-use impacts from developing about 200 mi of new transmission-line corridors to connect new units at the Highlands site would be noticeable, but not destabilizing, and additional mitigation beyond the measures and conditions identified would not be warranted.

Cumulative Impacts

Future urbanization could contribute to additional decreases in open areas, forests, and wetlands and generally result in some increased residential and industrialized areas. However growth would likely be limited since the Highlands County Commissioners voted to pursue a “Rural Land Stewardship” program to maintain the rural character of the county (Atlantic Blue 2007). Increased urbanization, especially long linear projects such as new or expanded roads or pipelines, would also contribute to the loss of open or forested areas and increase fragmentation of habitats along or near the transmission lines. Due to the extent of new transmission lines that would be built, the review team expects that the corridors would have a noticeable impact on the local area. Florida Gas Transmission Company proposes to expand its liquefied natural gas (LNG) pipeline in the vicinity, passing near the Highlands site and collocated with US-70. This project would have limited impacts on land use because a small

incremental amount of land would be converted to a new land use, and it would be adjacent to the current road. The Florida High Speed Rail project would intersect the potential transmission-line corridor where the corridor crosses Interstate 4, near Winston, Florida. However, the review team expects cumulative impacts would be minimal because both projects likely would be using existing public rights-of-way that already have been established and modified for current uses. Development would likely be limited in the nearby parks and conservation areas and the Seminole Indian reservation. Therefore, the incremental impacts associated with increased urbanization would be minimal.

Global climate change could increase temperature and reduce precipitation, which could result in reduced crop yields and livestock productivity (GCRP 2009), which, in turn, may change portions of agricultural and ranching land uses in the geographic area of interest. In addition, global climate change could increase sea level and storm surges in the geographic area of interest (GCRP 2009), thereby changing land use through inundation and loss of coastal wetlands and other low-lying areas. However, existing State and national forests, parks, reserves, and managed areas would help preserve wetlands and forested areas to the extent that they are not affected by sea-level rise. Because other projects identified in Table 9-19 that are within the geographic area of interest would be consistent with applicable land-use plans and control policies and would occur in dispersed locations, the review team considers their contribution to the cumulative land-use impacts to be relatively minor and manageable.

In the State of Florida's Conditions of Certification (FDEP 2010a), CREC Unit 1 and 2, two coal-fired plants, would stop operating by December 31, 2020, as long as PEF completes the licensing process, construction activities, and commences commercial operation of LNP Units 1 and 2 within a timely manner. If the Highlands site were selected, the review team expects the same condition would apply. If CREC Units 1 and 2 are shut down, land use at the units likely would remain industrial. Depending on economic conditions, PEF sells 60 to 95 percent of the coal plant ash to cement and building materials manufacturers, with the remainder going to Citrus Central Landfill in Lecanto, Florida. With the closure of CREC Units 1 and 2, this source of ash no longer would be available locally. The review team expects land-use impacts associated with the shutdown of Units 1 and 2 would be minimal.

Because detailed information concerning the routing of the possible new transmission-line corridors is not known at this time, a complete evaluation of potential land-use impacts cannot be made. Based on the information provided by PEF and the review team’s in independent review, the review team concludes that the land-use impacts of building and operating two new nuclear reactor units at the Highlands site and other projects would be MODERATE. The proposed project would be a significant contributor to the MODERATE impacts due to the substantial amount of land that would be needed for the proposed power plant, reservoir, and transmission infrastructure.

9.3.4.2 Water Use and Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affect water use and quality, including the other Federal and non-Federal projects listed in Table 9-19. The Highlands site is located in rural Highlands County in Florida near the Kissimmee River. PEF has indicated that the development of this site for two nuclear units would require the building of a water reservoir on the Highlands site supplied with water from the Kissimmee River (PEF 2009a).

The geographic area of interest for the Highlands site is considered to be the drainage basin of the Kissimmee River upstream and downstream of the site because this is the resource that would be affected if the proposed project were located at the Highlands site. For groundwater, the ROI is limited to the alternative site because PEF has indicated no plans for use of groundwater to build and operate the plant (CH2M Hill 2009).

PEF indicates that the primary source of water for the site would be the Kissimmee River. Groundwater is considered an unavailable or unreliable resource for large quantities of cooling water at all of the alternative sites; in addition, permitting large groundwater withdrawals for industrial use is generally inconsistent with State policy (CH2M Hill 2009). This analysis therefore assumes that groundwater would not be used during building or operation of the two units at this site and that all water needs would be met with surface water from the Kissimmee River.

Surface water is available at the site from the Kissimmee River. Historical flow data for October 1948 through September 1951, and October 1962 through September 1964, are available for the Kissimmee River near Fort Basinger, Florida (USGS 2010c, d). The USGS has recently begun to measure flow again at this site and data from May 2009 to the present are available on its website. Mean annual flow for the historic record ranged from 566 cfs in 1963 to 2878 cfs in 1949 with the lowest monthly flow reported as 276.8 cfs in January 1963.

Building Impacts

The review team assumes that the surface-water use for building activities at the Highlands site would be identical to the proposed groundwater use for the LNP site. During building, the total maximum usage is projected to be 550,000 gpd (0.85 cfs) and the projected average estimated maximum groundwater usage 275,000 gpd (0.43 cfs) (see Table 3-2). This assumes that surface water would be used at the Highlands site for potable and sanitary use as well as various building related activities. This surface-water withdrawal rate is less than the potential operation withdrawal. This surface-water withdrawal rate is inconsequential when compared to the historic average monthly flow in the Kissimmee River, being less than 1 percent of the discharge for even the lowest month reported (January 1963). The review team concludes that the impact of surface-water use for building the potential units at the Highlands site would be

minimal because withdrawal is small compared to the average monthly flow and withdrawal from the river would be temporary and limited to the building period.

As stated above, the review team assumed that no groundwater would be used to build the units at the Highlands site. The review team also assumes that the impact of dewatering the excavations needed for building two units at the site would be managed through the installation of diaphragm walls and grouting as is proposed for the LNP site. Therefore, because there would be no groundwater use and the impact of dewatering would be controlled, the review team determined that there would be little or no impact on groundwater resources.

Surface-water quality would most likely be affected by surface-water runoff during site preparation and the building of the facilities. FDEP would require PEF to develop an E&SCP and a SWPPP (PEF 2009a). These plans would be developed before initiation of site-disturbance activities and would identify measures to be used during site-preparation activities to mitigate erosion and control stormwater runoff (PEF 2009a).

The plans would identify BMPs to control the impacts of stormwater runoff. The review team anticipates that PEF would construct new detention/infiltration ponds and drainage ditches to control delivery of sediment from the disturbed area to onsite waterbodies. Sediment carried with stormwater from the disturbed area would settle in the detention ponds and the stormwater would infiltrate into the shallow aquifer. Implementation of BMPs should minimize impacts on surface-waterbodies near the Highlands site. Therefore, the surface-water-quality impacts near the Highlands site would be temporary and minimal.

While building new nuclear units at the Highlands site, groundwater quality may be affected by leaching of spilled effluents into the subsurface. The review team assumes that the BMPs PEF has proposed for the LNP site would be in place during building activities and therefore the review team concludes that any spills would be quickly detected and remediated. In addition, groundwater impacts would be limited to the duration of these activities, and therefore, would be temporary. The review team reviewed the general BMPs that could be expected to be required at such a site (FDEP 2010a). Because any spills related to building activities would be quickly remediated under BMPs, and the activities would be temporary, the review team concludes that the groundwater-quality impacts from building at the Highlands site would be minimal.

Operational Impacts

The Highlands site was identified by PEF as needing a cooling-water storage reservoir to meet plant cooling needs during periods of low flow. The review team assumed that the cooling-water system for the proposed units, if they were to be built and operated at the Highlands alternative site, would be similar to that proposed at the LNP site; specifically, the cooling water system would use cooling towers and blowdown would be discharged to the Kissimmee River. The cooling-water reservoir would provide capacity for times when adequate water from the river may not be available. PEF did not provide details of the cooling-water intake and effluent

discharge locations. However, it is standard practice for power plants to design cooling-water intake and effluent discharge locations such that recirculation of discharged effluent to the intake does not occur. The reservoir was sized assuming the plant would operate on four cycles of concentration. The total cooling-water requirements would be 45 Mgd (31,250 gpm) and storage of a 90-day supply of water would be needed. In determining the acreage needed to achieve this amount of storage PEF assumed the reservoir would have an effective depth of 10 ft. PEF indicates that the resulting reservoir size would be 1291 ac (PEF 2009d; CH2M Hill 2009).

PEF indicates that the water needed to operate two units would be approximately 40,000 gpm or 89 cfs. As indicated in Chapter 3, evaporative losses from cooling two units would be approximately 28,000 gpm (62 cfs). A withdrawal of 89 cfs represents 16 percent of the mean annual flow of the Kissimmee River during the year with the lowest flow on record and 32 percent of the flow during the month with the lowest mean monthly discharge. Consumptive use of 62 cfs represents 11 percent of the lowest mean annual flow and 22 percent of the lowest mean monthly flow. Based on the indication that the water needed to operate two units at the Highlands site would represent a significant portion of the flow in the river, the review team determined that the operational surface-water-use impact of potential the plant at the Highlands site would be noticeable but not destabilizing.

As stated above, the review team assumed that no groundwater would be used to operate the units at the Highlands site. Therefore, because there would be no groundwater use, the review team determined that there would be no impact on groundwater resources during operations.

During the operation of two new nuclear units at the Highlands site, impacts on surface-water quality could result from stormwater runoff, discharges of treated sanitary and other wastewater and blowdown from cooling towers into the receiving waterbody. PEF did not provide the blowdown rate at the Highlands site. The review team conservatively assumed that the blowdown rate would be the same as that at the LNP site, 57,923 gpm (129 cfs). This assumption is conservative because the proposed plant at the Highlands site would use freshwater from the Kissimmee River rather than more saline water at the LNP site, requiring less frequent and smaller blowdown discharge. FDEP would require PEF to develop a SWPPP (PEF 2009a). These plans would identify measures to be used to control stormwater runoff (PEF 2009a). The blowdown would be regulated by FDEP pursuant to 40 CFR Part 423 and all discharges would be required to comply with limits established by FDEP in a NPDES permit.

During the operation of the two units at the Highlands site, impacts on groundwater quality could result from potential spills. Spills that might affect the quality of groundwater would be prevented and mitigated by BMPs. Because BMPs would be used to mitigate spills and no intentional discharge to groundwater should occur, the review team concludes that the groundwater-quality impacts from operation of two nuclear units at the Highlands site would be minimal.

Cumulative Impacts

In addition to water-use and water-quality impacts from building and operations activities, cumulative analysis considers past, present, and reasonably foreseeable future actions that affect the same water resources.

For the cumulative analysis of impacts on surface water, the geographic area of interest for the Highlands site is considered to be the drainage basin of the Kissimmee River upstream and downstream of the site because this is the resource that would be affected by the proposed project. For groundwater, the ROI is limited to the alternative site because PEF has indicated no plans for use of groundwater to build and operate the plant. Actions that have past, present, and future potential impacts on water supply and water quality near the Highlands site include existing agriculture and existing and future urbanization in the region.

The GCRP has compiled the state of knowledge in climate change. This compilation has been considered in the preparation of this EIS. The projections for changes in temperature, precipitation, droughts, and increasing reliance on aquifers within the Kissimmee Basin are similar to those at other alternative sites in Florida. Such significant changes in climate would result in adaptations to both surface-water and groundwater management practices and policies that are unknown at this time.

Cumulative Water Use

Surface-water use during the building and operation of two units at the Highlands site would be dominated by water use for operations. PEF indicates that a reservoir would be needed to provide cooling water during periods of low flow. A withdrawal of 89 cfs represents 16 percent of the mean annual flow during the year with the lowest flow on record and 32 percent of the flow during the month with the lowest mean monthly discharge. Consumptive use of 62 cfs represents 11 percent of the lowest mean annual flow and 22 percent of the lowest mean monthly flow. Based on the indication that the water needed to operate two units at the Highlands site would represent a significant portion of the flow in the river, the review team determined that the operational surface-water-use impact of the proposed plant at the Highlands site would be noticeable.

The impacts of the other projects listed in Table 9-19 are considered in the analysis included above or would have little or no impact on surface-water use. The projects believed to have little impact are excluded from the analysis either because they are too distant from the Highlands site, use relatively little or no surface water, or have little or no discharge to surface water. Some projects (for example park and forest management) are ongoing, and changes in their operations that would have large impacts on surface water use appear unlikely.

Therefore, the review team concludes that cumulative impacts on surface-water use would be MODERATE. Building and operating the proposed plant at the Highlands site would be a significant contributor to these water-use impacts.

As stated above, the review team assumed that no groundwater would be used to build or operate the units at the Highlands site and that groundwater impacts from dewatering would be controlled with diaphragm walls and grouting. Therefore, the review team determined that the Highlands site by itself would have minimal impact on groundwater resources.

The impacts of the other projects listed in Table 9-19 are considered elsewhere in this analysis or else would have little or no impact on groundwater use. The projects believed to have little impact are excluded from the analysis either because they are too distant from the Highlands site, or use relatively little or no groundwater. Some projects (for example park and forest management) are ongoing, and changes in their operations that would have large impacts on groundwater use appear unlikely.

Therefore, the review team concludes that cumulative impacts on groundwater use would be SMALL.

Cumulative Water Quality

Point and non-point sources have affected the water quality of the Kissimmee River upstream and downstream of the site. Water-quality information presented above for the impacts of building and operating the proposed new units at the Highlands site would also apply to evaluation of cumulative impacts. The Kissimmee River appears on Florida's list of impaired waters because of the presence of nutrients, fecal coliform, depressed dissolved oxygen, copper, un-ionized ammonia, and mercury in fish tissue (FDEP 2010e); therefore, the review team concluded that the cumulative impact on surface-water quality of the receiving waterbody would be MODERATE. As mentioned above, the State of Florida requires an applicant to develop a SWPPP (PEF 2009a). The plan would identify measures to be used to control stormwater runoff (PEF 2009a). The blowdown would be regulated by EPA pursuant to 40 CFR Part 423 and all discharges would be required to comply with limits established by FDEP in a NPDES permit. Such permits are designed to protect water quality. Therefore, the review team concluded that building and operating the proposed units at the Highlands site would not be a significant contributor to these impacts on surface-water quality, because industrial and wastewater discharges from the proposed units would comply with NPDES permit limitations and any stormwater runoff from the site during operations would comply with the SWPPP (PEF 2009a).

The review team also concludes that with the implementation of BMPs, the impacts of groundwater quality from building and operating two new nuclear units at the Highlands site would likely be minimal. Therefore, the cumulative impact on groundwater quality would be SMALL.

The impacts of other projects listed in Table 9-19 are either considered in the analysis included above or would have little or no impact on surface-water and groundwater quality.

9.3.4.3 Terrestrial and Wetland Resources

Site Description

The following impact analysis includes direct, indirect, and cumulative impacts from construction and preconstruction activities and operations on terrestrial and wetland resources. The analysis also considers past, present, and reasonably foreseeable future actions that affect those resources, including the other Federal and non-Federal projects and those projects listed in Table 9-19. For the analysis of terrestrial ecological impacts at the Highlands site, the geographic area of interest is considered to be a 20 mi-wide area centered on the Highlands site and the associated offsite and transmission-line corridors. This 20-mi radius is expected to encompass the locations of possible development projects potentially capable of substantially influencing terrestrial ecological resources on and close to the Highlands project site. This geographical area of influence generally coincides with those defined for hydrology and aquatic ecology, both of which are closely interrelated with the terrestrial ecology of this setting. This area includes watersheds providing direct runoff from the Highlands site to the lower Kissimmee River basin and the northern portion of Lake Okeechobee, as well as the Lake Whales Ridge district and the watersheds through which the transmission lines would be routed.

The Highlands site is a greenfield site located in the Eastern Florida Flatwoods ecoregion in a remote rural area near the Kissimmee River (EPA 2010l). Land use on the site and in the vicinity is predominantly agricultural, with significant farming operations and citrus groves present. Habitats present on the site are typical of the Eastern Florida Flatwoods ecoregion and include freshwater marshes and wet prairies with some mixed wetland hardwoods. Freshwater marsh vegetation communities from a range of hydroperiods include species such as arrowhead (*Sagittaria* spp.) and pickerelweed (*Pontederia lanceolata*), combinations of saw grass (*Cladium* spp.), cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), maidencane (*Panicum hemitomon)*, beakrush (*Rhynchospora spp*), spikerush (*Eleocharis* spp.), bladderwort (*Utricularia* spp.), white water lily (*Nymphaea odorata*), floating hearts (*Nymphoides aquatica*), and yellow cow lily (spatterdock, *Nuphar luteum*). Wet prairie vegetation communities include sparse short saw grass (*Cladium jamaicense*), beak rush (*Rhynchospora* spp.*)*, black sedge (*Schoenus nigricans*), wire grass (*Aristida stricta*), and dwarf cypress (*Taxodium* spp.). Mixed wetland hardwood communities in this part of Florida can include species such as oaks (*Quercus virginiana, Q. falcata*, and *Q. alba*) beech (*Fagus grandifolia*), hickory (*Carya* spp.) and needle-leaved evergreens, such as loblolly pine and spruce pine (*Pinus glabra*) (FWS 2007).

The proposed associated transmission-line corridors would begin in the Eastern Florida Flatwoods ecoregion and cross the Central Florida Ridges and Uplands and Southwestern Florida Flatwoods ecoregions. Vegetation community types in the Central Florida Ridges and Uplands ecoregion include sand hill vegetation such as turkey oak, bluejack oak, and longleaf pine forests with common understory species of running oak, gopher apple, and bluestem and panicum grasses (USDA 2006). One of the proposed transmission-line corridors passes

directly through the Lake Whales Ridge district, that contains some of the largest tracts of sandhill communities left in Florida, which provides habitat for many endemic plant species. Vegetation community types in the Southwestern Florida Flatwoods ecoregion include forests dominated by slash pine, longleaf pine, cabbage palm, and live oak with typical understory species of saw palmetto, gallberry, and grasses such as bluestems and wiregrasses (USDA 2006).

Important Species

Common wildlife, including important species, associated with the above-mentioned ecoregions that may occur on the Highlands site and associated transmission-line corridors include recreationally important species such as Florida white-tailed deer, bobcat, feral hog, squirrel, northern bobwhite, and mourning dove, as well as skunk, raccoon, and several species of woodpecker. Various bird, reptile, and amphibian species also have the potential to reside on the Highlands site and associated transmission-line corridors (USDA 2006; FNAI 2009).

No site-specific surveys have been conducted for threatened and endangered species on the site and in the vicinity, offsite corridors or the associated transmission-line corridors. Table 9-19 lists all Federally and State-listed species that could occur on the Highlands site and vicinity, within offsite corridors, and in the counties crossed by the transmission-line corridors. Some of these species may at times be found on or in the vicinity of the Highlands site and associated offsite corridors. Counties crossed by the likely transmission-line corridors for the Highlands site include Highlands, Glades, Osceola, Polk, and Sumter Counties. PEF has stated that on-the-ground field surveys would be conducted before commencement of ground-disturbing activities on the site and in the offsite corridors and transmission-line corridors as required by the FDEP (PEF 2009a; CH2M Hill 2009; FDEP 2010a).

Building Impacts

Impacts from building two nuclear units and supporting facilities on wildlife habitat would be unavoidable. Activities that would affect wildlife include land clearing and grading (temporary and permanent), filling and or draining of wetlands, increased human presence, heavy equipment operation, traffic, noise, avian collisions, and fugitive dust. These activities would likely displace or destroy wildlife that inhabits the areas of disturbance. Some wildlife, including important species, would perish or be displaced during land clearing for the above activities as a consequence of habitat loss, fragmentation, and competition for remaining resources. Less mobile animals, such as reptiles, amphibians, and small mammals, would be at greater risk of incurring mortality than more mobile animals, such as birds, many of which would be displaced to adjacent communities. Undisturbed land adjacent to areas of disturbance could provide habitat to support displaced wildlife, but increased competition for available space and resources could affect population levels. Wildlife would also be subjected to impacts from noise and traffic, and birds could be injured if they collide with tall structures. The impact on wildlife

from noise is expected to be temporary and minor. The creation of new transmission-line corridors could be beneficial for some species, including those that inhabit early successional habitat or use edge environments, such as white-tailed deer, northern bobwhite, eastern meadowlark, and the gopher tortoise. Birds of prey, such as red-tailed hawks would likely exploit newly created hunting grounds. Forested wetlands within the corridors would be converted to and maintained in an herbaceous or scrub-shrub condition that could provide improved foraging habitat for waterfowl and wading birds. However, fragmentation of forests could adversely affect species that are dependent on large tracts of continuous forested habitat.

To accommodate the building of two nuclear units on the Highlands site, PEF would need to clear approximately 441 ac of terrestrial habitats for the nuclear facility and approximately 329 ac for associated offsite structures and corridors, and an additional 1291 ac of land would need to be cleared and excavated to accommodate a reservoir (see Table 9-20 and Table 9-21) (CH2M Hill 2009).

Table 9-20. Summary of Impacts by Land-Use Class for the Highlands Site

Land-Use Class (FLUCFCS) (acreage)	Onsite	Reservoir	Offsite Corridors (Except Transmission)	Transmission Corridors[(a)]
Urban and Built Environment (percent of area)	0 (0%)	0 (0%)	19 (6%)	1766 (27%)
Agriculture	436 (99%)	1156 (90%)	263 (80%)	3004 (46%)
Upland Nonforested	0 (0%)	0 (0%)	7 (2%)	410 (6%)
Upland Forested	0 (0%)	0 (0%)	10 (3%)	351 (5%)
Water	0 (0%)	0 (0%)	5 (2%)	28 (<1%)
Wetlands	6 (1%)	135 (10%)	17 (5%)	558 (9%)
Barren Lands	0 (0%)	0 (0%)	8 (2%)	4 (<1%)
Transportation, Communication and Utilities	0 (0%)	0 (0%)	0 (0%)	395 (6%)

Source: CH2M Hill 2009
(a) Acreages for transmission lines are total acres available, not acres affected.

Table 9-21. Total Terrestrial Habitat Impacts for the Highlands Site

Impact Areas	Acres
Onsite Impact Areas	441
Reservoir Impact Areas	1291
Transmission-Line Corridor Areas	6516[(a)]
Offsite Impact Areas	329
Total Impact Areas	**2061 (plus portion of 6516-ac transmission**

	corridor)

Source: CH2M Hill 2009
(a) Transmission line acreage is total acres available in the transmission-line corridor, not acres affected.

Based upon FLUCFCS land-use data, approximately 6 ac of wetlands would be affected on the site during building (CH2M Hill 2009). Approximately 17 ac of wetlands would be affected in the offsite corridors (CH2M Hill 2009). Approximately 135 ac of wetlands would be affected to accommodate the reservoir (CH2M Hill 2009). PEF states that the nuclear facility would be sited to avoid wetlands whenever possible, and potential impacts on wetlands near building zones would be minimized through the use of established BMPs (PEF 2009a). Under Federal and State permitting requirements, PEF would be obligated to mitigate any unavoidable construction impacts on jurisdictional wetlands and listed species (FDEP 2010a).

New transmission system infrastructure would be needed to support a nuclear power facility at the Highlands site, which includes approximately 200 mi of transmission lines (estimates made by measuring the approximate distance of hypothetical corridors provided in CH2M Hill 2009; see assumptions in Section 9.3.4.1). There are no existing transmission lines or transmission-line corridors present on the site. PEF has assumed that transmission lines would be collocated within existing transmission-line corridors to the extent possible, thereby minimizing potential terrestrial impacts. In addition, transmission-line corridors, towers, and access road would be situated to avoid critical or sensitive habitats and species to the extent possible. Transmission-line corridor width would be dependent on the size, voltage, and whether existing corridors could be used, and would vary from 55 ft to 460 ft wide. These widths were used in the analysis of the hypothetical routes for each alternative site to determine land-use cover types (CH2M Hill 2009). The transmission-line corridors for the Highlands site would consist of approximately 6516 ac, of which approximately 558 ac would be wetlands, and approximately 351 ac would be forested habitat (CH2M Hill 2009). Some portion of the total 351 ac of forested habitat and 558 ac of wetland habitat present in the corridors would be affected; however, because actual routes have not been determined, impacts to forests and wetlands cannot be quantified. Under Federal and State permitting requirements, PEF would be obligated to mitigate any unavoidable construction impacts on jurisdictional wetlands and listed species. PEF stated that all land clearing associated with the nuclear facility, offsite structures, and transmission-line creation would be conducted according to Federal, State, and local regulations, permit requirements, existing procedures, and established BMPs (PEF 2009a; FDEP 2010a).

Building two new nuclear reactors at the Highlands site, including offsite corridors (except transmission corridors) and a reservoir would result in a loss of approximately 2061 ac of terrestrial habitat. Clearing land within the 6,516-ac transmission-line corridor would also result in a loss of an undetermined additional amount of forested terrestrial habitat and increase habitat fragmentation along the corridor. Other sources of impacts on terrestrial resources such as noise, increased risk of collision and electrocution, and displacement of wildlife would likely

be temporary and result in minimal impacts on the resource. Because of the extent of unavoidable terrestrial habitat loss, building the two new units and associated offsite facilities, including transmission lines, would noticeably alter the available terrestrial habitat in the landscape surrounding the Highlands site.

Operational Impacts

Impacts on terrestrial ecological resources, including important species, from operation of two new nuclear units at the Highlands site include those associated with transmission system structures, maintenance of transmission-line corridors, and operation of the cooling towers. Also, during plant operation, wildlife would be subjected to impacts from increased traffic.

Impacts on crops, ornamental vegetation, and native plants from cooling-tower drift cannot be evaluated in detail in the absence of information about the specific location of cooling towers at each alternative site. Similarly, bird collisions with cooling towers cannot be evaluated in the absence of information about the specific location of cooling towers at the site. The impacts of cooling-tower drift and bird collisions for existing power plants were evaluated in NUREG-1437 (NRC 1996) and found to be of minor significance for nuclear power plants in general, including those with various numbers and types of cooling towers. On this basis, the review team concludes, for the purpose of comparing the alternative sites, that the impacts of cooling-tower drift and bird collisions with cooling towers resulting from operation of new nuclear units would be minor.

Outdoor noise levels on the Highlands site are predicted to range from 90 dBA near the loudest equipment to 65 dBA in areas more distant from major noise sources (CH2M Hill 2008). Noise modeling predicts not perceptible to slight increases in noise from plant operations at the site boundary (CH2M Hill 2008). Except in areas immediately adjacent to major noise sources, expected noise levels would be below the 60- to 65-dBA threshold at which birds and red foxes (a surrogate for small and medium-sized mammals) are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the Highlands site would not be likely to disturb wildlife beyond the site boundary. Consequently, the review team concludes that the impacts of cooling-tower noise on wildlife would be minimal.

An evaluation of specific impacts resulting from building of transmission lines and transmission-line corridor maintenance cannot be conducted in any detail due to the lack of information, such as the specific locations of new rights-of-way that could result from transmission system upgrades. However, in general, impacts associated with transmission-line operation consist of bird collisions with transmission lines, EMF effects on flora and fauna, and habitat loss due to corridor maintenance. The impacts associated with transmission-line corridor maintenance activities include alteration of habitat, including but not limited to wetland and floodplain habitat, due to cutting and herbicide application.

Transmission lines and associated structures pose a potential avian collision hazard. Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to their low, fast flight and flocking behavior (EPRI 1993). Bird collisions with transmission lines are recognized as being of minor significance at operating nuclear power plants, including those with transmission-line corridors with variable numbers of power lines (NRC 1996). Accordingly, although additional transmission lines would be required for new nuclear units at the alternative sites, increases in bird collisions would be minor and these would likely not be expected to cause a measurable reduction in local bird populations. PEF would also be required to have an Avian Protection Plan in compliance with State certification guidelines (FDEP 2010a). Consequently, the incremental number of bird collisions posed by the addition of new transmission lines for new nuclear units would be negligible.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). At a distance of 300 ft, the magnetic fields from many lines are similar to typical background levels in most homes. Thus, impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003). Therefore, the incremental EMF impact posed by the addition of new transmission lines for new nuclear units would be negligible.

Existing roads providing access to the existing transmission-line corridors would likely be sufficient for use in any expanded corridors; however, new roads would be required during the development of new transmission-line corridors. Management activities (cutting and herbicide application) related to transmission-line corridors and related impacts on floodplains and wetlands in transmission-line corridors are recognized as being of minor significance at operating nuclear power plants, including those with transmission-line corridors of variable widths (NRC 1996). The review team assumes that the same vegetation and construction management of corridors currently used by PEF would be used in the establishment and maintenance of the new corridors. Under the Conditions of Certification for the State, PEF would also be required to retain existing vegetation whenever practicable and use BMPs that comply with the Florida State regulations (FDEP 2010a). Consequently, the incremental effects of the maintenance of transmission-line corridors and associated impacts on floodplains and

wetlands posed by expanding existing corridors or the addition of a new transmission-line corridor for new nuclear units would be negligible.

To summarize, the potential effects of operating two new nuclear reactors at the Highlands site would be primarily associated with the maintenance of transmission-line corridors and increased traffic. Operational impacts on terrestrial resources would be expected to be minimal.

Cumulative Impacts

There are no past or current actions in the geographic area of interest that have influenced terrestrial resources in a way similar to the building and operation of the proposed two new nuclear units at the Highlands site. However, terrestrial habitats throughout the geographic area of interest have been extensively altered by a history of forestry and agricultural practices as well as low density residential development.

Proposed reasonably foreseeable future actions that would affect terrestrial resources in a way similar to development at the Highlands site would include transmission-corridor creation and/or upgrading throughout the designated geographical ROI, and future urbanization would also be expected to occur. However, there is an area within the geographical ROI that is managed for the benefit of wildlife – the Brighton Indian Reservation, located near the Highlands site.

The other impact on terrestrial resources at the Highlands site would be the effect of global climate change on plants and wildlife. The impact of global climate change on terrestrial wildlife and habitat in the geographic area of interest is not precisely known. Global climate change would result in a rise in sea level and may cause regional increases in the frequency of severe weather, decreases in annual precipitation and increases in average temperature (GCRP 2009). Such changes in climate could alter terrestrial community composition on or near the Highlands site through changes in species diversity, abundance and distribution. Elevated water temperatures, droughts, and severe weather phenomena may adversely affect or severely reduce terrestrial habitat. Specific predictions of habitat changes in this region due to global climate change are inconclusive at this time. However, because of the regional nature of climate change, the impacts related to global climate change would be similar for all of the alternative sites.

Summary Statement

Impacts on terrestrial ecology resources are estimated based in the information provided by PEF and the review team's independent review. Past, present, and future activities in the geographic area of interest could affect terrestrial ecology in ways similar to the building of the proposed two units at the LNP site. The Highlands site is predominantly agricultural land and citrus groves, but, a large portion of the associated transmission-line corridors would cross natural habitats that would be substantially altered by development and maintenance activities noticeably affecting the level and movement of terrestrial wildlife populations in the surrounding landscape. Other anticipated development projects would further alter wildlife habitats and

migration patterns in the surrounding landscape. The review team therefore concludes that the cumulative impacts on baseline conditions for terrestrial ecological resources would be MODERATE. This determination is based upon the extent of expected wetland loss and habitat fragmentation from ongoing and planned development projects, continued widespread manipulation of habitats for commercial agricultural management, and anticipated losses of habitat for important species. The incremental impacts from building and operating the Highlands project would be a significant contributor to the moderate cumulative impact, primarily because of a loss or modification of habitats that support wildlife, wetlands, and important species. Although incremental impacts on terrestrial resources could be noticeable near the Highlands project site, these impacts would not be expected to destabilize the overall ecology of the regional landscape.

9.3.4.4 Aquatic Resources for the Highlands Site

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources. The proposed Highlands site has no existing infrastructure associated with development of a nuclear power plant. This greenfield site is adjacent to the Kissimmee River, which would be the water source for cooling and discharge. Water flow in the Kissimmee River is managed by the South Florida Water Management District (SFWMD). PEF maintains that because the Kissimmee River is being restored to its original river bed, the building of a reservoir would be required to ensure consistent water supply (PEF 2009a). The geographic area of interest includes the lower Kissimmee River basin from Chandler Slough south and including the northern portions of Lake Okeechobee as the area most likely to be affected by new nuclear units, as well as associated transmission-line corridors.

The Kissimmee River provides almost one-half of the inflow to Lake Okeechobee. The previously channelized river is currently under restoration, which is required for successful restoration of the Everglades as part of the Lake Okeechobee watershed. Originally feeding floodplain wetlands, the Kissimmee River was channelized for flood control to discharge excess water to Lake Okeechobee. Currently, the canal is being filled in specific areas to improve flow velocities and divert water flow to the original floodplains (Audubon of Florida 2005).

There are no sanctuaries or preserves that could be affected by locating the proposed units at the Highland site. The nearest managed area is the North Fork St. Lucie aquatic preserve east of Highlands County in St. Lucie and Martin Counties; the preserve protects 5000 ac of surface-water area on the St. Lucie River.

Commercially Important Species

While there is no commercial fishing in the Kissimmee River, Lake Okeechobee supports a small commercial fishery for catfish and black mullet (see Section 2.4.2). White catfish (*Ameiurus catus*), yellow bullhead (*A. natalis*), brown bullhead (*A. nebulosus*), and channel catfish (*Ictalurus punctatus*) have been documented in Lake Okeechobee. Spawning ranges

from spring to mid-summer, and these primarily nocturnal fish feed on benthic invertebrates and other fish (Rohde et al. 1994).

Recreationally Important Species

The Kissimmee River and Lake Okeechobee support a diverse recreational freshwater fishery. Largemouth bass and black crappie (*Pomoxis nigromaculatus*) represent the most popular, although some saltwater species are routinely caught near the Franklin and St. Lucie locks on Lake Okeechobee (FFWCC 2009b).

Non-Native and Nuisance Species

Water hyacinth, water lettuce *(Pistia stratiotes*), alligatorweed *(Alternanthera philoxeroides)*, and hydrilla are common invasive aquatic plant species that have been noted in the Kissimmee River basin and Lake Okeechobee that are controlled by the Kissimmee River restoration, and Lake Okeechobee restoration efforts in cooperation with FDEP/Florida Fish and Wildlife Conservation Commission's Invasive Plant Management Program (FDEP 2008). Torpedograss (Panicum repens) and melaleuca (*Melaleuca quinquenervia*) are also spreading rapidly in the marsh areas of Lake Okeechobee due to drought conditions and the lowering of the lake level. Exotic animals that have been introduced into Lake Okeechobee include tilapia (*Tilapia aurea)*, Asiatic clam (*Corbicula fluminea*), and water flea (*Daphnia lumholtzii*) (SFWMD 2000). Power plant operations are not expected to have an impact on the presence or spread of these species.

Critical Habitats

No critical habitat has been designated by the FWS or National Oceanic and Atmospheric Administration in the vicinity of the Highlands site.

Federally and State-Listed Species

There are no Federally and/or State-listed aquatic species that may occur near the Highlands site. Federally and/or State-listed species may occur along transmission-line corridors, but their occurrence cannot be determined at this time because specific details regarding placement of transmission infrastructure are not available.

Based on the assumption that BMPs would be in use during building, site, vicinity, and transmission preparation, building and operation activities are not expected to result in impacts on Federally or State-listed species.

Building Impacts

New cooling-water intake and discharge structures in addition to a cooling-water reservoir would be required at the Highlands site. Preparation of a reservoir with intake and discharge

structures would not result in impacts on aquatic resources from building activities. However, installation of a makeup-water intake structure on the Kissimmee River for fill water and a separate discharge to the Kissimmee River to receive discharge would result in the temporary displacement of aquatic biota within the vicinity of both structures on the Kissimmee River. It is expected that these biota would return to the area after installation is complete. Sedimentation due to disturbances of the river bank and bottom during installation could affect local benthic populations. However, the impacts on aquatic organisms would be temporary and largely mitigable through the use of BMPs. The impacts of building a cooling-water reservoir may be significant depending on the siting of the reservoir. During the review team's site visit, observations of the proposed site via public roads indicated the presence of streams that are either perennial or seasonal. Offsite corridor preparations would cross 10 streams and 2 open waterbodies (CH2M Hill 2009). These aquatic resources have not been examined for diversity of aquatic biota, but nonetheless still represent aquatic habitat that would likely be affected by the building of facilities for the site. The use of BMPs during building activities could minimize impacts on aquatic biota located in water resources within the site building areas.

New transmission-line infrastructure would be required for a new two-unit facility. There are currently no existing transmission-line corridors in the immediate vicinity of the Highlands site and new corridors would need to be established. Transmission corridors appear to follow routes in Highlands, Osceola, Polk, and Sumter Counties (CH2M Hill 2009). PEF anticipates transmission-line corridors would cross 4 streams and 37 open waterbodies and should have minimal impact on aquatic resources (CH2M Hill 2009).

Operational Impacts

Impingement and entrainment of organisms from the Kissimmee River and from a constructed reservoir would be the most likely impacts on aquatic populations that could occur from operation of two new nuclear units at the Highlands site.

Assuming (1) a closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities (66 FR 65256), (2) a maximum through-screen velocity of 0.5 fps at the cooling-water intake, and (3) an intake flow of less than or equal to 5 percent of the mean annual flow, then anticipated impacts on aquatic populations from entrainment and impingement are expected to be minimal. However, as discussed in Section 9.3.4.2, the withdrawal of water from the Kissimmee River needed to operate two new units would be 16 percent of the mean annual flow during the year with the lowest flow on record. During low-flow conditions, impingement and entrainment impacts may be noticeable. Operational impacts associated with water quality and discharge cannot be determined without additional detailed analysis. However, based on the review team's experience with other facilities, the review team concludes that with proper design the impacts on aquatic resources due to the blowdown discharge from operation of two new nuclear units at the Highlands site would likely be minimal with FDEP NPDES compliance.

The review team also concludes that operational impacts on aquatic biota from maintenance of the transmission-line corridors would also be minimal assuming that appropriate BMPs are used.

Cumulative Impacts

Cumulative impacts on aquatic resources within the Kissimmee River basin include the restoration activities associated with removing anthropogenic channelization and restoration to historic river flow, and Lake Okeechobee and Everglades restoration activities managed by USACE and SFWMD. All restoration activities are planned to increase the productivity and biodiversity within the Kissimmee-Okeechobee-Everglades ecosystems (SFWMD 2005). Restoration activities such as backfilling and channel carving to reconnect hydrological resources are managed through use of BMPs to minimize erosion and sedimentation (USACE 1996). Early restoration improvements have already demonstrated successful establishment of pre-channelized conditions and communities characteristic of free-flowing riverine habitats (SFWMD 2008).

Other impacts include operation of dairy farms, agriculture, and small businesses that discharge wastewater to the Kissimmee River basin within the geographic area of interest for the Highlands site. These dairy operators and businesses have active NPDES permits for discharge.

Anthropogenic activities, such as residential or industrial development near the vicinity of a nuclear facility, can present additional constraints on aquatic resources. Future activities may include shoreline development (i.e., removal of habitat), increased water needs, and increased discharge of effluents into the Kissimmee River. The effects of continued dairy practices and agriculture could result in additional habitat loss and/or degradation due to water use using surface waters and groundwater withdrawal, point and non-point source pollution, siltation, and bank erosion. The review team is also aware of the potential for global climate change to affect aquatic resources. The impact of global climate change on aquatic organisms and habitat in the geographic area of interest is not precisely known. Global climate change would result in a rise in sea level and may cause regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (GCRP 2009). Such changes in climate could alter aquatic community composition on or near the Highlands site through changes in species diversity, abundance, and distribution. Elevated water temperatures, droughts, and severe weather phenomena may adversely affect or severely reduce aquatic habitat, but specific predictions of aquatic habitat changes in this region due to global climate change are inconclusive at this time. The level of impact resulting from these events would depend on the intensity of the perturbation and the resiliency of the aquatic communities.

Summary Statement

Impacts on aquatic ecology resources are estimated based on the information provided by PEF, the State of Florida, and the review team's independent review. Properly siting associated transmission lines, avoiding habitat for protected species, minimizing interactions with waterbodies and watercourses along the corridors, and the using BMPs during intake and discharge installation, transmission-line corridor preparation, and tower placement would minimize building and operation impacts. There would be impacts associated with the loss of aquatic habitat, particularly during low flow conditions in the river, due to the consumptive loss of water from closed-cycle cooling. There also would be unspecified impacts related to the construction and operation of a cooling reservoir, however, these could be minimized through proper siting and the use of BMPs during construction. The use of a cooling reservoir would partially mitigate the effects of consumptive water loss on aquatic habitat during low river flow. The review team concludes that the cumulative impacts of building and operating two new reactors on the Highlands site combined with other past, present, and future activities on most aquatic resources in the Kissimmee River basin and Lake Okeechobee would be SMALL.

9.3.4.5 Socioeconomics

The following impact analysis includes direct, indirect, and cumulative impacts from building activities and operations at the Highlands site, which is located southwest of the Kissimmee River in a rural area of Highlands County, Florida. The analysis considers other past, present, and reasonably foreseeable future actions that affect socioeconomics, including other Federal and non-Federal projects listed in Table 9-19. For the analysis of socioeconomic impacts at the Highlands site, the geographic area of interest is the region within a 50-mi radius of the Highlands site (the region). In evaluating the socioeconomic impacts of site development and operation at the Highlands site, the review team undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources.

The Highlands site is a greenfield site in central Florida. The review team drew upon USCB 2000 data to find the available total construction workforce within the host county, adjacent counties, and nearby counties with a major population center within a reasonable commuting distance from the site. For the Highlands site, this included Highlands, Hardee, De Soto, Glades, Okeechobee, Polk, Martin, St. Lucie, and Palm Beach Counties. The total construction workforce employed in these counties in 2000 was 76,849 workers. Based on this availability, the review team assumed that up to 80 percent of the 3300-person workforce involved in building the two-unit plant, or 2640 workers, would be drawn from existing residents of the region, and that 20 percent, or 660 workers, would be in-migrants to the area. This 20 percent would include special trades needed for nuclear power plant production that may not be available in the region.

For the purposes of this analysis the review team assumed that about one-quarter or 165 of the in-migrating workers would be distributed about evenly among Polk, St. Lucie, Martin, or Palm

Beach Counties, because they offer more urban amenities than the EIA. The review team assumed that the other 495 in-migrating workers would be distributed among Highlands County and the immediately adjacent Glades, De Soto, Hardee, and Okeechobee Counties, according to available housing. The review team considered this five-county area as the local area where most socioeconomic impacts would be expected to be the greatest (Economic Impact Area, EIA). The review team focused on effects of the workforce involved in building the two-unit plant because the operations workforce would be smaller, with expected smaller socioeconomic impacts. Table 9-22 provides some socioeconomic data for the EIA.

The review team assumed that all in-migrating workers would bring families; this is unlikely but provides an upper bound to the population increase associated with the project. The review team used the 2.49 average Florida family size to project the distribution of new jobs and population in the EIA due to in-migrating workers listed in Table 9-23.

Physical and Aesthetics Impacts

The physical impacts on workers and the public of building and operating a two-unit plant at the Highlands site would be very similar to those described for the LNP site. People who work or live around the site could be exposed to noise, fugitive dust, and gaseous emissions from building activities. Building workers and personnel working onsite could be the most affected. Air-pollution emissions are expected to be controlled by applicable BMPs and Federal, State, and local regulations. During plant operations, standby diesel generators used for auxiliary power would have air-pollution emissions. These generators would see limited use for only short periods of time. Applicable Federal, State, and local air-pollution requirements would apply to all fuel-burning engines. At the site boundary, the annual average exposure from gaseous emission sources is anticipated to not exceed applicable regulations during normal operations. The impacts of plant operations on air quality are expected to be minimal. As with building impacts, potential offsite receptors of operations noise and emissions are generally located well away from the site boundaries.

The Highlands site is in a rural, agricultural area. Residential and commercial areas are located away from the site boundaries, applicable air-pollution regulations would have to be met by PEF, and applicable BMPs would be put in place during the construction and use of the site access road. Therefore, based on information provided by PEF and the review team's independent review of reconnaissance-level information, the review team concludes that the physical impacts of building and operating the two units at the Highlands site would be minimal on workers and the local public around the site.

Building activities and plant operations are not expected to affect any offsite buildings. Most buildings are well removed from the site boundaries. Because this is a greenfield site, there are no onsite buildings to be affected by shock and vibration from pile-driving and other related activities. No long-term physical impacts on structures, including any residences near the site boundaries, would be expected. Therefore, based on consideration of reconnaissance-level

Table 9-22. Socioeconomic Data for the Highlands Site EIA

Data Category	Highlands	Glades	De Soto	Hardee	Okeechobee	Data source
Population						
1980	47,526	5992	19,039	20,357	20,264	(1a)
1990	68,432	7591	23,865	19,499	29,627	(1)
2000	87,366	10,576	32,209	26,938	35,910	(1)
Projected 2010	103,201	11,330	34,423	29,362	41,476	(2)
Median Household Income (1999)	$30,160	$30,744	$30,714	$30,183	$30,456	(3)
Vacant Housing Units 2000	11,375	1938	2862	1654	2911	(1)
Total Housing Units						
2000	48,846	5790	13,608	9,820	15,504	(1)
2007	54,467	6067	14,478	10,482	16,512	(1)
Workforce						
Employed	30,051	3677	12,742	9901	14,169	(3)
Peak Project	2139	368	976	794	1352	(3)
Total Schools[(a)]	1A 4B 7 A-B 3C	2 A-B 2 B-C	1 A 1B 3A-B 1C 1B-C	0 A 2 B 5 A-B 1 C	1 A 1 B 4 A-B 2 C 1 A-B-C	(4)
Number of Schools Failing	0	0	0	1	0	(4)

Student-Teacher Ratio						
Police	Sheriff Dept – 341 full-time and 18 part-time employees;	Sheriff Dept – 60+ employees; currently expanding; patrol division with 19 members	Sheriff Dept	Sheriff Dept – patrol division of 4 squads.	Sheriff Dept - 44 deputies	(5)
Emergency Services	EMS department, details not available	EMS and fire departments, details not available	Emergency operations center with 5 staff; 3 fire stations	EMS department and emergency ops center, details NA	EMS department and emergency operations center, details not available	(6)
Population						
White	84.7	78.3	74.5	72.1	81	(3)
Afr-American	9.8	10.8	12.7	8.9	8.3	(3)
Hispanic	12.1	15.1	24.9	35.7	18.6	(3)
Low-Income	15.2	15.2	23.6	24.6	16.0	(3)

(a) A-elementary school; B-middle school ;C-high school
Sources:
(1a) USCB 1990
(1) USCB 2000
(2) 2010 projection assuming 2000-2008 growth rate (from USCB 2009) extends to 2010
(3) USCB 2000
(4) FDOE 2009a
(5) Highlands Sheriff 2009, Glades Sheriff 2009, De Soto Sheriff 2009, Hardee Sheriff 2009, Okeechobee Sheriff 2009
(6) Highlands EM 2009, Glades EM 2009, De Soto EM 2009, Hardee EM 2009, Okeechobee 2009
EMS = emergency management services

Table 9-23. Projected Distribution of Workers and Associated Population Increase in the EIA

County	Percent Population Increase 1990-2000[(a)]	Projected Percent Increase 2000–2010 [(b)]	Workers In-Migrating to Build Dixie Plant	Civilian Workforce in 2007 [(c)]	Population of In-Migrating Workers and Families	Population of Workers and Families as a Percent of Projected 2010 Population	Population of Workers and Families as a Percent of Projected 2010 Population + In-Migrants
Highlands	27.7	18.1	271	40,340	676	0.66	0.65
Glades	39.3	7.1	46	4615	115	1.02	1.01
De Soto	35.0	6.9	68	14,046	170	0.49	0.49
Hardee	38.2	9.0	39	12,071	98	0.33	0.33
Okeechobee	21.2	15.5	69	16,512	173	0.42	0.42

(a) Based on USCB data, as reported in PEF 2007

(b) Calculated as 1.25 times percent change 2000–2008 shown in USCB 2009, i.e., assumes rate of change for first eight years would continue through last two years of the decade.

(c) Fedstats for Florida and Florida Counties. Compiled from the Bureau of Economic analysis, Bureau of Labor Statistics, U.S. Census Bureau. Accessed 3.8.10 at http://www.fedstats.gov/qf/states/12/12029.html.

information, the review team concludes that the physical impacts of building and operating a two-unit nuclear plant on offsite buildings would be minor.

PEF reports that a reservoir may need to be created for water supply. Because its size and footprint are unknown, the review team cannot predict whether such a reservoir would affect aesthetics in the vicinity of the plant. However, there would likely be vegetative screening around the reservoir that would potentially mitigate the aesthetic impacts.

As the transmission lines to connect the site to the distribution grid are put in place and the buildings and cooling towers associated with the new reactors reach their final heights and begin operating, they would add a visible industrial landscape, with a noticeable aesthetic

impact. In places requiring the clearing of new transmission-line corridors, aesthetic impacts would be noticeable but not destabilizing, depending on the proximity of viewers and the nature of vegetation remaining between them and the corridors. Given the general characteristics of the area, there would likely be vegetative screening around the site that would potentially mitigate the aesthetic impacts at the reactor site.

Demographic Impacts

Table 9-23 lists the estimated project-related population migrating into the EIA at peak workforce levels and the population increase in each county between 1990 and 2000 and between 2000 and 2010. As seen in the table, each county saw a greater population increase between 1990 and 2000 than is forecast for between 2000 and 2010; with the exception of Okeechobee County, where growth during the 1990s was a great deal higher. The proposed project would increase the population in each of the EIA by an estimated 1.01 percent or less over projected populations for 2010. Consequently, the review team found that the in-migrating population associated with building two new nuclear generating units would have a minor demographic impact in the EIA.

Economic Impacts

The review team determined that the impact of jobs associated with building the two units would have a minor effect on total employment in the EIA, with in-migrating workers projected at 1 percent or less of the 2007 civilian workforce in any county. The impact of approximately 541 new operations jobs (70 percent of operations workforce) within a 1-hour commute of the site would be minor on employment levels in the EIA. Due to the smaller economy of the Highlands EIA compared to the Levy EIA, and the smaller number of in-migrating workers at the period of peak workforce, the review team concludes that the expected number of indirect jobs and income created by building and operating the two-unit plant at the Highlands site due to the multiplier effect would be no greater than that estimated for the LNP site and that the combined direct and indirect economic effects would cause only a slight increase the counties' economies.

State and local taxes would be governed by Florida law. The review team assumed that tax revenues generated from sales and use taxes associated with building and operation of the proposed project at the Highlands site would be similar to those evaluated for the LNP site in Sections 4.4.3.2 and 5.4.3.2, with a minor impact on revenues in the EIA and region. The review team concluded that increased property taxes from a facility at the Highlands site during operations would have a substantial beneficial impact on Highlands County, but minimal impacts on the other counties in the EIA and region. The review team found that additional property taxes on new houses built by in-migrating workers would constitute a small percentage increase in the local tax base in the EIA. Therefore, the review team determined that the impact of both the building and operation of the proposed project on residential property tax revenues would be minor and beneficial everywhere in the region, with the exception of Highlands County, where property tax impacts would be substantial and beneficial.

Housing

The review team compared the 2000 figures for vacant housing in the EIA listed in Table 9-22 with the number of in-migrating workers projected for peak workforce years listed in Table 9-23. Table 9-22 housing figures do not include RV parks, campgrounds, or hotels, and thus provide a lower bound of what would be available to house workers. To estimate the baseline number of houses that would be needed in the EIA (i.e., without the hypothetical plant), the review team divided the projected non-project related increase in population by 2.49 (Florida average family size) and determined the vacant housing stock in the EIA could absorb both the in-migrating workers and the remainder of the projected population increase. In the EIA, less than 5 percent of the vacant housing present in 2000 would be needed to house in-migrating workers, assuming that each worker occupied a separate housing unit.

The U.S. Census Housing Profile (USCB 2000b) for the EIA estimated the following:

- Highlands County – a total housing stock of 48,846 units with a rental vacancy rate of 23 percent (approximately 11,375 housing units were unoccupied at the time of the survey).
- Glades County – a total housing stock of 5790 units with a rental vacancy rate of 33 percent (approximately 1938 housing units were unoccupied at the time of the survey).
- De Soto County – a total housing stock of 13,608 units with a rental vacancy rate of 21 percent (approximately 2862 housing units were unoccupied at the time of the survey).
- Hardee County – a total housing stock of 9820 units with a rental vacancy rate of 17 percent (approximately 1654 housing units were unoccupied at the time of the survey).
- Okeechobee County – a total housing stock of 15,504 units with a rental vacancy rate of 19 percent (approximately 2911 housing units were unoccupied at the time of the survey).

The review team expects that the in-migrating workforce could be absorbed into the existing housing stock in the EIA and the region without a measureable impact. Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that housing impacts of building and operating two nuclear units at the Highlands site would not be noticeable.

Public Services

The review team assumed that the Highlands EIA, like the LNP EIA, have planned to meet needs for public services based on forecast population increases that did not include the presence of a workforce associated with constructing and operating a two-unit nuclear plant. The review team based its analysis of potential impacts on public services on the level of population increase represented by in-migrating workers and their families during peak workforce years, an estimated increase of 1.01 percent or less over projected populations for 2010, as shown in Table 9-23. Using this approach, the review team expects that impacts of

the proposed project on county public services during peak workforce years would be minor in the EIA.

Transportation

Main roads in Highlands County include US-27, a multi-lane north-south road with LOS standard of "C"; SR-70, a two-lane east-west road across the southern third of the county with LOS standard of "C"; and SR-64, a two-lane road that extends west from US-27 into Hardee County in the northwest of the county with LOS standard of "C." These roads form part of the Strategic Intermodal System, for which the FDOT sets the standards (FDOT 2009a). SR-66/US-98, a two-lane east-west road across the northern third of the county, is not part of the Strategic Intermodal System and Highlands County has not set standards for this route. Where US-98 turns north to join US-27 when it meets SR-66, it is subject to the LOS standard of "C" as part of the Strategic Intermodal System. For this analysis, the review team assigned the east-west SR-66/US 98 a LOS standard of "C," consistent with other two-lane U.S. highways and State roads in the county.

One-way annual (2008) AADT counts for US-27 ranged from 14,500 to 17,000 around the intersection with SR-64; 10,500 in both directions around the intersection with SR-66/US-98; and 4500 to 4200 around the intersection with SR-70. One-way AADT counts for SR-70 ranged from 2100 to 1700 around the intersection with US-27; and 2100 to 2000 in the eastern side of the county. One-way AADT counts for SR-66 west of US-27 ranged from 2900 through 3100. One-way AADT counts for SR-64 west of US-27 ranged from 5200 to 5100 (FDOT 2008).

The review team determined that US-27, SR-70, SR-64, and SR-66/US-98 would be the main routes used by workers commuting to the plant site, with SR-70 linking to the site access road. The review team considered the impact of the traffic associated with the peak workforce and building-related activities in terms of likelihood that it would change the LOS along SR-70 to be lower than the assigned standard "C." The review team assumed 2281 trips daily (following LNP site transportation analysis in Section 4.4.4.1), split 65 percent to/from the east and 35 percent to/from the west, based on the split of in-migrating worker residence discussed previously, combined with the split of commuters from Polk, Martin, St. Lucie, and Palm Beach Counties. At morning shift change, this would add 1977 cars to the total flow on SR-70, 924 incoming from the east, 498 from the west; and 357 outgoing to the east, 193 to the west. The incoming traffic from the east would increase the flow by almost 50 percent over the 2008 AADT for SR-70 in the east side of the county, but, according to FDOT's generalized planning standards (FDOT 2009b), this total flow would not reduce the LOS below "C." While more analysis would be required, once specific proposals for turn lanes, signals, and other modifications were made, the review team identified the potential that a noticeable, intermittent impact would be observed at the intersection of SR-70 with the site access road, analogous to that predicted for the LNP site. Given the lower number of commuters during operations, the review team believes the traffic-related impacts during operations would be minor.

Education

Table 9-22 provides data about schools in the EIA. All schools met the State teacher-student ratio classroom requirements in 2007–2008 with the exception of one school in Hardee County. The review team assumed that school districts in the EIA, like those for the LNP site, would address short-term gains in student population with mobile classrooms and that the PK-12 public schools would be funded according to the Florida equalized funding formula (FDOE 2009). The review team assumed that students would accompany each in-migrating worker family in the average of the ratios of students per household from the LNP site counties listed in Table 2-35, resulting in the number of new students during peak workforce years listed in Table 9-24.

Table 9-24. Students from In-Migrating Families at Peak Workforce Years

County	In-Migrating Worker Households	Grades PK–3 Students[(a)]	New Rooms	Grades 4–8 Students[(b)]	New Rooms	Grades 9–12 Students[(c)]	New Rooms
Highlands	271	43	2	22	1	25	1
Glades	46	7	0	4	0	4	0
De Soto	68	11	1	6	0	6	0
Hardee	39	6	0	3	0	4	0
Okeechobee	69	11	1	6	0	6	0

Source: Table 4-14 and Florida State Constitution Amendment of Section 1, Article IX (November 2002)
(a) 0.158 per household; 18 students per teacher required by State law
(b) 0.081 per household; 22 students per teacher required by State law
(c) 0.091 per household; 25 students per teacher required by State law
PK = preschool

The review team found that the addition of up to four classrooms in Highlands County and one classroom in De Soto and Okeechobee Counties would amount to less than one additional classroom per school, which would constitute a minor impact. Glades and Hardee counties would not need additional classrooms to accommodate project-related students and still meet applicable student/teacher ratios.

Recreation and Aesthetics

The economy in the Highlands EIA draws on its natural resources, including many lakes and parks. Because the exact footprint of the site is not determined, specific impacts on specific recreational facilities from site structures and the intake and discharge structures are not known. However, based on the considerations discussed for the LNP site, the review team anticipates that adverse impacts of building units at the Highlands site would have minor to noticeable impacts on use of the recreational facilities from which activities would be visible or audible. Given the general characteristics of the area, there would likely be vegetative screening around the site that would potentially mitigate the aesthetic impacts. The increased population in the EIA may increase use of local recreational areas, which is expected to have negligible impact

on either the sites or the recreational experience, given the number, geographic distribution, and variety of recreational locations available. In places requiring the clearing of new transmission-line corridors, aesthetic impacts would be noticeable but not destabilizing, depending on the proximity of viewers and the nature of vegetation remaining between them and the corridors.

PEF reports that a reservoir may need to be created for water supply. Because its size and footprint are unknown, the review team cannot predict whether such a reservoir would affect resources currently used for recreation or subsistence. However, there would likely be vegetative screening around the reservoir that would potentially mitigate the aesthetic impacts.

Summary of Socioeconomics

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. In summary, based on information provided by PEF and its own independent evaluation, the review team finds that the socioeconomic impacts of building two units at the Highlands site would be minor with three exceptions. There would be noticeable adverse, but not destabilizing, effects on transportation in Highlands County near the site during construction and minor during operations. The tax impacts on Highlands County would be substantial and positive. The aesthetic impact of transmission lines would be noticeable.

Cumulative Impacts

In addition to assessing the incremental socioeconomic impacts from the building and operation of two nuclear units on the Highlands site, the cumulative impact assessment considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts on a given region, including other Federal and non-Federal projects. For the analysis of cumulative socioeconomic impacts at the Highlands site, the geographic area of interest is the region within a 50-mi radius centered on the Highlands site (the region) with special consideration of Highlands, De Soto, Glades, Hardee, and Okeechobee Counties, because that is where the review team expects socioeconomic impacts to be the greatest (Economic Impact Area, EIA). Table 9-19 identifies the projects that have contributed and will continue to contribute to the demographics, economic climate, and community infrastructure of the region. Collectively these projects will contribute to a long-term and overall trend toward urbanization and its associated increase in population and economic activities.

The Highlands site is a greenfield site in a rural area. The EIA is within commuting distance of Tampa/St. Petersburg. Sebring and Avon Park in Highlands County are each communities of about 10,000 people, but the EIA is predominately rural. Within the region, the Avon Park Air Force Range and active residential, retirement, and recreational developments along with planned improvements to the areas transportation infrastructure are expected to result in continued urbanization that would have noticeable socioeconomic effects on the economy and

residents of the EIA. The review team determined that cumulative socioeconomic effects of building new units at the Highlands site and the actions identified in Table 9-19 would not differ noticeably from the project effects analyzed above. Thus, the review team determined that the cumulative socioeconomic effects of the proposed project and other past, present, and reasonably foreseeable projects would be SMALL, with the following exceptions attributable to building and operating the Highlands site. Highlands County would experience MODERATE but short-term and spatially limited impacts on roads/traffic that would reduce to SMALL during operations, and LARGE beneficial impacts on tax receipts after the plant begins operations. The review team anticipates MODERATE long-term impacts on aesthetics along the transmission lines and corridors. Building nuclear units at the Highland site would be a significant contributor to the MODERATE impacts on roads/traffic. Building and operating nuclear units at the Highland site would be a significant contributor to MODERATE impacts on aesthetics along the transmission lines and corridors.

9.3.4.6 Environmental Justice

The review team used the approach to identify minority and low-income populations of interest described in Section 2.6. Figure 9-4 and Figure 9-5 show the distribution of minority and low-income populations of interest by census block group within the region. As seen in these figures, a number of block groups that meet the criteria for minority populations of interest are in the region, including areas to the northwest, south, and east of the Highlands site, and much of the southeastern quadrant of the region. The closest minority populations of interest are within3 mi of the Highlands site. There are fewer block groups with low-income populations of interest in the region, most of which are coincidental with those with minority populations. There is a large area with low-income populations of interest to the southeast of the site, with isolated pockets elsewhere. The closest low-income populations of interest are 10 to 12 mi northeast of the Highlands site. The 35,280-ac Brighton Reservation, managed by the Seminole Indian Tribe, is located southeast of the Highlands site within the region. The 2000 census indicates that 566 people, predominately Native Americans, live on the reservation (USCB 2000b).

The review team investigated the presence of unique characteristics or practices in minority or low-income communities that could result in different socioeconomic impacts for the Highlands site compared to the general population. The review team found two potential sources of environmental justice impacts arising from unique characteristics and practices: proximity to transmission line corridors as a source or pathway to impacts, and subsistence fishing.

The review team identified two minority census block groups within 3 to 6 mi of the Highlands site but determined neither of these communities resided near a road that could be considered a potential commuting route for construction or operations workers. To the northwest from the center of the Highlands site is a line of identified census block groups with minority populations of interest. This line roughly follows a conceptual transmission-line route proposed by PEF that could impose adverse physical impacts on those communities during transmission-line

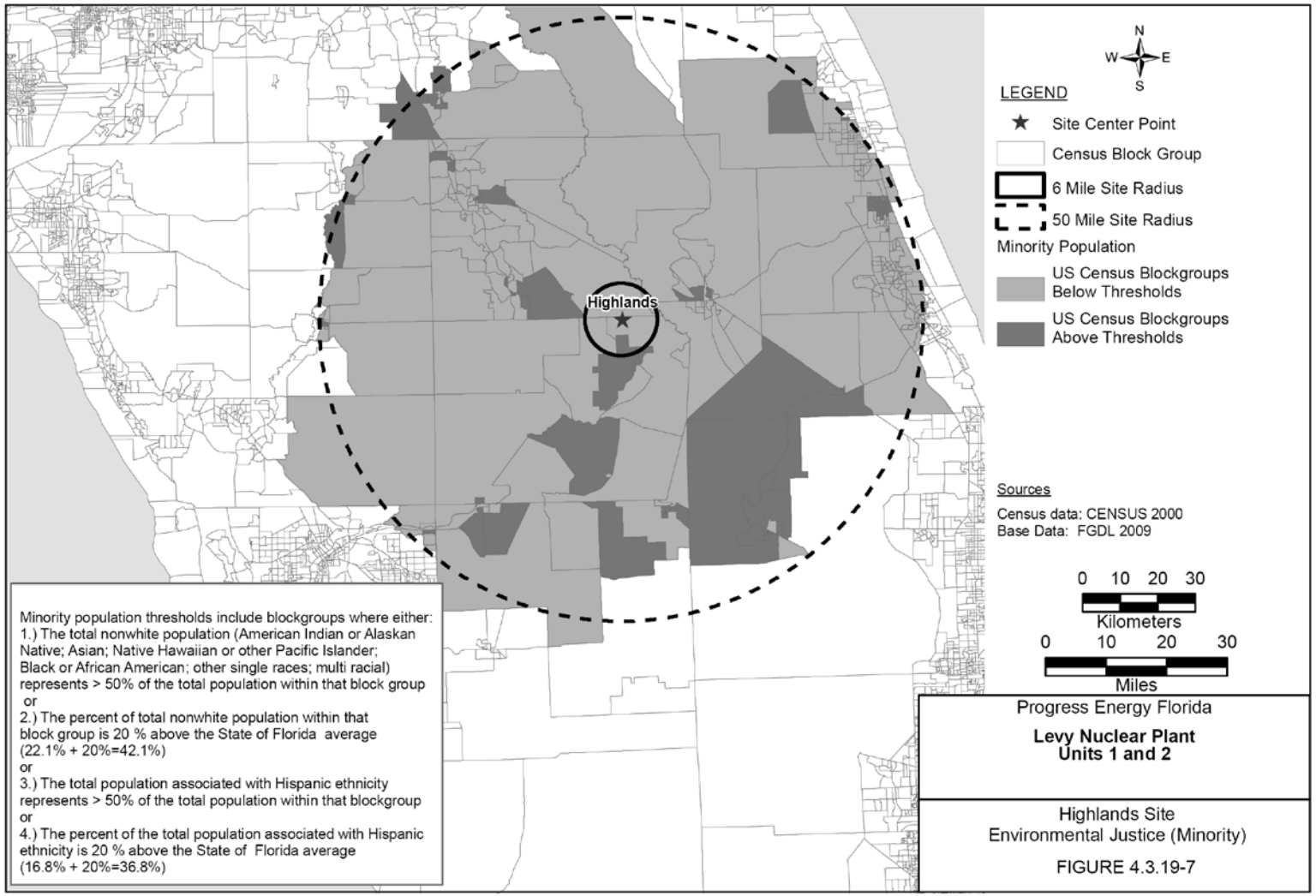

Figure 9-4. Highlands Site Minority Populations. (CH2M Hill 2009; PEF 2009d)

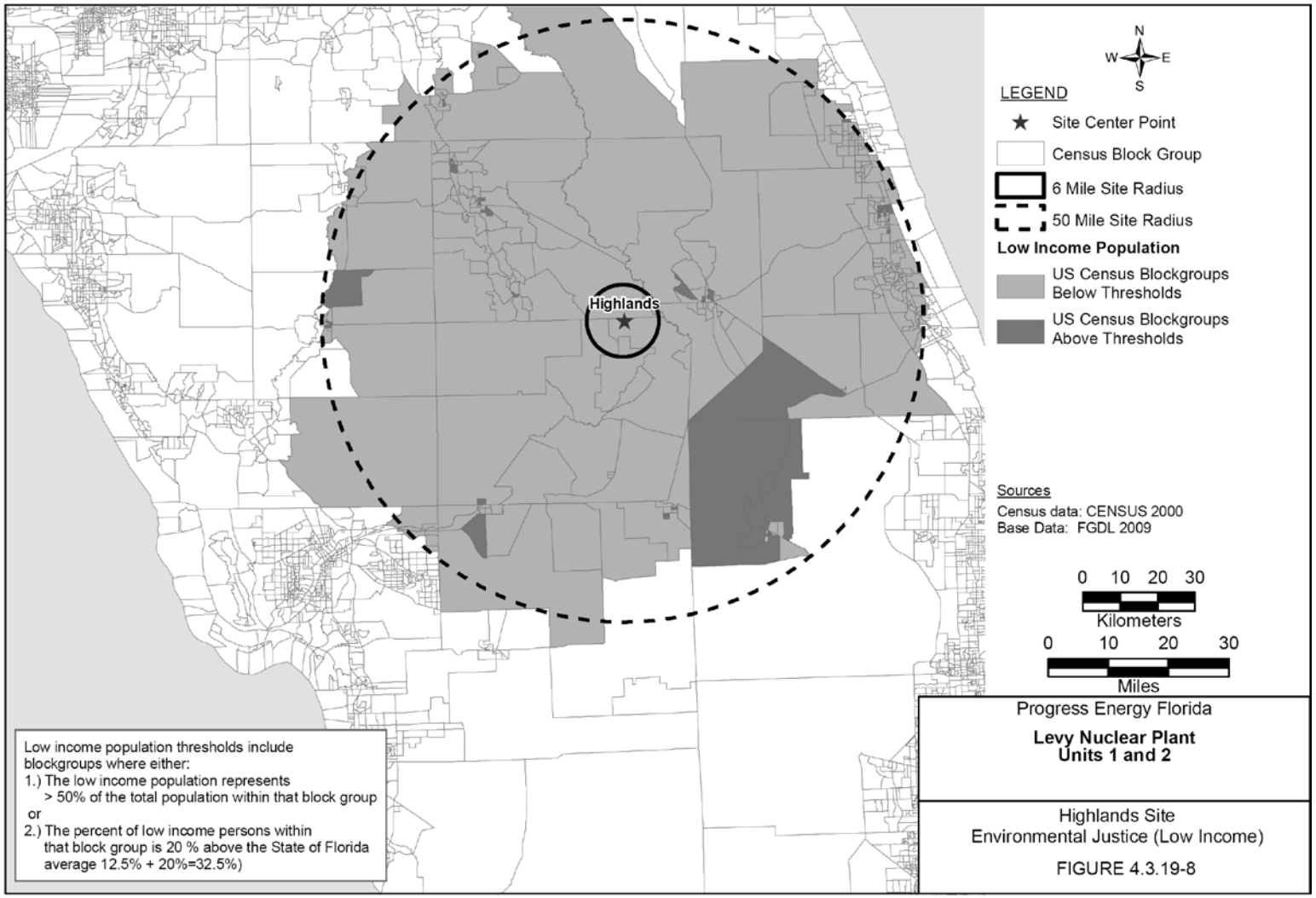

Figure 9-5. Highlands Site Low-Income Populations. (CH2M Hill 2009; PEF 2009d)

construction. If the transmission lines from the site were to follow this conceptual path the impact on the minority populations could be considered disproportionate and adverse. Therefore the review team concludes there is a potential for a noticeable disproportionately high and adverse impact from transmission-line construction.

Highlands County Environmental Health Division and Community Services Division personnel were unable to provide information about subsistence activities in the county, but the Community Services Division noted that hunting is popular in the county. Personnel from the County Natural Resources Department said that perhaps one percent of the county population may engage in subsistence fishing. On average 100 to 150 people per day may rely on fishing for their protein source. They noted that 12 percent of county population receives food stamps. (Highlands County 2009). The review team assumes that subsistence fishing activities might be affected during portions of the building phase, perhaps requiring that fishermen use different locations. In the absence of specific information about effects on local lakes and streams that are used for subsistence fishing, the review team concludes that there may be disproportionately high and adverse effects on minority and low-income populations that engage in subsistence fishing, possibly extending to the Native American residents of the Brighton Reservation in Glade County.

The review team concludes that the physical effects of building activities (noise, fugitive dust, air emissions, traffic) would not impose disproportionately high and adversely affects on minority or low-income populations because the effects would be attenuated by distance and intervening foliage such that even the closest population of interest would not experience adverse effects. Therefore, the review team determined the physical environmental justice impacts from building and operations would be minor.

The review team concluded that environmental justice impacts would be potentially noticeable on subsistence fishing populations and on minority communities along the proposed transmission-line corridor.

Cumulative Impacts

The review team determined the building and operation of a proposed nuclear power plant at the Highlands site would be unlikely to have a disproportionately high adverse impact on minority or low-income populations due to economic impacts, or impacts on community infrastructure; but could have a disproportionately high and adverse impact on minority or low-income populations living near transmission line corridors (aesthetics) or engaged in subsistence activities. The cumulative impact assessment considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative environmental justice impacts in the region, including other Federal and non-Federal projects. The review team did not find any activity listed on Table 9-19 that would have a cumulative environmental justice effect when placed in context with the hypothetical Highlands project. The review team concluded that, in addition to building and operating two new nuclear units at the Highlands site,

the inclusion of other past, present, and reasonably foreseeable future projects would add only a minor impact on minorities or low-income populations. Therefore, the cumulative environmental justice impacts could be MODERATE, with the building and operating of two nuclear units at the Highlands site a significant contributor to the impact..

9.3.4.7 Historic and Cultural Resources

The following cumulative impact analysis includes building and operating two new nuclear generating units at the Highlands site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect historic and cultural resources, including the other Federal and non-Federal projects listed in Table 9-19. For the analysis of cultural impacts at the Highlands site, the geographic area of interest is considered to be the APE that would be defined for this site. This includes the direct effects APE, defined as the area physically affected by the site-development and operation activities at the site and transmission lines. The indirect effects APE is defined as the area visually affected and includes an additional 0.5-mi radius APE around the transmission-line corridors and a 1-mi-radius APE around the cooling towers.

Reconnaissance activities in a cultural resource review have particular meaning. Typically, the activities include preliminary field investigations to confirm the presence or absence of cultural resources. However, in developing this EIS, the review team relies upon reconnaissance-level information to perform its alternative site evaluation in accordance with ESRP 9.3 (NRC 2000). Reconnaissance-level information is data that are readily available from agencies and other public sources. It can also include information obtained through visits to the site area. To identify the historic and cultural resources at the Highlands site, the following information was used:

- PEF ER (2009a)
- National Register of Historic Places database (NPS 2010)
- Florida Historical Markers Program (FDOS 2010)
- NRC Alternative Sites Visit October 14–17, 2008 (NRC 2009).

Historically, the Highlands site and vicinity were largely undisturbed and likely contained intact archaeological sites associated with the past 10,000 years of human settlement. Over time, the area has been disturbed by mostly agricultural development (PEF 2009a). As described in Section 9.3.4.6, the Brighton Indian Reservation is located within the region but not within the geographical area of interest. In its ER, PEF states that an initial database search for potentially significant cultural resources in Highlands County did not identify any NRHP-listed sites in the vicinity of the Highlands site and that a cultural and archaeological resources investigation would be required before siting a new reactor at this location. PEF also states that consultation with the SHPO would occur if any significant historic, cultural, or archaeological resources are

identified and that appropriate mitigation measures would be put in place before construction and operation.

A search of the NRHP database completed by the review team revealed 14 sites listed in Highlands County, including the Haines Elizabeth House and the Sebring Downtown Historic District (NPS 2010), and 3 Historic Properties listed in Glades County, including Moore Haven Downtown Historic District, Moore Haven Residential Historic District, and Red Barn. A search of the Florida State Historical Markers Program completed by the review team revealed one historical marker in Highlands County – Fort Basinger built in 1837 during the Seminole Wars (FDOS 2010). In addition, a cultural resources inventory completed for an EIS for the Florida Gas Transmission Company, LLC Phase VIII Expansion Project has identified five archaeological sites and nine historic structures in a stretch of expansion area called Greenfield 3. This area crosses four counties, including Highlands, and runs along the border of Glades and Highlands Counties. Five of the nine historic structures are considered “potentially eligible” with Florida SHPO concurrence.

Building Impacts

To accommodate building two new nuclear generating units on the Highlands site, PEF would need to clear approximately 300 ac for the main power plant site (the same acreage needed for the LNP site) and 1282 ac for the reservoir (PEF 2009a). If the Highlands site were chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the SHPO, Tribes, and interested parties. The results would be used in the site-planning process to avoid cultural resources impacts. If significant cultural resources were identified by these surveys, the review team assumes that PEF would develop protective measures in a manner similar to those for the LNP site, and therefore the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing, excavation, and grading activities could destabilize important attributes of historic and cultural resources.

There are no existing transmission-line corridors connecting to the Highlands site. Section 9.3.4.1 describes the proposed transmission-line corridors associated with this site. Visual impacts from transmission lines may result in significant alterations to the visual landscape within the geographic area of interest. If the Highlands site were chosen for the proposed project, the review team assumes that PEF would conduct its transmission line-related cultural resource surveys and procedures in a manner similar to that for the LNP site described in Section 4.6. In addition, the review team assumes the State of Florida’s Conditions of Certification regarding transmission line siting and building activities would apply, and therefore the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing, excavation, and grading activities could destabilize important attributes of historic and cultural resources.

Operations Impacts

Impacts on historic and cultural resources from the operation of two new nuclear generating units at the Highlands site would include those associated with the operation of new units and maintenance of transmission lines. The review team assumes that the same procedures currently used by PEF, including the State of Florida's Conditions of Certification, would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of the two new units and associated impacts on the cultural resources would be negligible for the physical and visual APEs.

Cumulative Impacts

Past actions in the geographic area of interest that have similarly affected historic and cultural resources include rural development and agricultural development and activities associated with these land-disturbing activities such as road development. Table 9-19 lists past, present, and reasonably foreseeable projects and other actions that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest. Projects from Table 9-19 that are evaluated in the cultural resources cumulative analysis include future urbanization, the Florida High Speed Rail project, and the Florida Gas Transmission (FGT) Phase VIII Expansion project.

Long linear projects such as new or expanded roads, the Florida High-Speed Rail project, or the FGT Phase VIII Expansion may intersect the proposed transmission-line corridors. Because cultural resources can likely be avoided by long linear projects, impacts on cultural resources would be minimal. If building associated with such activities results in significant alterations (both physical alteration and visual intrusion) of cultural resources in the transmission-line corridors, then cumulative impacts on cultural resources would be greater.

Cultural resources are nonrenewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that the cumulative impacts from building and operating two new nuclear generating units on the Highlands site and other projects would be SMALL. This impact-level determination reflects no known cultural resources that could be affected; however, if the Highlands site were to be developed then cultural resource surveys and evaluations would need to be conducted and PEF would assess and resolve the adverse effects of the undertaking. Adverse effects could result in greater cumulative impacts.

9.3.4.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affected air quality, including the shutdown of two coal-fired units at CREC, and other Federal and non-Federal projects listed in Table 9-19. The geographic area of interest for the Highlands

site is Highlands and Glades Counties, which are in the Southwest Florida Intrastate Air Quality Control Region (40 CFR 81.97).

The emissions related to building and operating a nuclear plant at the Highlands site would be similar to those at the LNP site. The air quality status for Highlands County, as set forth in 40 CFR 81.310, reflects the effects of past and present emissions from all pollutant sources in the region. Highlands County is classified as being in attainment for all NAAQSs.

The atmospheric emissions related to building and operating a nuclear plant at the LNP site in Levy County, Florida, are described in Chapters 4 and 5. Emissions of criteria pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of criteria pollutants at the LNP site were evaluated and also determined to have a SMALL impact.

Cumulative Impacts

Reflecting on the projects listed in Table 9-19, all industrial projects listed in the table would have *de minimis* impacts. The impact of the closing of two coal-fired units at CREC on criteria pollutants at the Highlands site are not considered because the CREC is located outside of the geographic area of interest for this site. Given the small amount of emissions from this project, it is unlikely that the air quality in the region would degrade to the extent that the region would be declared to be in nonattainment for any of the NAAQSs.

The air quality impact of the Highlands site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air quality impacts. There are no land uses or projects, including the aforementioned sources in Table 9-19, that would have emissions during site development that would, in combination with emissions from the Highlands site, result in a degradation of air quality in the region.

Releases from the operation of two new units at the Highlands site would be intermittent and made at low altitudes with little or no vertical velocity. The air quality impacts of current emissions near the Highlands site are included in the baseline air quality status. The cumulative impacts from emissions of effluents from the Highlands site and other sources would not be noticeable.

The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in Section 7.6. The impacts of the emissions are not sensitive to the location of the source. Consequently, the discussion in Section 7.6 is applicable to a nuclear power plant located at the Highlands site. The review team concludes that the national and worldwide cumulative impacts of greenhouse gas emissions are noticeable. The review team further concludes that the cumulative impacts would be noticeable, with or without the greenhouse gas emissions of the project at the Highlands site or the potential shutdown of the fossil-fuel units at CREC.

Cumulative impacts on air quality resources are estimated based on the information provided by PEF and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for greenhouse gas emissions) that could affect air quality resources. The cumulative impacts on criteria pollutants from emissions from the Highlands site and other projects would not be noticeable. The review team concludes that the national and worldwide cumulative impacts of greenhouse gas emissions are noticeable. The review team further concludes that cumulative impacts from construction, preconstruction, and operations, and other past, present, and reasonably foreseeable future actions on air quality resources in geographic areas of interest would be SMALL for criteria pollutants and MODERATE for greenhouse gas emissions. The incremental contribution of impacts on air quality resources from building and operating two new units at the Highlands site would be insignificant for both criteria pollutants and greenhouse gas emissions.

9.3.4.9 Nonradiological Health

The following analysis assesses impacts from building activities and operations for the Highlands site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect nonradiological health, including the other Federal and non-Federal projects listed in Table 9-19. Impacts from building activities that have the potential to affect the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the increased traffic associated with the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to affect the health of members of the public and workers includes exposure to etiological agents, noise, EMFs, and impacts from the transport of workers to and from the site.

Most of the nonradiological health impacts associated with building and operation (e.g., air emissions, noise, occupational injuries) would be limited to areas within approximately 2 mi from the site. Occupational injuries would occur only within the boundaries of the site, and noise from construction and operation has likewise been assessed as minimal for offsite receptors beyond a 2-mi radius. For nonradiological health impacts associated with transmission lines, the geographic area of interest would be the transmission line corridor. If the facility were built and operated at the Highlands alternative site, the Kissimmee River would serve as the source and discharge receptor of cooling water. In addition, a reservoir would need to be built to assure an adequate cooling-water supply.

Building Impacts

Nonradiological health impacts on construction workers and members of the public from building two new nuclear units at the Highlands site would be similar to those evaluated in Section 4.8 for the LNP site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and

transportation accidents, injuries, and fatalities. A detailed noise study has not been performed for the Highlands site, but it is likely that noise impacts from building, except for rare, high-noise activities such as pile-driving, would comply with State and local noise ordinances and that the overall noise impact associated with building would be minimal. Fugitive dust and vehicle emissions during building would be controlled by good management practices and compliance with Federal, State, and local air quality regulations.

The incidence of construction worker accidents would be the same as that for the LNP site, the only difference being potential injuries associated with cooling reservoir construction.

Analyses in Section 9.3.4.5 indicated that noticeable but intermittent traffic impacts would be observed during peak building activities at the Highlands site at the intersection of SR-70 and the site access road. These impacts would be of the same magnitude as those predicted for building at the LNP site. Owing to the rural nature of the Highlands site, there is little potential for cumulative impacts with other projects, and additional injuries and fatalities from traffic accidents involving transportation of materials and personnel for building of a new nuclear power plant at the Highlands site would be similar to those estimated in Section 4.8.3 for building at LNP site.

Because all of the past, present, or potential future construction projects identified in Table 9-19 are distant (greater than 10 mi) from the Highlands site, combined nonradiological impacts from construction at the Highlands site and other projects would not occur. Cumulative impacts of building at the Highlands alternative site would therefore be minimal.

Operational Impacts

Noise, air emissions, and occupational injuries from the operation of two new nuclear units at the Highlands site would be similar to those evaluated in Section 5.8 for the LNP site. Occupational health impacts on workers (e.g., falls, electric shock, or exposure to other hazards) at the Highlands site would be the same as those evaluated for workers at two new units operating at the LNP site. The cooling-system discharge from the facility could encourage the growth of etiologic organisms in the Kissimmee River. Etiological agent growth could be reduced by the use of biocides in the cooling systems, thermal discharge would be restricted by NPDES permit limitations, and exposure to impaired water would be limited by controls on access to the discharge zone (fencing, signage, and other security measures). However, because discharge may amount to a significant proportion of minimum flows in the Kissimmee River, and because water quality in the river has been identified as impaired due to the of presence of nutrients, fecal coliform, depressed dissolved oxygen, un-ionized ammonia, and other pollutants (FDEP 2010e), the review team has concluded that the discharge of blowdown to the river could have a noticeable effect on the growth of etiological agents. Exposure to etiological agents in the cooling-water reservoir would not pose an additional health risk as long as access to the reservoir is limited by virtue of its being within the controlled and fenced site boundaries.

Noise and EMF exposure from operations would be monitored and controlled in accordance with applicable OSHA regulations. Although no detailed noise modeling has been performed for the Highlands site, it is likely that noise impacts would be similar to those predicted for operations at the LNP site. The effects of EMF on human health in the transmission-line corridors would be controlled and minimized by conformance with NESC criteria and adherence to the standards for transmission systems regulated by the FDEP. Nonradiological impacts of traffic associated with the operations workforce would therefore be less than the impacts during building (minimal).

A number of the projects and activities identified in Table 9-19 (stormwater discharges, minor permitted municipal discharges) might also affect water quality in the Kissimmee River near the Highlands site. However, these releases are unlikely to have significant cumulative impacts on water quality with a nuclear facility built at the Highlands site because all of the current and future projects are distant from the site. In addition, chemicals released from the nuclear facility would be limited by an NPDES permit to levels that would not adversely affect water quality, even in combination with the existing pollutant load in the Kissimmee River. As noted above, however, blowdown discharge may result in increased water temperature that could facilitate the growth of etiological agents.

The review team is also aware of the potential climate changes that could affect human health; recent analyses of these issues (GCRP 2009) have been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature and a decrease in precipitation, which may alter the presence of microorganisms and parasites in surface water. While the overall impacts of climate change may not be insignificant (see Section 7.7), the effect of, or contribution to, climate change impacts by the operation of two new units at the Highlands site is likely to be minor. In its analysis of climate change impacts, the review team did not identify any additional information that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases associated with operation of a nuclear facility at the Highlands site.

Summary

The assessment of impacts on nonradiological health from building and operation of the two new units at the Highlands alternative site is based on the information provided by PEF and the review team's independent evaluation. The review team concludes that nonradiological health impacts on workers and the public resulting from building two new units and associated transmission lines at the Highlands site would be minimal. The review team also expects that the nonradiological health impacts to the workers and public from the operations of two new nuclear units at the Highlands site would be minimal, except for the potential growth of etiological agents in the Kissimmee River from the influence of blowdown discharges during droughts or low-flow periods. These effects could be reduced if the blowdown were discharged to the cooling reservoir, rather than directly to the river. Exposure to etiological agents could be

increased if access to the cooling reservoir is not limited by physical and administrative controls. Based on these findings, the review team concludes that cumulative impacts on nonradiological health from related past, present, and future actions in the geographic area of interest and building and operations of two nuclear units at the Highlands site would be SMALL to MODERATE. The severity of impacts would depend on the design characteristics of the facility, which have not been fully defined. . If exposure to water heated by thermal discharge is not limited by administrative of physical controls, the contribution from building and operations at the Highlands site could be a significant contributor to the cumulative nonradiological health impacts.

9.3.4.10 Radiological Impacts of Normal Operations

The following impact analysis includes radiological impacts from building activities and operation for two additional nuclear units at the Highlands site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects listed in Table 9-19. As described in Section 9.3.4, the Highlands site is a greenfield site. The geographic area of interest is the area within a 50-mi radius of the Highlands site. There are no major facilities that result in regulated exposures to the public or biota within 50 mi of the Highlands site. However, there are likely to be hospitals and industrial facilities with 50 mi of the Highlands site that use radioactive materials. The St. Lucie Units 1 and 2 nuclear power plants are located approximately 50 mi from the Highlands site.

The radiological impacts of building and operating two AP1000 units at the Highlands site would include direct radiation and liquid and gaseous radioactive effluents. The cow-milk pathway doses at this site would be higher than at the LNP site because of the proximity of dairies, but doses would still be within regulatory limits. Releases of radioactive materials and all pathways of exposure would produce low doses to people and biota offsite, well below regulatory limits. The impacts are expected to be similar to those estimated for the LNP site. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Highlands site. This conclusion is based on the radiological monitoring programs conducted around currently operating nuclear power plants.

The radiological impacts of existing St. Lucie Units 1 and 2 also include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite that are well below regulatory limits as demonstrated by the ongoing radiological environmental monitoring program conducted around the St. Lucie site.

Based on the information provided by PEF and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the two proposed AP1000 units and other past, present, and reasonably foreseeable projects and actions in the geographic area of interest around the Highlands site would be SMALL.

9.3.4.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for two nuclear units at the Highlands site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including the other Federal and non-Federal projects and those projects listed in Table 9-19. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Highlands site. The Highlands site is a greenfield site about 50 mi west of the existing St. Lucie power plant site; there are two nuclear facilities at the St. Lucie site. There are no proposed reactors that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Highlands site.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the LNP site would be minimal for AP1000 reactors. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet the NRC safety criteria. The AP1000 design is independent of site conditions, and the meteorological conditions of the Highlands and LNP sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Highlands site would be minimal.

Assuming the meteorology, population distribution, and land use for the Highlands site are similar to the LNP site, risks from a severe accident for an AP1000 reactor located at the Highlands site are expected to be similar to those analyzed for the LNP site. These risks for the LNP site are presented in Tables 5-18 and 5-19 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For the existing plants within the geographic area of interest, namely St. Lucie Units 1 and 2, the Commission has determined that the probability-weighted consequences of severe accidents are SMALL (10 CFR Part 51, Appendix B, Table B-1). On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Highlands site would be SMALL.

9.3.5 Putnam Site

This section covers the review team's evaluation of the potential environmental impacts of siting a new two-unit nuclear power plant at the Putnam alternative site (hereafter Putnam site) in northeastern Florida. The site is located in a rural area of Putnam County west of the St. Johns River. The St. Johns River would be the source for water for plant cooling and other plant uses, and construction of a new water-storage reservoir would be required. Putnam is a greenfield site not currently owned by PEF (PEF 2009a). Conceptual routes of transmission lines necessary to connect the Putnam site to the electrical grid are located in Ocala, Sumter, Lake, Deltona, Seminole, and Putnam Counties.

The following sections include a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if implemented at the Putnam site and other actions in the same geographic area were considered. This assessment includes the impacts of the NRC-authorized construction and operations and impacts of preconstruction activities. Also included in the assessment are past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Putnam site. Other actions and projects considered in this cumulative analysis are described in Table 9-25.

The geographic area of interest for cumulative impacts considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Putnam site. An accident at a nuclear plant within 100 mi of the Putnam site could increase this risk. The Crystal River Nuclear Plant (CREC Unit 3) is within 100 mi of the Putnam site and is included in Table 9-25. Other nuclear plants in Florida, Alabama, and Georgia are more than 100 mi from the Putnam site and are therefore not included in the cumulative impact analysis.

9.3.5.1 Land Use and Transmission Lines

The following analysis includes impacts from building and operating two nuclear units at the Putnam site, along with the necessary transmission lines to connect them to the grid. The analysis also considers other past, present, and reasonably foreseeable future actions that affect land use, including the other Federal and non-Federal projects listed in Table 9-25. For this analysis, the geographic area of interest for considering cumulative impacts is the area within the 20-mi radius of the Putnam site and the associated transmission-line corridors. The review team determined that a 20-mi radius would represent the smallest area that would be directly affected because it includes the primary communities (such as Palatka, East Palatka, and Satsuma) that would be affected by the proposed project if it were located at the Putnam site.

The Putnam site is located in Putnam County, Florida. Historically, the geographic area of interest was known for forestry and agriculture. Existing land uses in the area include forestry, agriculture, and low-density residential. The Putnam site is not subject to the Florida Coastal Zone Management Act because the site is not located within one of the designated Florida coastal zone counties. The Ocala National Forest and the St. Johns River Blueway are located within the 50-mi region.

Zoning changes would be needed to accommodate building and operation of a nuclear power plant at the Putnam site. Like the LNP site, the footprint of new power-generating units would be approximately 627 ac, with about 150 ac of additional land needed for temporary facilities and laydown yards. In addition, PEF indicates that a 1291-ac reservoir would be needed at the

Table 9-25. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Cumulative Analysis of the Putnam Alternative Site

Project Name	Summary of Project	Location	Status
Energy Projects			
Seminole Power Plant	Two 650-MW coal-fired generation units	Within 10 mi	Operational (SEC 2010)
Putnam Steam Power Plant	Two combined-cycle gas/oil units generating a total net 494 MW	Within 10 mi	Operational (EPA 2010j)
Operation and decommissioning of CREC Units 1–5	The CREC consists of five power-generating plants operated by PEF; four fossil-fuel plants and one nuclear plant. The fossil-fuel plants began operations in 1966, 1969, 1982, and 1984. The nuclear plant began operations in 1977.	Within 100 mi of the Putnam site in northern Citrus County	Operational. The State of Florida Siting Board's Conditions of Certification for LNP would require PEF to discontinue the operations of the two fossil-fuel units by December 31, 2020, assuming licensing, construction, and commencement of operation of LNP occurs in a timely manner (DOE/EIA 2010; FDEP 2010a).
Renewal of the CREC nuclear Unit 3 operating license	Extension of operations of CREC Unit 3 for an additional 20-year period beyond the end of the current license term, which is valid through midnight December 3, 2016.	Within 100 mi of the Putnam site in northern Citrus County	Proposed. If granted, the license renewal would provide PEF the authority to continue operations through 2036. The draft Supplemental EIS for the license renewal is scheduled to be issued in 2010 (PEF 2008).

Table 9-25. (contd)

Project Name	Summary of Project	Location	Status
Uprate at CREC Unit 3	CREC Unit 3 is planning to request a power uprate or increase to the maximum power level at which the nuclear power plant may operate.	Within 100 mi of the Putnam site in northern Citrus County	Proposed. The application submitted to the State of Florida was approved in August 2008. A Federal application is expected to be submitted to the NRC in 2010 (PEF 2009f).
Mining Projects			
Surface mining	Excavation of sand, gravel, and other minerals, including the Grandin Sand Mine and the Keuka Sand Mine.	Throughout region	Operation and inactive
Parks and Conservation Areas			
Parks, forests, and reserves	Several parks, recreation, and conservation areas are located within the 50-mi region, for example the Ocala National Forest and the St. Johns River Blueway.	Throughout region	Currently managed by various local, State, and Federal agencies and organizations. Development likely limited in these areas (St. Johns County 2010).
Other Actions/Projects			
Minor water dischargers	NPDES-permitted dischargers including Putnam County Central Landfill, City of Palatka WWTP, E. Putnam County WW System, Hiawatha Condominiums WWTP, Georgia Pacific paper mill, and others.	Throughout region	Operational
Hard Rock Material	Concrete batch plant and ready-mixed concrete plant	Within 10 mi	Operational (EPA 2010k)
Other Actions/Projects			
Various hospitals and industrial facilities that use radioactive materials	Medical and other industrial isotopes	Within 50 mi	Operational in nearby cities and towns
Future urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and railroads, such	Throughout region	Construction would occur in the future, as described in State and local land-

Table 9-25. (contd)

Project Name	Summary of Project	Location	Status
	as SR-20 improvements; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.		use planning documents (FDOT 2010; Putnam County 2006).

WW = wastewater; WWTP = wastewater-treatment plant

Putnam site to provide cooling water during periods of low flow of the St. Johns River (PEF 2009d; CH2M Hill 2009). Construction of these facilities would result in a permanent land-use change from agriculture and forestry to a transportation, communications, and utilities land-use category. As shown in Table 9-25, there are coal-fired and combined-cycle gas/oil power plants, sand/gravel mines, and a concrete batch plant currently operating in the geographic area of interest around the Putman site.

Additional land-use impacts include possible additional growth and land conversions to accommodate new workers and services. Because the workforce would be dispersed over larger geographic areas in the labor supply region, the impacts from land conversion for residential and commercial buildings induced by new workers relocating to the local area can be absorbed into the wider region. Therefore, the review team concludes that such impacts would be minimal.

There are no existing transmission lines or transmission-line corridors in the geographic area of interest around the Putnam site. New transmission lines would need to be constructed to connect the site to existing transmission lines. The transmission lines would run through counties designated under the Florida Coastal Management Program. Any expansion of these transmission-line corridors would require review under the procedures established under the Florida Coastal Management Program. Procedures for siting new transmission lines in Florida are discussed in Section 4.1.2. The review team assumes that the conditions of certification issued to PEF by the FDEP would apply at all of the alternative sites.

The review team estimated the linear run of the expected transmission-line corridors by referring to PEF Figure 3.3.3-15 (PEF 2010), which depicts the potential routing of corridors needed to connect the Putnam units to the grid. That figure suggests that 215 mi of transmission-line corridor would be needed. For purposes of land-use impact analysis, the review team made the assumption that 10 ac/mi would be disturbed, based on the LNP case where 1790 ac are expected to be disturbed over the 180 mi of corridor, as discussed in Section 4.1.2. The review team concludes that this assumption is reasonable because siting in Florida is a relatively rigorous process (Site Certification Application process), and the applicant would be bound by permit conditions resulting from that process, which would force it to use existing corridors to the

extent practicable. The review team expects the SCA process would be consistently applied anywhere transmission lines are proposed in Florida. Therefore, the review team concludes that about 2150 ac of land would be disturbed to construct the transmission-line corridors for the Putnam site. Similar to the case at the LNP site, the review team concludes that land-use impacts from developing about 215 mi of new transmission-line corridors to connect new units at the Putnam site would be noticeable, but not destabilizing, and additional mitigation beyond the measures and conditions identified would not be warranted.

Cumulative Impacts

Future urbanization could contribute to additional decreases in open areas, forests, and wetlands and generally result in some increased residential and industrialized areas. However, growth would likely be limited since the population is projected to increase by approximately 1 percent per year during the period from 2000 to 2015 (Putnam County 2006). Increased urbanization, especially long linear projects such as new or expanded roads or pipelines also would contribute to the loss of open or forested areas and increase fragmentation of habitats along or near the transmission lines. Due to the extent of new transmission lines that would be built, the review team expects that the corridors would have a noticeable impact on the local area. Development would likely be limited in the nearby parks and conservation areas. Therefore, the incremental impacts associated with increased urbanization would be minimal.

Global climate change could increase temperature and reduce precipitation, which could result in reduced crop yields and livestock productivity (GCRP 2009), which, in turn, may change portions of agricultural and ranching land uses in the geographic area of interest. In addition, global climate change could increase sea level and storm surges in the geographic area of interest (GCRP 2009), thereby changing land use through inundation and loss of coastal wetlands and other low-lying areas. However, existing forests, parks, reserves, and managed areas would help preserve wetlands and forested areas to the extent that they are not affected by a rise in sea level. Because other projects identified in Table 9-25 that are within the geographic area of interest would be consistent with applicable land-use plans and control policies and would occur in dispersed locations, the review team considers their contribution to the cumulative land-use impacts to be relatively minor and manageable. Because detailed information concerning the routing of the possible new transmission-line corridors is not known at this time, a complete evaluation of potential land-use impacts cannot be made.

In the State of Florida's Conditions of Certification (FDEP 2010a), CREC Unit 1 and 2, two coal-fired plants, would stop operating by December 31, 2020, as long as PEF completes the licensing process, construction activities, and commences commercial operation of LNP Units 1 and 2 within a timely manner. If the Putnam site were selected, the review team expects the same condition would apply. If CREC Units 1 and 2 are shut down, land use at the units likely would remain industrial. Depending on economic conditions, PEF sells 60 to 95 percent of the coal plant ash to cement and building materials manufacturers, with the remainder going to Citrus Central Landfill in Lecanto, Florida. With the closure of CREC Units 1 and 2, this source

of ash no longer would be available locally. The review team expects land-use impacts associated with the closure of CREC Units 1 and 2 would be minimal.

Based on the information provided by PEF and the review team's own independent review, the review team concludes that the land-use impacts of building and operating two new nuclear reactor units at the Putnam site and other projects would be MODERATE. The proposed project would be a significant contributor to the MODERATE impact due to the substantial amount of land that would be needed for the proposed power plant, reservoir, and transmission infrastructure.

9.3.5.2 Water Use and Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affect water use and quality, including the other Federal and non-Federal projects listed in Table 9-25. The Putnam site is located in rural Putnam County in Florida near the St. Johns River. PEF has indicated that the development of this site for two nuclear units would require the building of a water reservoir on the Putnam site supplied with water from the St. Johns River (PEF 2009a).

The geographic area of interest for the Putnam site is considered to be the drainage basin of the St. Johns River upstream and downstream of the site because this is the resource that would be affected by the proposed project. For groundwater the ROI is limited to the alternative site because PEF has indicated no plans for use of groundwater to build and operate the plant (CH2M Hill 2009).

PEF indicates that the primary source of water for the site would be the St. Johns River. Groundwater is considered an unavailable or unreliable resource for large quantities of cooling water at all of the alternative sites; in addition, permitting large groundwater withdrawals for industrial use is generally inconsistent with State policy (CH2M Hill 2009). This analysis therefore assumes that groundwater would not be used during the building or operation of the two units at this site and that all water needs would be met with surface water from the St. Johns River.

Surface water is available at the site from the St. Johns River. Historical flow data for October 1992 through the present are available for the St. Johns River at Buffalo Bluff near Satusma Florida (USGS 2009). Mean monthly flow for the historic record ranges from 1840 cfs in May to 7445 cfs in November. Minimum monthly flows have fallen below 230 cfs at times.

Building Impacts

The review team assumes that the surface-water use for building activities at the Putnam site would be identical to the proposed groundwater use for the LNP site. During building at the LNP site the total maximum usage is projected to be 550,000 gpd (0.85 cfs) and the projected

average estimated maximum groundwater usage is 275,000 gpd (0.43 cfs) (see Table 3-2). This assumes that surface water would be used at the Putnam site for potable and sanitary use as well as various building related activities. This surface-water withdrawal rate is inconsequential when compared to the historic flow in the St. Johns River. The review team concludes that the impact of surface-water use for building the potential units at the Putnam site would be minimal because withdrawal is small compared to the average monthly flow and withdrawal from the river would be temporary and limited to the building period.

As stated above, the review team assumed that no groundwater would be used to build the units at the Putnam site. The review team also assumes that the impact of dewatering the excavations needed for building two units at the site would be managed through the installation of diaphragm walls and grouting as is proposed for the LNP site. Therefore, because there would be no groundwater use and the impact of dewatering would be controlled, the review team determined that there would be little or no impact on groundwater resources.

Surface-water quality would most likely be affected by surface-water runoff during site preparation and the building of the facilities. FDEP would require PEF to develop an E&SCP and a SWPPP (PEF 2009a). These plans would be developed before initiation of site-disturbance activities and would identify measures to be used during site-preparation activities to mitigate erosion and control stormwater runoff (PEF 2009a).

The plans would identify BMPs to control the impacts of stormwater runoff. The review team anticipates that PEF would construct new detention/infiltration ponds and drainage ditches to control delivery of sediment from the disturbed area to onsite waterbodies. Sediment carried with stormwater from the disturbed area would settle in the detention ponds and the stormwater would infiltrate into the shallow aquifer. Implementation of BMPs should minimize impacts on surface-waterbodies near the Putnam site. Therefore, the surface-water-quality impacts near the Putnam site would be temporary and minimal.

While building new nuclear units at the Putnam site, groundwater quality may be affected by leaching of spilled effluents into the subsurface. The review team assumes that the BMPs PEF has proposed for the LNP site would be in place during building activities, and therefore the review team concludes that any spills would be quickly detected and remediated. In addition, groundwater impacts would be limited to the duration of these activities, and therefore, would be temporary. The review team reviewed the general BMPs that could be expected to be required at such a site (FDEP 2010a). Because any spills related to building activities would be quickly remediated under BMPs and the activities would be temporary, the review team concludes that the groundwater-quality impacts from building at the Putnam site would be minimal.

Operational Impacts

The Putnam site was identified by PEF as needing a cooling-water storage reservoir to meet plant cooling needs during periods of low flow. The review team assumed that the cooling water

system for the proposed units, if they were to be built and operated at the Putnam site, would be similar to that proposed at the LNP site; specifically, the cooling water system would use cooling towers and blowdown would be discharged to the St. Johns River. The cooling-water reservoir would provide capacity for times when adequate water from the river may not be available. PEF did not provide details of the cooling-water intake and effluent discharge locations. However, it is standard practice for power plants to design cooling-water intake and effluent discharge locations such that recirculation of discharged effluent to the intake does not occur. The reservoir was sized assuming that the plant would operate on four cycles of concentration, that the total cooling-water requirements would be 45 Mgd (31,250 gpm) and that storage of a 90-day supply of water would be needed. In determining the acreage needed to achieve this amount of storage PEF assumed the reservoir would have an effective depth of 10 ft. PEF indicates that the resulting reservoir size would be 1291 ac (PEF 2009d; CH2M Hill 2009).

PEF indicates that the water needed to operate two units would be approximately 40,000 gpm or 89 cfs. As indicated in Chapter 3, evaporative losses from cooling two units would be approximately 28,000 gpm (62 cfs). A withdrawal of 89 cfs represents approximately 5 percent of the lowest mean monthly flow for the period of record. Flow in individual months has been much lower, which supports the need for a water reservoir on the Putnam site supplied with water from the St. Johns River. Minimum flows have been established for the St. Johns River (Fla. Admin. Code 2010). Minimum flows are specified for frequent high, average, and frequent low flow conditions of the river near DeLand, approximately 75 miles upstream of the Putnam site. The minimum flow values corresponding to frequent high, average, and frequent low flow conditions are 4600, 2050, and 1100 cfs, respectively. The withdrawal of 89 cfs would be 8 percent of the minimum recommended frequent low flow in the river. Based on the indication that the water needed to operate two units at the Putnam site would be less than 5 percent of the lowest mean monthly flow and 8 percent of the minimum recommended frequent low flow, the review team determined that the operational surface-water-use impact of a potential plant at the Putnam site would be minor.

As stated above, the review team assumed that no groundwater would be used to operate the units at the Putnam site. Therefore, because there would be no groundwater use, the review team determined that there would be no impact on groundwater resources.

During the operation of two new nuclear units at the Putnam site, impacts on surface-water quality could result from stormwater runoff, discharges of treated sanitary and other wastewater, and blowdown from cooling towers into the receiving waterbody. PEF did not provide the blowdown rate at the Putnam site. The review team conservatively assumed that the blowdown rate would be the same as that at the LNP site, 57,923 gpm (129 cfs). This assumption is conservative because the proposed plant at the Putnam site would use freshwater from the St. Johns River rather than more saline water at the LNP site, requiring less frequent and smaller blowdown discharge. FDEP would require PEF to develop a SWPPP (PEF 2009a), which would identify measures to be used to control stormwater runoff (PEF 2009a). The blowdown

would be regulated by FDEP pursuant to 40 CFR Part 423 and all discharges would be required to comply with limits established by FDEP in a NPDES permit.

During the operation of two new nuclear units at the Putnam site, impacts on groundwater quality could result from potential spills. Spills that might affect the quality of groundwater would be prevented and mitigated by BMPs. Because BMPs would be used to mitigate spills and no intentional discharge to groundwater should occur, the review team concludes that the groundwater-quality impacts from operation of two nuclear units at the Putnam site would be minimal.

Cumulative Impacts

In addition to water-use and water-quality impacts from building and operations activities, cumulative analysis considers past, present, and reasonably foreseeable future actions that affect the same water resources.

For the cumulative analysis of impacts on surface water, the geographic area of interest for the Putnam site is considered to be the drainage basin of the St. Johns River upstream and downstream of the site because this is the resource that would be affected by the proposed project. For groundwater, the ROI is limited to the alternative site because PEF has indicated no plans for use of groundwater to build and operate the plant. Actions that have past, present, and future potential impacts on water supply and water quality near the Putnam site include the Seminole Power Plant and the Putnam Steam Power Plant (both located within 20 mi of the Putnam site), existing agriculture, and existing and future urbanization in the region.

The GCRP has compiled the state of knowledge in climate change. This compilation has been considered in the preparation of this EIS. The projections for changes in temperature, precipitation, droughts, and increasing reliance on aquifers within the St. Johns River drainage are similar to those at other alternative sites in Florida. Such significant changes in climate would result in adaptations to both surface-water and groundwater management practices and policies that are unknown at this time.

Cumulative Water Use

PEF indicates that the water needed to operate two units would be approximately 40,000 gpm or 89 cfs. As indicated in Chapter 3, evaporative losses from cooling two units would be approximately 28,000 gpm (62 cfs). PEF indicates that a reservoir would be needed to provide cooling water during periods of low flow. A withdrawal of 89 cfs represents approximately 5 percent of the lowest mean monthly flow for the period of record. Flow in individual months has been much lower, which supports PEF's statement that a water reservoir on the Putnam site supplied with water from the St. Johns River would be needed

Based on the indication that the water needed to operate two units at the Putnam site would be less than 5 percent of the lowest mean monthly flow and 8 percent of the minimum

recommended frequent low flow, the review team determined that the operational surface-water-use impact of a potential plant at the Putnam site would be minor.

The impacts of the other projects listed in Table 9-25 are considered in the analysis included above or would have little or no impact on surface-water use. The effects of withdrawals by large existing surface water users (such as by the two power generating stations mentioned above, and local agricultural and municipal users) are already reflected in historical streamflow data provided by the USGS. Other projects, that would have little impact, are excluded from the analysis either because they are too distant from the Highlands site, or use relatively little or no surface water, or have little or no discharge to surface water. Some projects (for example park and forest management) are ongoing, and changes in their operations that would have large impacts on surface water use appear unlikely. As stated above, minimum flows have been established for the St. Johns River (Fla. Admin. Code 2010). A withdrawal of 89 cfs would be 8 percent of the minimum recommended frequent low flow in the river. Therefore, the review team concludes that cumulative impacts on surface-water use would be MODERATE. Building and operating the proposed units at the Putnam site would not be a significant contributor to the cumulative impact on surface water use of St. Johns River.

As stated above, the review team assumed that no groundwater would be used to build or operate the units at the Putnam site and that groundwater impacts from dewatering would be controlled with diaphragm walls and grouting. Therefore the review team determined that there would be minimal impact on groundwater resources. The impacts of the other projects listed in Table 9-25 are considered in this analysis or would have little or no impact on groundwater use. Therefore, the review team concludes that cumulative impacts on groundwater use would be SMALL.

Cumulative Water Quality

Point and non-point sources have affected the water quality of the St. Johns River upstream and downstream of the site. The FDEP, under the Federal Water Pollution Control Act (Clean Water Act) Section 305(b), prepares a statewide Water Quality Inventory. The FDEP also identifies impaired waterbodies during this process and lists them on the 303(d) List. The 303(d) List of Waters reports on streams and lakes identified as being impaired for one or more pollutants and that do not meet one or more of the water-quality standards. The lower St. Johns River appears on Florida's list of impaired waters because of the presence of nutrients, fecal coliform, depressed dissolved oxygen, turbidity, dioxin, iron, lead, zinc, and mercury in fish tissue (FDEP 2009h); therefore, the review team concludes that the cumulative impact on surface-water quality of the receiving waterbody would be MODERATE. Water-quality information presented above for the impacts of building and operating the new units at the Putnam site would also apply to evaluation of cumulative impacts. As mentioned above, the State of Florida would require PEF to develop a SWPPP (PEF 2009a), which would identify measures to be used to control stormwater runoff (PEF 2009a). The blowdown would be regulated by EPA pursuant to

40 CFR Part 423 and all discharges would be required to comply with limits established by FDEP in a NPDES permit. Such permits are designed to protect water quality. Past and present action in the region has noticeably affected surface water quality adversely. Therefore, the review team concluded that building and operating the proposed units at the Putnam alternative site would not be a significant contributor to impacts on surface-water quality because industrial and wastewater discharges from the proposed units would comply with NPDES permit limitations and any stormwater runoff from the site during operations would comply with the SWPPP (PEF 2009a).

The review team also concludes that with the implementation of BMPs, the impacts on groundwater quality from building and operating two new nuclear units at the Putnam site would likely be minimal. Therefore, the cumulative impact on groundwater quality would be SMALL. The impacts of other projects listed in Table 9-25 are either considered in the analysis included above or would have little or no impact on surface-water and groundwater quality.

9.3.5.3 Terrestrial and Wetland Resources

Site Description

The following impact analysis includes direct, indirect, and cumulative impacts from construction and preconstruction activities and operations on terrestrial and wetland resources. The analysis also considers past, present, and reasonably foreseeable future actions that affect the terrestrial ecological resources, including the other Federal and non-Federal projects and the projects listed in Table 9-25. For the analysis of terrestrial ecological impacts at the Putnam site, the geographic area of interest is considered to be a 20-mi-wide area centered on the Putnam site and the associated offsite and transmission-line corridors. This 20-mi radius is expected to encompass the locations of possible development projects potentially capable of substantially influencing terrestrial ecological resources on and close to the Putnam project site. This geographical area of influence generally coincides with those defined for hydrology and aquatic ecology, both of which are closely interrelated with the terrestrial ecology of this setting. This area includes watersheds providing direct runoff from the Putnam site to onsite streams and the St. John's River, as well as the watersheds through which the transmission lines would be routed.

The Putnam site is a greenfield site situated in a rural area in the Eastern Florida Flatwoods ecoregion on the lower St. Johns River, a blackwater river designated as an American Heritage River. The St. Johns River is a wide, meandering, slow-moving river system that drops less than 30 ft as it flows north from its origins in south-central Florida to the Atlantic Ocean near Jacksonville (St. Johns Riverkeeper 2009). Most of the site has been disturbed by previous mining activities, but much has been reclaimed. Land use on and in the vicinity of the Putnam site is mostly forested habitat, with a large proportion of coniferous plantations and forest regeneration areas (CH2M Hill 2009). Habitats found on the Putnam site and in the vicinity are typical of those in the Eastern Florida Flatwoods ecoregion, which include mixed wetland

hardwoods, cypress swamps, hydric pine flatwoods, freshwater marshes, and some wet prairies.

The associated transmission-line corridors would begin in the Eastern Florida Flatwoods ecoregion and cross the Central Florida Ridges and Uplands and Southwestern Florida Flatwoods ecoregions. Vegetation community types in the Central Florida Ridges and Uplands ecoregion include sandhill vegetation such as turkey oak, bluejack oak, and longleaf pine for the dominant canopy species along with common understory species of running oak, gopher apple, and bluestem and panicum grasses (USDA 2006). Vegetation community types in the Southwestern Florida Flatwoods ecoregion include slash pine, longleaf pine, cabbage palm, and live oak with typical understory species of saw palmetto, and gallberry.

Important Species

Common wildlife, including important species, associated with the above-mentioned ecoregions that may occur on the Putnam site and associated transmission-line corridors includes Florida recreationally important species such as white-tailed deer, bobcat, feral hog, squirrel, northern bobwhite, and mourning dove, as well as skunk, raccoon, and several species of woodpecker. Various bird, reptile, and amphibian species also have the potential to reside on the Putnam site and associated transmission-line corridors (USDA 2006; FNAI 2009).

No site-specific surveys have been conducted for threatened and endangered species on the site and in the vicinity, offsite corridors, or the associated transmission-line corridors. Table 9-7 lists all Federally and State-listed species that could occur on the Putnam site and in the vicinity, offsite corridors, and in the counties crossed by the transmission-line corridors. Some of these species may at times be found on or in vicinity of the Putnam site and associated offsite corridors. Counties crossed by the transmission-line corridors for the Putnam site would include Hillsborough, Marion, Pinellas, Polk, Putnam, Seminole, Sumter, and Volusia Counties. PEF has stated that on-the-ground field surveys would be conducted before commencement of ground-disturbing activities on the site and in the offsite corridors and transmission-line corridors as required by the FDEP (PEF 2009a; CH2M Hill 2009; FDEP 2010a).

Building Impacts

Impacts from building two nuclear units and supporting facilities on wildlife habitat would be unavoidable. Activities that would affect wildlife include land clearing and grading (temporary and permanent), filling and or draining of wetlands, increased human presence, heavy equipment operation, traffic, noise, avian collisions, and fugitive dust. These activities would likely displace or destroy wildlife that inhabits the construction areas. Some wildlife, including important species, would perish or be displaced during land clearing for any of the above projects as a consequence of habitat loss, fragmentation, and competition for remaining resources. Less mobile animals, such as reptiles, amphibians, and small mammals, would be at greater risk of incurring mortality than more mobile animals, such as birds, many of which

would be displaced to adjacent communities. Undisturbed land adjacent to disturbed areas could provide habitat to support displaced wildlife, but increased competition for available space and resources could affect population levels. Wildlife would also be subjected to impacts from noise and traffic, and birds could be injured if they collide with tall structures. The impact on wildlife from noise is expected to be temporary and minor. The creation of new transmission-line corridors could be beneficial for some important wildlife species, including those that inhabit early successional habitat or use edge environments, such as white-tailed deer, northern bobwhite, eastern meadowlark, and the gopher tortoise. Birds of prey, such as red-tailed hawks would likely exploit newly created hunting grounds. Forested wetlands within the corridors would be converted to and maintained in an herbaceous or scrub-shrub condition that could provide improved foraging habitat for waterfowl and wading birds. However, fragmentation of upland and wetland forests could affect species that are dependent on large tracts of continuous forested habitat.

To accommodate the building of two nuclear units on the Putnam site, PEF would need to clear approximately 441 ac of terrestrial habitats for the nuclear facility, approximately 191 ac for associated offsite structures and corridors (excluding transmission line corridors), and an additional 1282 ac of land would need to be cleared and excavated to accommodate a reservoir (See Table 9-26 and Table 9-27) (CH2M Hill 2009). Based upon FLUCFCS land-use data, approximately 34 ac of wetlands would be affected on the site during building (CH2M Hill 2009). Approximately 15 ac of wetlands would be affected in the offsite corridors (CH2M Hill 2009). Approximately 210 ac of wetlands would be affected to excavate the reservoir (CH2M Hill 2009).

Table 9-26. Summary of Impacts by Land-Use Class for the Putnam Alternative Site

Land-Use Class (FLUCFCS) (acreage)	Onsite	Reservoir	Offsite Corridors (Except Transmission)	Transmission Corridors[(a)]
Urban and Built Environment (percent of area)	159 (36%)	413 (32%)	19 (10%)	1360 (23%)
Agriculture	0 (0%)	1 (<1%)	11 (6%)	828 (14%)
Upland Nonforested	17 (4%)	3 (<1%)	1 (1%)	202 (3%)
Upland Forested	225 (51%)	652 (51%)	138 (72%)	1978 (33%)
Water	0 (0%)	3 (<1%)	1 (1%)	402 (7%)
Wetlands	34 (8%)	210 (16%)	15 (8%)	702 (12%)
Barren Lands	0 (0%)	0 (0%)	5 (3%)	15 (<1%)
Transportation, Communication and Utilities	7 (2%)	9 (1%)	2 (1%)	516 (9%)

Source: CH2M Hill 2009
(a) Acreages listed for transmission-line corridors are total acres available, not total acres affected.

Table 9-27. Total Terrestrial Habitat Impacts for the Putnam Site

Impact Areas	Acres
Onsite Impact Areas	442
Reservoir Impact Areas	1291
Transmission-Line Corridor Areas	6003[(a)]
Offsite Impact Areas	191
Total Impact Areas	1908 (plus portion of 6003-ac transmission corridor)

Source: CH2M Hill 2009
(a) Acreages for transmission lines are total acres available in the corridor, not total acres affected.

PEF states that the nuclear facility would be sited to avoid wetlands whenever possible and potential impacts on wetlands near building zones would be minimized through the use of established BMPs (PEF 2009a). Under Federal and State permitting requirements, PEF would be obligated to mitigate any unavoidable construction impacts on jurisdictional wetlands and listed species (FDEP 2010a).

New transmission-system infrastructure would be needed to support a nuclear power facility at the Putnam site and would include approximately 215 mi of transmission lines (estimates made by measuring the approximate distance of hypothetical corridors provided in CH2M Hill [2009]; see assumptions in Section 9.3.5.1). There are no existing transmission lines or transmission-line corridors present on the site. PEF has assumed that transmission lines would be collocated within existing transmission-line corridors to the extent possible, thereby minimizing potential terrestrial impacts (CH2M Hill 2009). In addition, transmission-line corridors, towers, and the access road would be situated to avoid critical or sensitive habitats and species to the extent possible. Transmission-line corridor width would vary from 55 ft to 460 ft wide, depending on size, voltage, and whether or not existing corridors could be used. These widths were used in the analysis of the hypothetical routes for each alternative site to determine land-use cover types within the identified corridor (CH2M Hill 2009). The transmission-line corridors for the Putnam site include 6003 ac, of which approximately 702 ac are wetlands and approximately 1978 ac is forested habitat (CH2M Hill 2009). Some portion of the total 1978 ac of forested habitat and 702 ac of wetland habitat present in the corridors would be affected; however, because actual routes have not been determined, impacts on forests and wetlands cannot be quantified. Under Federal and State permitting requirements, PEF would be obligated to mitigate any unavoidable construction impacts on jurisdictional wetlands and listed species. PEF stated that all land clearing associated with the nuclear facility, offsite structures, and transmission-line creation would be conducted according to Federal, State, and local regulations, permit requirements, existing procedures, and established BMPs (PEF 2009a; FDEP 2010a).

Building two new nuclear reactors at the Putnam site, including the reservoir and offsite corridors (except transmission line corridors), would result in the loss of approximately 1924 ac of terrestrial habitat. Clearing land for the transmission-line corridor would also result in a loss of an undetermined amount of terrestrial habitat due to clearing and increase habitat fragmentation along the corridor. Other sources of impacts on terrestrial resources such as noise, increased risk of collision and electrocution, and displacement of wildlife would likely be temporary and result in minimal impacts on the resource. Because of the extent of unavoidable terrestrial habitat losses, building the two new units would noticeably alter the available terrestrial habitat on and in the landscape surrounding the Putnam site.

Operational Impacts

Impacts on terrestrial ecological resources, including important species, from operation of two new nuclear units at the Putnam site include those associated with transmission system structures, maintenance of transmission-line corridors, and operation of the cooling towers. Also, during plant operation, wildlife would be subjected to impacts from collisions with increased traffic.

Impacts on crops, ornamental vegetation, and native plants from cooling-tower drift cannot be evaluated in detail in the absence of information about the specific location of cooling towers at each alternative site. Similarly, bird collisions with cooling towers cannot be evaluated in the absence of information about the specific location of cooling towers at the site. The impacts of cooling-tower drift and bird collisions for existing power plants were evaluated in NUREG-1437 (NRC 1996) and found to be of minor significance for nuclear power plants in general, including those with various numbers and types of cooling towers. On this basis, the review team concludes, for the purpose of comparing the alternative sites, that the impacts of cooling-tower drift and bird collisions with cooling towers resulting from operation of new nuclear units would be minor.

Outdoor noise levels on the Putnam site are predicted to range from 90 dBA near the loudest equipment to 65 dBA in areas more distant from major noise sources (CH2M Hill 2008). Noise modeling predicts not perceptible to slight increases in noise from plant operations at the site boundary (CH2M Hill 2008). Except in areas immediately adjacent to major noise sources, expected noise levels would be below the 60- to 65-dBA threshold at which birds and red foxes (a surrogate for small and medium-sized mammals) are startled or frightened (Golden et al. 1980). Thus, noise from operating cooling towers at the Putnam site would not be likely to disturb wildlife beyond the site boundary. Consequently, the review team concludes that the impacts of cooling-tower noise on wildlife would be minimal.

An evaluation of specific impacts resulting from building of transmission lines and transmission-line corridor maintenance cannot be conducted in any detail due to the lack of information, such as the specific locations of new rights-of-way that could result from transmission system upgrades. However, in general, impacts associated with transmission-line operation consist of

bird collisions with transmission lines, EMF effects on flora and fauna, and habitat loss due to corridor maintenance. The impacts associated with transmission-line corridor maintenance activities include alteration of habitat, including wetland and floodplain habitat, due to cutting and herbicide application, and similar related impacts.

Transmission lines and associated structures pose a potential avian collision hazard. Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to their low, fast flight and flocking behavior (EPRI 1993). Bird collisions with transmission lines are recognized as being of minor significance at operating nuclear power plants, including transmission-line corridors with variable numbers of power lines (NRC 1996). Accordingly, although additional transmission lines would be required for new nuclear units at the Putnam site, increases in bird collisions would be minor and they would likely not be expected to cause a measurable reduction in local bird populations. PEF would also be required to have an Avian Protection Plan in compliance with State certification guidelines (FDEP 2010a). Consequently, the incremental number of bird collisions posed by the addition of new transmission lines for new nuclear units would be negligible.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). At a distance of 300 ft, the magnetic fields from many lines are similar to typical background levels in most homes. Thus, impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003). Therefore, the incremental EMF impact posed by addition of new transmission lines for new nuclear units would be negligible.

Roads providing access to the existing transmission-line corridors at the Putnam site would likely be sufficient for use in any expanded corridors; however, new roads would be required during the construction of new transmission-line corridors. Management activities (cutting and herbicide application) related to transmission-line corridors and related impacts on floodplains and wetlands in transmission-line corridors are recognized as being of minor significance at operating nuclear power plants, including those with transmission-line corridors of variable widths (NRC 1996). The review team assumes that the same vegetation and construction

management of corridors currently used by PEF would be used in the establishment and maintenance of the new corridors. Under the Conditions of Certification for the State, PEF would also be required to retain existing vegetation whenever practicable and use BMPs that comply with the Florida State regulations (FDEP 2010a). Consequently, the incremental effects of the maintenance of transmission-line corridors and associated impacts on floodplains and wetlands posed by expanding existing corridors or the addition of a new transmission-line corridor for new nuclear units would be negligible.

To summarize, the potential effects of operating two new nuclear reactors at the Putnam site would be primarily associated with the maintenance of transmission-line corridors and increased traffic. Operational impacts on terrestrial resources would generally be expected to be minimal.

Cumulative Impacts

Past and present actions in the geographic area of interest that have influenced terrestrial resources in a way similar to the building and operation of the proposed two new nuclear units at the Putnam site include the approximately 2000-ac Seminole Power Plant and the Putnam Steam Power Plant. Construction of the nuclear facility at the Putnam site would have impacts on terrestrial resources similar to those of the proposed project at the LNP site, and operation of the transmission system would have similar impacts on terrestrial resources as mentioned above. The Iluka Resources Inc. mine, located north of the Putnam site, would have also affected terrestrial resources in a similar way. Furthermore, terrestrial habitats throughout the geographic area of interest have been extensively altered by a history of forestry and agricultural practices as well as low density residential development.

Proposed reasonably foreseeable future actions that would affect terrestrial resources in a way similar to development at the Putnam site would include transmission-line creation and/or upgrading throughout the designated geographical ROI, and future urbanization would also be expected to occur. There are no areas within the geographical ROI that are managed for the benefit of wildlife.

The other impact on terrestrial resources at the Putnam site would be the effect of global climate change on plants and wildlife. The impact of global climate change on terrestrial wildlife and habitat in the geographic area of interest is not precisely known. Global climate change would result in a rise in sea level and may cause regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (GCRP 2009). Such changes in climate could alter terrestrial community composition on or near the Putnam site through changes in species diversity, abundance and distribution. Elevated water temperatures, droughts, and severe weather phenomena may adversely affect or severely reduce terrestrial habitat. Specific predictions of habitat changes in this region due to global climate change are inconclusive at this time. However, because of the regional nature of climate change, the impacts related to global climate change would be similar for all of the alternative sites.

Summary Statement

Impacts on terrestrial ecology resources are estimated based in the information provided by PEF and the review team's independent review. There are past, present, and future activities in the geographic area of interest that could affect terrestrial ecology in ways similar to the building of two units at the Putnam site. The Putnam site and some of the associated transmission lines are natural habitats that would be substantially altered by development and maintenance activities, noticeably affecting the level and movement of terrestrial wildlife populations in the surrounding landscape. Other anticipated development projects would further alter wildlife habitats and migration patterns in the surrounding landscape. The review team therefore concludes that the cumulative impacts on baseline conditions for terrestrial ecological resources would be MODERATE. This determination is based upon the extent of expected wetland loss and habitat fragmentation from ongoing and planned development projects, continued widespread manipulation of habitats for commercial forest management, and anticipated losses of habitat for important species. The incremental impacts from building and operating the Putnam project would be a significant contributor to the moderate cumulative impact, primarily because of a loss or modification of habitats that support wildlife, wetlands, and important species. Although incremental impacts on terrestrial resources could be noticeable near the Putnam project site, these impacts would not be expected to destabilize the overall ecology of the regional landscape.

9.3.5.4 Aquatic Resources

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources. The proposed Putnam site has no existing infrastructure associated with development of a nuclear power plant. This greenfield site is adjacent to the St. Johns River, which is proposed as the water source for cooling and discharge. Water flow in the St. Johns River is managed by the St. Johns River Water Management District (SJRWMD), with an established minimum average flow of 240 cfs for the St. Johns River below the Lake Washington weir. PEF maintains that there would be adequate flow to supply water through a closed-cycle cooling design for a two-unit plant. However, under drought conditions, the St. Johns River may not be able to provide sufficient water, and PEF acknowledges that the building of a reservoir would be required to ensure consistent water supply (PEF 2009a). The geographic area of interest includes the site and vicinity streams as well as the St. Johns River upstream and downstream of the intake and discharge as the area most likely to be affected by new nuclear units, as well as associated transmission-line corridors.

The St. Johns River flows from swampy headwaters in Melbourne, Florida, northward to the mouth near Mayport on the Atlantic Ocean. Classified as an American Heritage River, the St. Johns River has experienced a severe decline in water quality and increased use as a freshwater resource, which have prompted the water management district to improve water quality and restore habitat, particularly in the lower river basin, which includes Putnam County

(SJRWMD 2008a). Several initiatives are planned to target water quality, biological health, and sediment management in the lower St. Johns River basin and the connecting Lake George basin, which is also located in Putnam County (SJRWMD 2008b).

There are no sanctuaries or preserves that could be affected by the proposed action. The nearest State-managed areas are the Oklawaha River Aquatic Preserve in Marion County and the Wekiva River Aquatic Preserve to the south of Putnam County. The Oklawaha River Aquatic Preserve covers 4600 ac of submerged lands and flows into the St. Johns River at Palatka (FDEP 2009d). The Wekiva River Aquatic Preserve encompasses 19,000 ac of submerged land and flows into the middle St. Johns River basin (FDEP 2009f).

Commercially Important Species

Commercial fisheries allowed in the St. Johns River include menhaden (*Brevoortia tyrannus*), black mullet, and blue crab. For life history information on the black mullet and blue crab refer to Section 2.4.2.

The Atlantic menhaden inhabit inland tidal waters and spawn offshore during October through March. Juvenile development typically occurs in estuarine or tidal habitat with salinities less than 10 ppt (ASMFC 2009). Fished as both a bait and food fish, landings for Putnam County in 2008 recorded over 12,000 lb (FFWCC 2009a).

Recreationally Important Species

Largemouth bass, speckled perch (*Pomoxis nigromaculatus*), striped bass (*Morone saxatilis*), catfish (*Ameiurus* spp.), blue crab, and sunfish (*Lepomis* spp.) are the primary recreational species caught in the Lake George basin and Putnam County area of the St. Johns River (BASS Online Inc. 2008).

Non-Native and Nuisance Species

Water hyacinth, water lettuce, and hydrilla are common invasive aquatic plant species that have been noted in the St. Johns River and are controlled by the SJRWMD through the FDEP/Florida Fish and Wildlife Conservation Commission's Invasive Plant Management Program (FDEP 2008). Power plant operations are not expected to affect these aquatic nuisance species.

Critical Habitats

No critical habitat has been designated by the FWS or NMFS in the vicinity of the Putnam County alternative site.

Federally and State-Listed Species

Federally and State-listed aquatic species that may occur near the Putnam County alternative site include the endangered Florida manatee and the endangered shortnose sturgeon

(*Acipenser brevirostrum*). Federally and State-listed species may also occur along transmission-line corridors in Hillsborough County, such as the endangered green sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, loggerhead sea turtle, and the threatened gulf sturgeon. Detailed species information is provided in Section 2.4.2.3.

Florida Manatee (*Trichechus manatus latirostris*)

The Florida manatee upper St. Johns River management unit, which includes Putnam County, constitutes approximately 5 percent of the total manatee population, but is the fastest growing of the four management units. Over 450 ac are regulated in Putnam County by FWS as Manatee Protection Zones (FFWCC 2007d). PEF would comply with the Standard Manatee Conditions for In-Water Work (FDEP 2010a) for construction activities in the St. Johns River to prevent impacts on manatees in the vicinity of construction activities. Thermal discharges from operations may result in increased use of habitat near the point of discharge if discharge is to the St. Johns River. Plant outages that result in cold shock could affect manatees that become habituated to power plant thermal discharges.

Shortnose Sturgeon (*Acipenser brevirostrum*)

Shortnose sturgeon range along the eastern Canadian and U.S. coast from the St. John River in Canada to the St. Johns River in Florida. All spawning occurs in freshwater during a narrow 1- to 2-week period in the spring. Females only spawn every 3 to 5 years after reaching sexual maturity at age 8 to 12. Males may spawn every year after reaching age 6 to 10 (NMFS 1998). Shortnose sturgeon are sensitive to water-quality conditions and require rocky or gravel substrate for spawning. If habitat is not favorable, spawning will not occur, and the lower St. Johns River has little of this preferred habitat type. In the St. Johns River, most catch records for the shortnose sturgeon have occurred in the lower basin near Palatka. A sampling survey from 2002 to 2003 recorded a single shortnose sturgeon to the south of Palatka, despite more than 820 hours of sampling effort (FFWCC 2009c). To date, no evidence of spawning or adult migration in the St. Johns River has been collected to indicate that there is a viable reproducing population in this river.

Building Impacts

New cooling-water intake and discharge structures in addition to a cooling-water reservoir would be required at the Putnam County site. Installation of a new intake and discharge would result in the temporary displacement of aquatic biota within the vicinity of both structures. It is expected that these biota would return to the area after installation is complete. Sedimentation due to disturbances of the river bank and bottom during installation activities could affect local benthic populations. However, the impacts on aquatic organisms would be temporary and largely mitigable through the use of BMPs. The impacts of building a cooling-water reservoir may be significant depending on the siting of the reservoir. During the review team's visit to the Putnam site, observations of the site from public roads indicated the presence of streams that

are either perennial or seasonal. These aquatic resources have not been examined for diversity of aquatic biota, but nonetheless, they represent aquatic habitat that would likely be affected by the building of facilities for the site. Offsite corridor preparations would not cross any streams, but would cross two open waterbodies (CH2M Hill 2009). The use of BMPs during building activities would result in minimal impacts on aquatic biota located in water resources within the site building areas.

New transmission-line infrastructure would be required for a new two-unit facility. There currently are no existing transmission-line corridors in the immediate vicinity of the greenfield site, and new corridors would need to be established. Transmission corridors appear to follow the Polk-Hillsborough-Pinellas corridor identified for the LNP site in addition to other corridors in Marion, Putnam, Seminole, Sumpter, and Volusia Counties (CH2M Hill 2009). PEF anticipates transmission-line corridors would cross 7 streams and 94 open waterbodies and should have minimal impact on aquatic resources, including minimal impacts on threatened and endangered sea turtles and the threatened gulf sturgeon (CH2M Hill 2009).

Operational Impacts

Impingement and entrainment of organisms from the St. Johns River and from a constructed reservoir would be the most likely impacts on aquatic populations that could occur from operation of two new nuclear units at the Putnam County site. Assuming a closed-cycle cooling system, a maximum through-screen intake velocity of 0.5 ft/sec or less and an intake flow of less than or equal to 5 percent of the mean annual flow which meets the EPA's Phase I regulations for new facilities (66 FR 65256), the anticipated impacts on aquatic populations from entrainment and impingement are expected to be minimal. Operational impacts associated with water quality and discharge cannot be determined without additional detailed analysis. However, based on the staff's experience with other facilities, the review team concludes that with proper design the impacts on aquatic resources due to the blowdown discharge from operation of two new nuclear units at the Putnam County site would likely be minimal with FDEP NPDES compliance.

The staff also concludes that operational impacts on aquatic biota from maintenance of the transmission-line corridors would be minimal assuming that appropriate BMPs are used.

Cumulative Impacts

Cumulative impacts on aquatic resources within the St. Johns River include the operation of Seminole Power Plant and Putnam Steam Power Plant, both of which use water from and discharge to the St. Johns River. Other impacts include small business and wastewater-treatment plants that discharge wastewater to the St. Johns River within the geographic area of interest for the Putnam site. These discharge operators and businesses have active NPDES permits for discharge.

Anthropogenic activities such as residential or industrial development near the vicinity of the nuclear facility can present additional constraints on aquatic resources. Future activities may include shoreline development (i.e., removal of habitat), increased water needs, and increased discharge of effluents into the St. Johns River. The effects of continued industrial discharge practices could result in additional habitat loss and/or degradation due to water use using surface waters and groundwater withdrawal, point and non-point source pollution, siltation, and bank erosion.

The review team is also aware of the potential for global climate change to affect aquatic resources. The impact of global climate change on aquatic organisms and habitat in the geographic area of interest is not precisely known. Global climate change would result in a rise in sea level and may cause regional increases in the frequency of severe weather, decreases in annual precipitation, and increases in average temperature (Karl et al. 2009). Such changes in climate could alter aquatic community composition on or near the Putnam site through changes in species diversity, abundance, and distribution. Elevated water temperatures, droughts, and severe weather phenomena may adversely affect or severely reduce aquatic habitat, but, specific predictions of aquatic habitat changes in this region due to global climate change are inconclusive at this time. The level of impact resulting from these events would depend on the intensity of the perturbation and the resiliency of the aquatic communities.

Summary Statement

Impacts on aquatic ecology resources are estimated based on the information provided by PEF, the State of Florida, and the review team's independent review. Properly siting associated transmission lines, avoiding habitat for protected species and minimizing interactions with waterbodies and watercourses along the corridors, and the using BMPs during intake and discharge installation, transmission-line corridor preparation, and tower placement would minimize building and operation impacts. There would be impacts associated with the loss of aquatic habitat, particularly during low flow conditions in the river, due to the consumptive loss of water from closed-cycle cooling. There also would be unspecified impacts related to the construction and operation of a cooling reservoir however these could be minimized through proper siting and the use of BMPs during construction. The use of a cooling reservoir would partially mitigate the effects of consumptive water loss on aquatic habitat during low river flow. The review team concludes that the cumulative impacts of building and operating two new reactors on the Putnam site combined with other past, present, and future activities on aquatic resources in the St. Johns River would be SMALL.

9.3.5.5 Socioeconomics

The following impact analysis includes direct, indirect, and cumulative impacts from the building activities and operations of two new nuclear units at the Putnam site, which is located in rural Putnam County in northeastern Florida. The analysis considers other past, present, and reasonably foreseeable future actions that affect socioeconomics, including other Federal and

non-Federal projects listed in Table 9-25. For the analysis of socioeconomic impacts at the Putnam site, the geographic area of interest is the region within a 50-mi radius centered on the Putnam site (the region) with special consideration of the five counties of Putnam, Clay, Flagler, Marion, and St. Johns Counties, because that is where the review team expects socioeconomic impacts to be the greatest. In evaluating the socioeconomic impacts of site development and operation at the Putnam site, the review team undertook a reconnaissance survey of the site using readily obtainable data from the Internet or published sources.

The Putnam site is a greenfield site located in an area in which there is an operating coal-fired power plant and a combined-cycle gas/oil-fired power plant, sand mines, and a concrete batch plant. The review team drew upon UCSB 2000 data to find the available total construction workforce within the host county, adjacent counties, and any nearby counties with a major population center within a reasonable commuting distance from the site. For the Putnam site, this included Putnam, Clay, Alachua, Marion, Volusia, Flagler, St. Johns, and Duval Counties. The total workforce employed in these counties in 2000 was 71,994 workers. Based on this workforce availability, the review team assumed that up to 80 percent of the 3300-person workforce involved in building the two-unit plant, or 2640 workers, would be drawn from existing residents of this region, and that 20 percent, or 660 workers, would migrant into the area. This 20 percent would include special trades needed for nuclear power plant production that may not be available in the region.

The review team identified the Economic Impact Area (EIA) for a two-unit nuclear plant at the Putnam site to include Putnam County and the immediately adjacent counties of Clay, Flagler, Marion, and St. Johns, based on the review team's expected effects of in-migrating workers and families. The review team expects that some of the in-migrating workers would choose to reside in Alachua, Duval, and Volusia Counties because of the amenities available in the larger cities there, but these counties' economies and community infrastructures are sufficiently large that the review team expects that project-related effects would not be noticeable. The review team focused on the effects of the workforce involved in building the two-unit plant because the operations workforce would be smaller than the construction and preconstruction workforce, with smaller socioeconomic impacts.

Table 9-28 provides some socioeconomic data for the EIA. For the purposes of this analysis the review team projected that about one-quarter, or 165 of the in-migrating workers, would be distributed among Alachua, Duval, and Volusia Counties because they offer more urban amenities than the counties in the EIA. The review team assumed that the other 495 in-migrating workers would be distributed among the EIA. The review team further assumed that all in-migrating workers would bring families; this is unlikely but provides an upper bound on population impacts associated with the project. The review team used the 2.49 average Florida family size to project the distribution of population due to in-migrating workers shown in Table 9-29.

Table 9-28. Socioeconomic Data for the Putnam Site EIA

Data Category	Putnam	Clay	Flagler	Marion	St. Johns	Data Source
Population						
1980	50,549	67,052	10,913	122,488	51,303	(1a)
1990	65,070	105,986	28,701	194,833	83,829	(1)
2000	70,423	140,814	49,832	259,914	123,148	(1)
Projected 2010	74,208	195,731	101,595	348,610	196,113	(2)
Median Household Income (1999)	$28,180	$48,854	$40,214	$31,944	$50,099	(3)
Vacant Housing Units						
2000	6031	3505	3158	15,908	8394	(1), (7)
2005	7582	5089	8396	24,860	13,619	(1), (7)
Total Housing Units						
2000	33,870	53,748	24,452	122,663	58,008	(9)
2005	35,870	71,735	48,454	159,283	83,147	(9)
Workforce						
2000	26,326	66,268	18,815	98,248	59,394	(3)
Peak Project	2669	5987	1873	8803	4491	(3)
Total schools[(a)]	1 A, 5 B, 9 A-B, 2 C, 1 B-C, 1 A-B-C	1A, 7 B, 22 A-B, 6 C, 1 B-C, 1 A-B-C	0 A, 2 B, 5 A-B, 3 C, 1 B-C	2 A, 9 B, 29 A-B, 8 C, 1 B-C, 1 A-B-C	0 A, 7 B, 17 A-B, 5 C, 2 B-C	(4)
Number of Schools Failing	1	1	1	4	0	(4)

Student-Teacher Ratio							
Police	Sheriff Dept	Sheriff Dept – 40-60 deputies	Sheriff Dept –4 patrol squads, traffic unit.	Sheriff Dept plus police depts. in Dunnellon, Belleview, and Ocala	Sheriff Dept – almost 200 employees and 300 in support		(5)
Emergency Services	Dept of emergency services; 70+ EMS staff at 7 stations; 2 staffed and 18 volunteer fire departments	Emergency management dept. 14 fire stations, emergency dispatchers	Emergency services includes fire and EMS – 80 budgeted positions, including fire and paramedics	Emergency operations department – joint county, Ocala, Dunnellon; 22 staffed and 7 volunteer fire stations	Emergency management department details not available		(6)
Population							
White	78.9	89.1	88.5	85.3	91.8		
Afr-American	17.3	7.3	9.4	12	6.5		
Hispanic	12.1	4.3	5.1	35.7	2.6		
Low Income	20.9	6.8	8.7	13.1	8.0	(3)	

(a) A-elementary school; B-middle school ;C-high school
Sources:
(1a) USCB 1990
(1) USCB 2000
(2) 2010 projection assuming 2000-2008 growth rate (from USCB 2009) extends to 2010
(3) USCB 2000
(4) FDOE 2009a
(5) Putnam: Putnam Sheriff 2009, Clay Sheriff 2009, Flagler Sheriff 2009, Marion: Section 2.5.2.6, St. Johns Sheriff 2009
(6) Putnam: Putnam EM 2009, Clay EM 2009, Flagler EM 2009, Marion EM 2009, Marion Fire 2009, St. Johns 2009
(7) USCB 2007
(8) USCB 2000
(9) Fedstats for Florida and Florida Counties. Compiled from the Bureau of Economic ~~analysis~~Analysis, Bureau of Labor Statistics, U.S. Census Bureau. Accessed 3.8.10 at http://www.fedstats.gov/qf/states/12/12029.html.
EMS = emergency management services

Table 9-29. Projected Distribution of Workers and Associated Population Increase in the EIA

County	Percent Population Increase 1990-2000[(a)]	Projected Percent Increase 2000–2010 [(b)]	Workers in-migrating to build Putnam Plant	Civilian Workforce in 2007[(c)]	Population of In-Migrating Workers and Families	Population of Workers and Families (as a percent of projected 2010)	Population of Workers and Families (as a percent of projected 2010 population + in-migrants)
Putnam	8.2	5.4	81	31,768	201	0.27	0.27
Clay	32.9	39.0	47	92,879	117	0.06	0.06
Flagler	73.6	103.9	42	30,599	105	0.10	0.10
Marion	32.9	34.1	213	135,333	530	0.15	0.15
St. Johns	46.9	59.3	112	89,843	280	0.14	0.14

(a) Based on USCB data, as reported in PEF 2007b

(b) Calculated as 1.25 times percent change 2000-2008 shown in USCB 2009, i.e., assumes rate of change for first eight years would continue through last two years of the decade.

(c) Fedstats for Florida and Florida Counties. Compiled from the Bureau of Economic analysis, Bureau of Labor Statistics, U.S. Census Bureau. Accessed 3.8.10 at http://www.fedstats.gov/qf/states/12/12029.html.

Physical and Aesthetics Impacts

The physical impacts on workers and the public from building and operating a two-unit plant at the Putnam site would be very similar to those described for the LNP site. People who work or live around the site could be exposed to noise, fugitive dust, and gaseous emissions from building activities. Building workers and personnel working onsite could be the most affected. Air-pollution emissions are expected to be controlled by applicable BMPs and Federal, State, and local regulations. During plant operations, standby diesel generators used for auxiliary power would have air-pollution emissions. These generators would see limited use and, if used, would be used for only short periods of time. Applicable Federal, State, and local air-pollution

requirements would apply to all fuel-burning engines. During normal operations, the annual average exposure from gaseous emission sources is anticipated to not exceed applicable regulations at the site boundary. The review team expects the impacts of plant operations on air quality to be minimal. As with building impacts, potential offsite receptors of operations noise and emissions are generally located well away from the site boundaries.

Building activities and unit operations are not expected to affect any offsite buildings. Most buildings are well removed from the site boundaries. Because this is a greenfield site, there are no onsite buildings to be affected by shock and vibration from pile-driving and other related activities. No long-term physical impacts on structures, including any residences near the site boundaries, would be expected. Therefore, based on consideration of reconnaissance-level information, the review team concludes that the physical impacts of station building and operation on offsite buildings would be minor.

PEF reports that a reservoir may need to be created for water supply. There would likely be vegetative screening around the reservoir that would potentially mitigate the aesthetic impacts. Therefore, the review team expects the aesthetic impacts of a reservoir would be minimal.

The Putnam site is in a rural area within an area that has experienced sustained, substantial population growth over the past several decades, as indicated in Table 9-28. Residential and commercial areas are located away from the alternative site boundaries, applicable air-pollution regulations would have to be met by PEF, and applicable BMPs would be put in place, including during the construction and use of the site access road. Therefore, based on information provided by PEF and the review team's independent review of reconnaissance-level information, the review team concludes that the physical impacts of building and operating the station would have minimal impact on workers and the local public around the Putnam site.

As the transmission lines to connect the site to the distribution grid are put in place and the buildings and cooling towers associated with the new reactors reach their final heights and begin operating, they would introduce a noticeable aesthetic impact that could be similar to those created by the existing fossil-fuel plants already operating within the county. In places requiring the clearing of new transmission-line corridors, aesthetic impacts would be noticeable but not destabilizing, depending on the proximity of viewers and the nature of vegetation remaining between them and the corridors. Given the general characteristics of the area, there would likely be vegetative screening around the site that would potentially mitigate the aesthetic impacts at the reactor site.

Demographic Impacts

Table 9-29 indicates the estimated project-related population migrating into the EIA at peak workforce levels and the population increase in each county between 1990 and 2000 and between 2000 and 2010. As seen in the table, each county except Putnam saw a large rate of population increase between 1980 and 2000, with continued high rates forecast for between

2000 and 2010. For Putnam County the rates are similar for both the 1990–2000 and the 2000–2010 periods, with a somewhat lower rate of increase forecast for 2000–2010 than for the prior decade, although this increase is upon a larger base. Given the estimated increase of 0.27 percent or less over projected populations for 2010, the review team found that the demographic impact of the in-migrating population associated with constructing two new nuclear generating units would be minor.

Economic Impacts

The review team determined that the combined impact of the direct and indirect jobs and income associated with building the two units would have a minor effect on total employment and income in the EIA, with in-migrating workers projected at less than 2.2 percent of the 2000 employee base in any county. The impact of approximately 541 operations jobs (70 percent of the total operations jobs) filled by in-migrating operations workers within a 1-hour commute of the site, and the indirect jobs they would create would be minor, given the size of the economy of the area.

State and local taxes would be governed by Florida law. The review team assumed that tax revenues generated from sales and use taxes associated with the building and operation of the proposed project at the Putnam site would be very similar to those evaluated for the LNP site in Sections 4.4.3.2 and 5.4.3.2, with a similar minor impact on revenues in the EIA and region. The review team concluded that increased property taxes from the proposed project at the Putnam site during operation would have a substantial beneficial impact on Putnam County. The review team found that additional property taxes on new houses built by in-migrating workers would constitute a small percentage increase in the local tax base in the EIA; thus the impact of operations on residential property tax revenues would be minor and beneficial for all of the region except Putnam County, where the review team determined property tax impacts would be substantial and beneficial.

Housing

The review team compared the 2000 figures for vacant housing in the EIA listed in Table 9-28 with the number of in-migrating workers projected for peak workforce years listed in Table 9-29. Table 9-28 housing figures do not include RV parks, campgrounds, or hotels, and thus provide a lower bound of what would be available to house workers. In the EIA, less than 2 percent of the 2000 vacant housing present in 2000 would be needed to house in-migrating workers, assuming that each worker occupied a separate housing unit. The review team divided the projected increase in population without the project by 2.49 (Florida average family size) to estimate the number of housing units required to accommodate the increase.

The U.S. Census Housing Profile (USCB 2000b) in the EIA estimated the following:

- Putnam County – a total housing stock of 33,870 units with a rental vacancy rate of 18 percent (approximately 6031 housing units were unoccupied at the time of the survey).

- Clay County – a total housing stock of 53,748 units with a rental vacancy rate of 7 percent (approximately 3505 housing units were unoccupied at the time of the survey).
- Flagler County – a total housing stock of 24,452 units with a rental vacancy rate of 13 percent (approximately 3158 housing units were unoccupied at the time of the survey).
- Marion County – a total housing stock of 122,663 units with a rental vacancy rate of 13 percent (approximately 15,908 housing units were unoccupied at the time of the survey).
- St. Johns County – a total housing stock of 58,008 units with a rental vacancy rate of 14 percent (approximately 8394 housing units were unoccupied at the time of the survey).

The review team expects that the in-migrating workforce could be absorbed into the existing housing stock in the EIA and the region without a measureable impact. Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that housing impacts of building and operating two nuclear units at the Putnam site would not be noticeable.

Public Services

The review team assumed that the Putnam EIA, like the three-county local area for the LNP EIA, have planned to meet needs for public services based on forecast population increases that did not include the presence of a workforce associated with building and operating a nuclear plant. The review team based its analysis of potential impacts on public services on the level of population increase represented by in-migrant workers during peak workforce years, an estimated increase of 0.27 percent or less over projected populations for 2010, as shown in Table 9-29. Using this approach, the review team expects that the impacts of building two units on county public services during peak workforce years would be minor in the EIA.

Transportation

Main roads in Putnam County include US-17, a two-lane north-south road on the eastern side of the county; SR-20, a two-lane east-west road across the center of the county; and SR-9, a two-lane north-south road that extends from the center of the county and trends northeast to join US-17 in the county capital, Palatka. All three roads have a LOS standard of "C." SR-20 forms part of the Strategic Intermodal System, for which the FDOT sets the standards (FDOT 2009a). The other roads are not part of the Strategic Intermodal System and are assigned LOS standards according to the Putnam County Comprehensive Plan (Putnam County 2009a).

One-way annual (2008) AADT counts for US-17 ranged from 17,000 to 16,500 near the bridge east of Palatka and east of the junction with SR-20; 5000 to 4900 north of Palatka; and 2600 to 4600 in the south of the county. Two-way AADT estimates for SR-20 ranged from 7600 in the west of the county to 15,900 near the intersection with SR-19 and 7700 just south of the

intersection with US-17. Two-way AADT estimates for SR-19 range from 2900 in the south of the county to 8600 south of the junction with SR-20 (FDOT 2008).

The review team considered these roads to be the main routes that would be used by workers commuting to the plant site, with US-17 linking to the site access road. The review team considered the impact of project-related traffic in terms of likelihood that it would change the LOS along US-17 to be lower than the assigned standard "C." The review team assumed 2281 trips daily (following LNP site analysis in Section 4.4.4.1), with 50 percent to/from the north and 50 percent to/from the south, based on the distribution of in-migrating worker residence discussed previously as well as commuters from Duval, Alachua, and Volusia Counties. At morning shift change, this would add 1977 cars to the total flow on SR-70, 711 incoming from the north, 711 from the south; and 275 outgoing to the north, 275 to the west. The incoming traffic from both north and south would increase the flow by about 15 percent over the 2008 AADT for US-17 north of Palatka, in the general site vicinity, which, according to FDOT's generalized planning standards (FDOT 2009b), would not reduce the LOS below "C." Effects south of Palatka would be less. An increase of 711 cars entering the Palatka area from US-17 south, SR-19 south, and SR-20 west would not significantly add to the 2008 counts. The review team found no evidence that the LOS for US-17 would change as a result of project-related traffic. While more analysis would be required once specific proposals for turn lanes, signals, and other modifications were made, the review team identified the potential for a noticeable, intermittent impact at the intersection of US-17 with the site access road, analogous to that predicted for the LNP site. Given the lower number of commuters during operations, the review team believes the traffic-related impacts during operations would be minor.

Education

Table 9-28 provides data about schools in the EIA. Schools in the socioeconomic impact area met the State teacher-student ratio classroom requirements in 2007–2008 with the exception of four schools in Marion County and one school each in each Putnam, Clay, and Flagler Counties. The review team assumed that school districts in the EIA, like those in the EIA for the LNP site, would address short-term gains in student population with mobile classrooms and that the PK-12 public schools would be funded according to the Florida equalized funding formula (FDOE 2009b). The review team assumed that students would accompany each in-migrating worker family in the average of the ratios of students per household from the LNP site counties listed in Table 2-35, resulting in the number of new students listed in Table 9-30.

The review team found that the addition of up to four classrooms in Marion County, one classroom each in Putnam and St. Johns Counties, and none in Clay or Flagler County would amount to less than one additional classroom per school, which would constitute a minor impact.

Table 9-30. Students from In-Migrating Families at Peak Workforce Years

County	In-Migrating Worker Households	Grades PK–3 Students[(a)]	New Rooms	Grades 4–8 Students[(b)]	New Rooms	Grades 9–12 Students[(c)]	New Rooms
Putnam	81	13	1	7	0	7	0
Clay	47	7	0	4	0	4	0
Flagler	42	7	0	3	0	4	0
Marion	213	34	2	17	1	19	1
St. Johns	112	18	1	9	0	10	0

Source: Table 4-14 and Florida State Constitution Amendment of Section 1, Article IX (November 2002)
(a) 0.158 per household; 18 students per teacher required by State law
(b) 0.081 per household; 22 students per teacher required by State law
(c) 0.091 per household; 25 students per teacher required by State law
PK = preschool

Recreation and Aesthetics

The review team learned that fishing for a number of species is important along the St. John's River in Putnam County (Florida Bass Online.com 2010). The review team anticipates that building activities would have short-term minor effects on the recreation industry.

The economy in the Putnam site EIA draws on its natural resources, including many lakes and parks. Because the exact footprint of the site is not determined, specific impacts on specific recreational facilities from site structures and the intake and discharge structures are not known, but, based on the considerations discussed for the LNP site, the review team anticipates that adverse impacts of building units at the Putnam site would have minor impacts on use of the recreational facilities from which activities would be visible or audible. The increased population in the EIA may increase use of local recreational areas, which is expected to have negligible impact on either the sites or the recreational experience, given the number, geographic distribution, and variety of recreational locations available.

Aesthetic viewsheds would be negatively affected by the height of structures during construction and operation. Given the general characteristics of the area, there would likely be vegetative screening around the site that would potentially reduce the aesthetic impacts to minor. In places requiring the clearing of new transmission-line corridors, aesthetic impacts would vary depending on the location of viewers and the nature of vegetation remaining between them and the corridors, ranging from minor to noticeable.

PEF reports that a reservoir may need to be created for water supply. There would likely be vegetative screening around the reservoir that would potentially mitigate the aesthetic impacts and therefore the impact would be minor. Also, there are many opportunities in the region for various sorts of recreation and the review expects the impact to recreation to be minimal.

Summary of Socioeconomics

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. Based on information provided by PEF and its own independent evaluation, the review team finds that the socioeconomic effects of building two units at the Putnam site would be minor with few exceptions. There would be noticeable, intermittent and temporary adverse effects on transportation in Putnam County in the immediate vicinity of the site. Once plant operations begin, the review team believes transportation impacts would be minor and tax impacts on Putnam County would be substantial and positive. The aesthetic impacts of the transmission lines and corridors would be noticeable in the areas along the corridors.

Cumulative Impacts

In addition to assessing the incremental socioeconomic impacts from the building and operation of two nuclear units on the Putnam site, the cumulative impact assessment considers other past, present, and reasonably foreseeable future actions including other Federal and non-Federal projects that could contribute to the cumulative socioeconomic impacts on a 50-mi radius centered on the Putnam site (the region) with special consideration of Putnam, Clay, Flagler, Marion, and St. Johns Counties, because that is where the review team expects socioeconomic impacts to be the greatest (Economic Impact Area, EIA). Table 9-25 identifies the projects that have contributed and will continue to contribute to the demographics, economic climate, and community infrastructure of the region.

The Putnam site is a greenfield site in a semi-rural area. The region and the EIA are located within commuting distance of several large cities and the coast, and have been growing rapidly over the past several decades. Within the region, active residential/retirement /recreational and commercial developments, along with planned improvements to the areas transportation infrastructure are expected to result in continued urbanization that would have noticeable socioeconomic effects on the economy and residents of the EIA. The review team determined that cumulative socioeconomic effects of building new units at the Putnam site and the actions identified in Table 9-25 would not differ noticeably from the project effects analyzed above. Thus, the review team determined that the cumulative socioeconomic effects of the proposed project and other past, present, and reasonably foreseeable projects would be SMALL, with the following exceptions: Putnam County would experience MODERATE, but short-term and spatially limited impacts on roads and traffic during construction and SMALL impacts during operation. Cumulative impacts would be LARGE and beneficial from property tax receipts in Putnam County after the plant begins operations, and small and beneficial elsewhere in the region. The review team anticipates MODERATE long-term impacts on aesthetics along the transmission lines and corridors. Building new units at the Putnam site would be a significant contributor to the MODERATE impacts on roads and traffic. Building and operating the Putnam

site would be a significant contributor to MODERATE impacts on aesthetics along the transmission lines and corridors.

9.3.5.6 Environmental Justice

The review team used the approach in Section 2.6 in identifying significant minority and low-income populations. Figure 9-6 shows the distribution of minority populations of interest by census block group within the region. There are block groups with a concentration of minority populations distributed throughout the region, but as seen in these figures, no minority or low-income populations of interest are within 6 mi of the Putnam site. Most of these populations are at some distance from the Putnam site. The largest geographic area with a concentration of minority populations is to the south-southeast of the Putnam site extending to the border of the region. Figure 9-7 shows the distribution of block groups with concentrations of low-income populations of interest in the region. There are seven geographic clusters of block groups with concentrations of low-income residents distributed widely within the area defined by the region. The closest identified block groups with low-income populations of interest are farther than 6 mi from the Putnam site.

The physical effects of building activities (noise, fugitive dust, air emissions, traffic) would not impose a disproportionately high and adverse affect on minority or low-income populations of interest because the effects would be small and spatially limited, with none extending to the geographic area of the minority or low-income populations of interest. The review team investigated the presence of unique characteristics or practices in minority or low-income communities that could result in different socioeconomic impacts from the Putnam site compared to the general population and found one unique characteristics that could lead to disproportionate impacts: reliance on subsistence. Personnel from the Putnam County Health Department, Florida Department of Environmental Protection, and Florida Fish and Wildlife Commission were unable to provide data on subsistence behavior in the region (Putnam County 2009b).

The review team assumes that some subsistence fishing may take place along the St. John's River, in addition to the recreational fishing mentioned in Section 9.3.5.5, and in the lakes in the west and southwest of the county. The review team assumes that subsistence fishing activities may be affected by construction runoff or spills, perhaps requiring fishermen to use different locations. In the absence of specific information about effects on local lakes and streams that are used for subsistence fishing, the review team concludes provisionally that there may be disproportionately high and adverse effects on low-income populations that engage in subsistence fishing.

Minority and low-income populations would experience the minor adverse effects on housing availability, public services; and education, and the noticeable, intermittent, and geographically concentrated adverse effects on transportation discussed in Section 9.3.5.5 during the peak

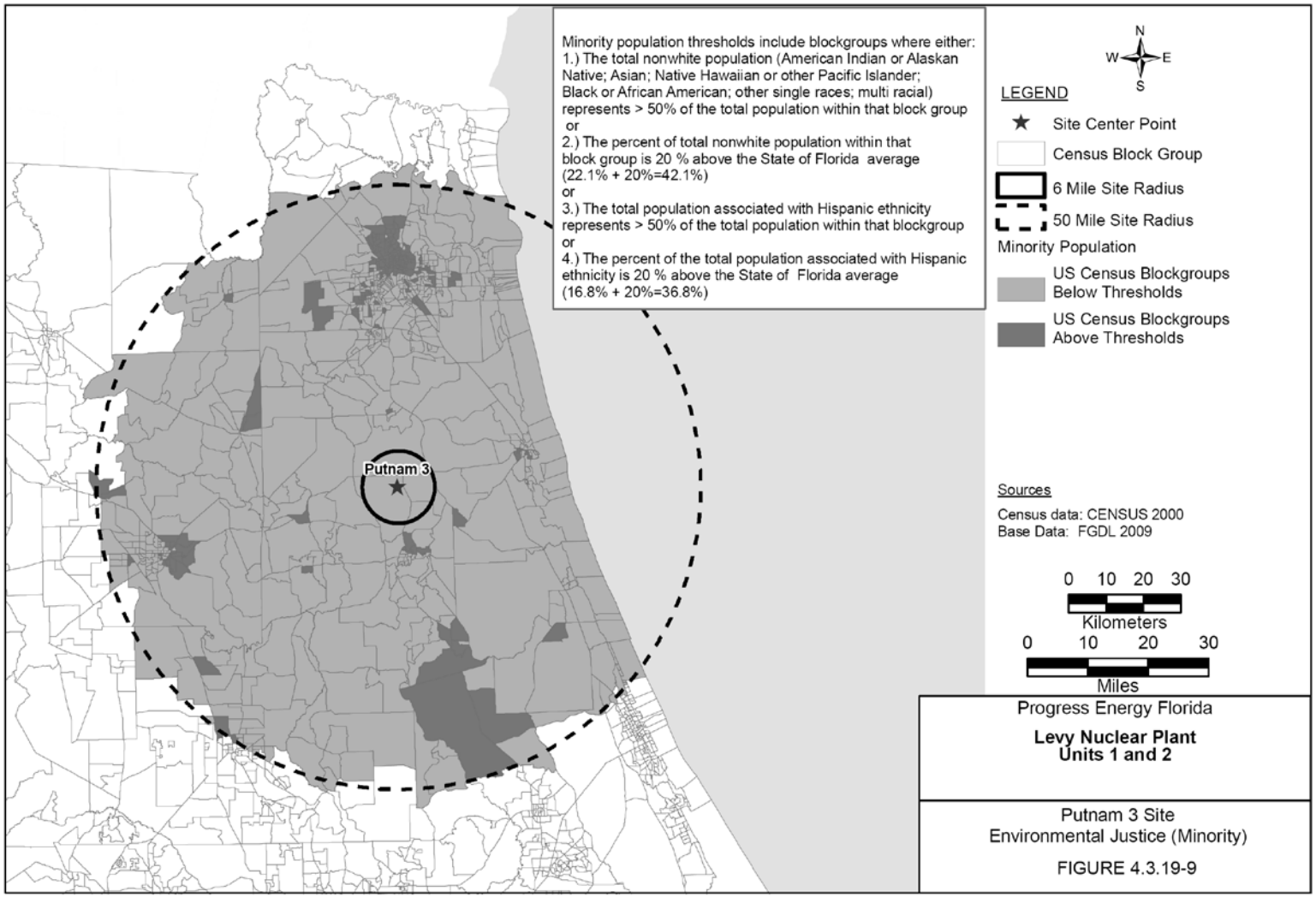

Figure 9-6. Putnam Site Minority Populations (PEF 2009d; CH2M Hill 2009)

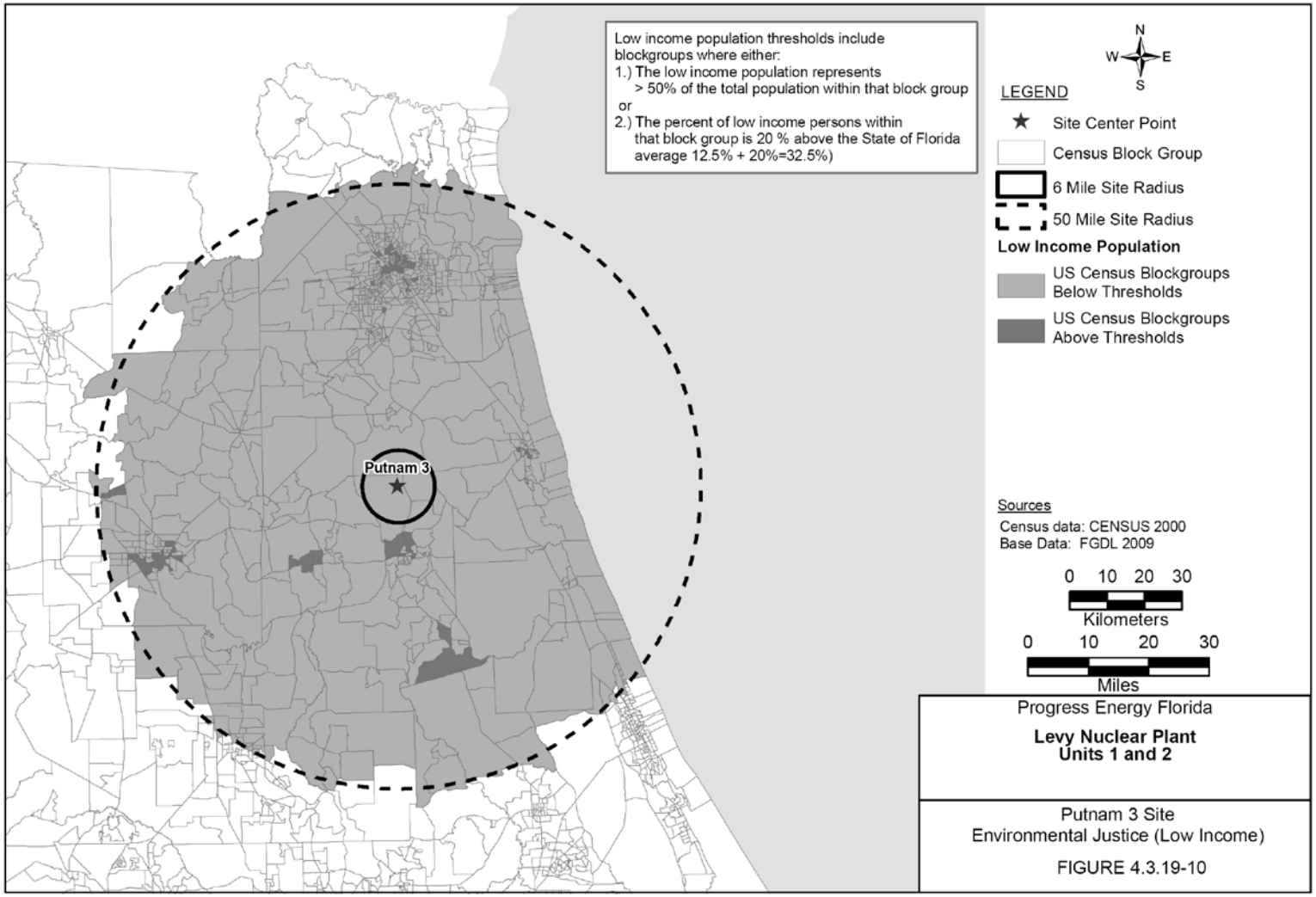

Figure 9-7. Putnam Site Low-Income Populations (PEF 2009d; CH2M Hill 2009)

workforce years. The review team has no evidence that impacts would be disproportionately high and adverse toward minority populations, nor toward low-income populations.

Cumulative Impacts

The building and operation of the proposed nuclear power plant at the Putnam site would be unlikely to have a disproportionately and adverse impact on minority or low-income populations due to physical impacts, economic impacts, or impacts on community infrastructure. With the exception of a potentially disproportionate MODERATE adverse impact on subsistence fishing, the review team expects that the impacts associated with the building and operation of two new units at Putnam on minority and low-income populations would be SMALL as discussed above. The review team concluded that, in addition to other past, present, and reasonably foreseeable future projects, building and operating two new nuclear units at Putnam would impose only a minor impact on minorities or low-income populations. Therefore, the environmental justice impacts would be SMALL, expect for subsistence fishing which may be MODERATE. Building and operating two units at the Putnam site would be a significant contributor to the MODERATE impact to subsistence fishing.

9.3.5.7 Historic and Cultural Resources

The following cumulative impact analysis includes building and operating two new nuclear generating units at the Putnam site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect historic and cultural resources, including the other Federal and non-Federal projects listed in Table 9-25. For the analysis of cultural impacts at the Putnam site, the geographic area of interest is considered to be the APE for this site. This includes the direct effects APE, defined as the area physically affected by the site-development and operation activities at the site and within the transmission–line corridors. The indirect effects APE is defined as the area visually affected and includes an additional 0.5-mi–radius APE around the transmission-line corridors and a 1-mi-radius APE around the cooling towers.

Reconnaissance activities in a cultural resource review have particular meaning. Typically, the activities include preliminary field investigations to confirm the presence or absence of cultural resources. However, in developing this EIS, the review team relied upon reconnaissance-level information to perform its alternative site evaluation in accordance with ESRP 9.3 (NRC 2000). Reconnaissance-level information is data that are readily available from agencies and other public sources. It can also include information obtained through visits to the site area. To identify the historic and cultural resources at the Putnam site, the following information was used:

- PEF ER (2009a)
- National Register of Historic Places database (NPS 2010)

- Florida Historical Markers Program (FDOS 2010)
- NRC Alternative Sites Visit October 14–17, 2008 (NRC 2009).

Historically, the Putnam site and vicinity were largely undisturbed and likely contained intact archaeological sites associated with the past 10,000 years of human settlement. Over time, the area has been disturbed by mostly agricultural development (PEF 2009a). In its ER, PEF states that an initial database search for potentially significant cultural resources in Putnam County identified NRHP-listed sites, and that further investigation would be required before siting new reactors at this location. PEF also states that consultation with the SHPO would occur if any significant historic, cultural, or archaeological resources are identified and that appropriate mitigation measures would be put in place before construction and operation.

A search of the National Register revealed 15 sites listed in Putnam County, including several historic districts – Palatka Ravine Gardens Historic District, Crescent City Historic District and Palatka South Historic District (NPS 2010). A search of the Florida Historical Markers Program revealed nine sites in Putnam County, including the CFBC and the Mount Royal Site, a Native American mound and earthworks site (FDOS 2010).

Building Impacts

To accommodate building two new nuclear generating units on the Putnam site, PEF would need to clear approximately 300 ac for the main power plant site (the same acreage needed for the LNP site) and 1282 ac for the reservoir (PEF 2009a). If the Putnam site were chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the SHPO, Tribes, and interested parties. The results would be used in the site-planning process to avoid cultural resources impacts. If significant cultural resources were identified by these surveys, the review team assumes that PEF would develop protective measures in a manner similar to that for the LNP site, and therefore the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing, excavation, and grading activities could destabilize important attributes of historic and cultural resources.

There are no existing transmission-line corridors connecting to the Putnam site. Section 9.3.5.1 describes the proposed transmission-line corridors associated with this site. Visual impacts from transmission lines may result in significant alterations to the visual landscape within the geographic area of interest. If the Putnam site were chosen for the proposed project, the review team assumes that PEF would conduct its transmission line-related cultural resource surveys and procedures in a manner similar to that for the LNP site, as described in Section 4.6. In addition, the review team assumes the State of Florida's Conditions of Certification regarding transmission-line siting and building activities would also apply, and therefore the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing,

excavation, and grading activities could destabilize important attributes of historic and cultural resources.

Operations Impacts

Impacts on historic and cultural resources from operation of two new nuclear generating units at the Putnam site would include those associated with the operation of new units and maintenance of transmission lines. The review team assumes that the same procedures currently used by PEF, including the State of Florida's Conditions of Certification, would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of the two new units and associated impacts on the cultural resources would be negligible for the physical and visual APEs.

Cumulative Impacts

Past actions in the geographic area of interest that have similarly affected historic and cultural resources include rural development and agricultural development and activities associated with these land-disturbing activities such as road development. Table 9-25 lists past, present, and reasonably foreseeable projects and other actions that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest. Projects from Table 9-25 that may fall within the geographic area of interest for cultural resources include future urbanization.

Long linear projects such as new or expanded roads may intersect the proposed transmission-line corridors. Because cultural resources can likely be avoided by long linear projects, impacts on cultural resources would be minimal. If building associated with such activities results in significant alterations (both physical alteration and visual intrusion) of cultural resources in the transmission-line corridors, then cumulative impacts on cultural resources would be greater.

Cultural resources are nonrenewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that the cumulative impacts from building and operating two new nuclear generating units on the Putnam site and other projects would be SMALL. This impact-level determination reflects no known cultural resources that could be affected; however, if the Putnam site were to be developed then cultural resource surveys and evaluations would need to be conducted and PEF would assess and resolve adverse effects of the undertaking. Adverse effects could result in greater cumulative impacts.

9.3.5.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affected or could affect air quality, including the shutdown of two coal-fired units at CREC, and other Federal and non-Federal projects listed in Table 9-25. The geographic area of interest for

the Putnam site is Putnam County, which is in the Jacksonville (Florida)-Brunswick (Georgia) Interstate Air Quality Control Region (40 CFR 81.91).

The emissions related to building and operating a nuclear plant at the Putnam site would be similar to those at the LNP site. The air quality status for Putnam County as set forth in 40 CFR 81.310 reflects the effects of past and present emissions from all pollutant sources in the region. Putnam County is classified as being in attainment for all NAAQSs.

The atmospheric emissions related to building and operating a nuclear plant at the LNP site in Levy County, Florida are described in Chapters 4 and 5. The criteria pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of criteria pollutants at the LNP site were evaluated and also determined to have a SMALL impact.

Cumulative impacts

Reflecting on the projects listed in Table 9-25, the most significant in regard to air quality are the Seminole Generating Station, which consists of two coal-fired boilers, and the Putnam Steam Plant, which consists of four combustion turbines fueled with either natural gas or fuel oil. Other industrial projects listed in Table 9-25 would have *de minimis* impacts. The impact of closing two coal-fired units at CREC on criteria pollutants at the Putnam site are not considered because the CREC is located outside of the geographic area of interest for this site. Given that these projects would be subject to institutional controls, it is unlikely that the air quality in the region would degrade to the extent that the region would be declared to be in non-attainment for any of the NAAQSs.

The air quality impact of Putnam site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air quality impacts. There are no land uses or projects, including the aforementioned sources at the Seminole Generating Station and Putnam Steam Plant, that would have emissions during site development that would, in combination with emissions from the Putnam site, result in a degradation of air quality in the region.

Releases from the operation of two new units at the Putnam site would be intermittent and made at low altitudes with little or no vertical velocity. The air quality impacts of current emissions near the Putnam site are included in the baseline air quality status. The cumulative impacts from emissions of effluents from the Putnam site and other sources would be noticeable, primarily due to emissions from the Seminole Generating Station and the Putnam Steam Power Plant.

The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in Section 7.6. The impacts of the emissions are not sensitive to the location of the source. Consequently, the discussion in Section 7.6 is applicable to a nuclear power plant located at the Putnam site. The review team concludes that the national and worldwide cumulative impacts of greenhouse gas emissions are noticeable. The review team further concludes that the

cumulative impacts would be noticeable, with or without the greenhouse gas emissions of the project at the Putnam site.

Cumulative impacts on air quality resources are estimated based on the information provided by PEF and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for greenhouse gas emissions) that could affect air quality resources. The cumulative impacts on criteria pollutants from emissions from the Putnam site and other projects could be noticeable, principally as a result of the contribution of the coal-fired units at the Seminole Generating Station and the Putnam Steam Power Plant. The national and worldwide cumulative impacts of greenhouse gas emissions are noticeable, and the review team concludes that cumulative impacts from construction, preconstruction, and operation and other past, present, and reasonably foreseeable future actions on air quality resources in geographic areas of interest would be SMALL to MODERATE for criteria pollutants (due primarily to the operation of the Seminole Generating Station) and MODERATE for greenhouse gas emissions. The incremental contribution of impacts on air quality resources from building and operating two new units at the Putnam site would be insignificant for both criteria pollutants and greenhouse gas emissions.

9.3.5.9 Nonradiological Health

The following analysis assesses impacts from building activities and operations for the Putnam site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect nonradiological health, including the other Federal and non-Federal projects listed in Table 9-25. Impacts from building activities that have the potential to affect the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to affect the health of members of the public and workers includes exposure to etiological agents, noise, EMFs, and increased traffic associated with the transport of workers to and from the site.

Most of the nonradiological health impacts associated with building and operation (e.g., air emissions, noise, occupational injuries) would be limited to areas within approximately 2 mi from the site. Occupational injuries would occur only within the boundaries of the site, and noise from construction and operation has likewise been assessed as minimal for offsite receptors beyond a 2-mi radius. For nonradiological health impacts associated with transmission lines, the geographic area of interest would be the transmission-line corridor. If the facility were built and operated at the Putnam site, the St. Johns River would serve as the source of cooling water. In addition, a reservoir would need to be built to assure an adequate cooling-water supply.

Building Impacts

Nonradiological health impacts on construction workers and members of the public from building two new nuclear units at the Putnam site would be similar to those evaluated in Section 4.8 for building at the LNP site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and transportation accidents, injuries, and fatalities. A detailed noise study has not been performed for the Putnam site, but it is likely that noise impacts from building, except for rare, high-noise activities such as pile-driving, would comply with Federal, State and local noise ordinances, and that the overall noise impact associated with building would be minimal. Fugitive dust and vehicle emissions during building would be controlled by good management practices and compliance with Federal, State, and local air quality regulations. The incidence of construction worker accidents would be the same as that for the LNP site, the only difference being potential injuries associated with building of the cooling-water reservoir.

Analyses in Section 9.3.5.5 indicated that noticeable but intermittent traffic impacts would be observed during peak building activities at the Putnam site at the intersection of US-17 and the site access road. These impacts would be of the same magnitude as those predicted for building at the LNP site. Given the existing traffic patterns in the area near the Putnam site, there is little potential for cumulative traffic impacts with other projects, and additional injuries and fatalities from traffic accidents involving transportation of materials and personnel for building of a new nuclear power plant at the Putnam site would be similar to those estimated in Section 4.8.3 for building at the LNP site.

Because all of the past, present, or potential future construction projects identified in Table 9-25 are relatively distant (greater than 10 mi) from the Putnam site, combined nonradiological impacts from building at the Putnam site and other projects would not occur. Cumulative impacts of building at the Putnam alternative site would therefore be minimal.

Operational Impacts

Noise, air emissions, and occupational injuries from the operation of two new nuclear units at the Putnam site would be similar to those evaluated in Section 5.8 for the LNP site. Occupational health impacts on workers (e.g., falls, electric shock or exposure to other hazards) at the Putnam site would likely be the same as those evaluated for workers at two new units operating at the LNP site. The cooling-system discharge from the facility might encourage the growth of etiologic organisms in the St. Johns River. Etiological agent growth could be reduced by the use of biocides in the cooling systems, thermal discharge would be restricted by NPDES permit limitations, and exposure to impaired water would be limited by controls on access to the discharge zone (fencing, signage, and other security measures). However, because the cooling-system discharge may amount to a significant proportion of the recommended minimum flow in the St. Johns River, and water quality in the river has been identified as impaired due to the presence of nutrients, fecal coliform, depressed dissolved oxygen, turbidity, and other pollutants

(FDEP 2009h), the review team has concluded that the discharge of blowdown to the river could have a noticeable effect on the growth of etiological agents. Exposure to etiological agents in the cooling-water reservoir would not pose an additional health risk as long as access to the reservoir is limited by virtue of its being within the controlled and fenced site boundaries.

Noise and EMF exposure from operations would be monitored and controlled in accordance with applicable OSHA regulations. Although no detailed noise modeling has been performed for the Putnam site, it is likely that noise impacts would be similar to those predicted for operations at the LNP site. The effects of EMF on human health in the transmission-line corridors would be controlled and minimized by conformance with NESC criteria and adherence to the standards for transmission systems regulated by the FDEP. Nonradiological impacts of traffic associated with the operations workforce would therefore be less than the impacts during building.

A number of the projects and activities identified in Table 9-25 (surface mining, minor permitted municipal discharges) may also affect water quality in the St. Johns River near the Putnam site. However, these releases are unlikely to have significant cumulative impacts on water quality with a nuclear facility built at the Putnam site because all of the current and future projects are distant from the site. In addition, the amounts of chemicals released from the nuclear facility would be limited by NPDES permits to levels that would not adversely affect water quality, even in combination with the existing pollutant load in the St. Johns River. As noted above, however, blowdown discharge may result in increased water temperature that could facilitate the growth of etiological agents.

The review team is also aware of the potential climate changes that could affect human health; recent analyses of these issues (GCRP 2009) have been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature and a decrease in precipitation, which may alter the presence of microorganisms and parasites in surface water. While the overall impacts of climate change may not be insignificant (see Section 7.7), the effect of, or contribution to, climate change impacts by the operation of two new units at the Putnam site is likely to be minor. In its analysis of climate change impacts, the review team did not identify any additional data that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases associated with operation of a nuclear facility at the Putnam site.

Summary

The assessment of impacts on nonradiological health from building and operation of the two new units at the Putnam alternative site is based on the information provided by PEF and the review team's independent evaluation. The review team concludes that nonradiological health impacts on workers and the public resulting from building two new units and associated transmission lines at the Putnam alternative site would be minimal. Similarly, the review team also expects occupational injuries and other nonradiological health impacts on workers and the public of two new nuclear units operating at the Putnam site would be minimal except for

potential growth of etiological agents in the St. Johns River from the influence of the cooling-system blowdown discharges during droughts or low-flow periods. These effects could be reduced if the blowdown were discharged to the cooling reservoir, rather than directly to the river. Exposure to etiological agents could be increased if access to the cooling reservoir is not limited by physical and administrative controls. Based on these findings, the review team concludes that cumulative impacts on nonradiological health from related past, present, and future actions in the geographic area of interest and building and operations of two nuclear units at the Putnam site would be SMALL to MODERATE. The severity of impacts would depend on the design characteristics of the facility, which have not been fully defined. If exposure to water heated by thermal discharge is not limited by administrative of physical controls, the contribution from building and operations at the Putnam site could be a significant contributor to the cumulative nonradiological health impacts.

9.3.5.10 Radiological Impacts of Normal Operations

The following impact analysis includes radiological impacts from building activities and operation for two additional nuclear units at the Putnam site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects listed in Table 9-25. As described in Section 9.3.5, the Putnam site is a greenfield site. The geographic area of interest is the area within a 50-mi radius of the Putnam site. There are no major facilities that result in regulated exposures to the public or biota within 50 mi of the Putnam site. However, there are likely to be hospitals and industrial facilities with 50 mi of the Putnam site that use radioactive materials.

The radiological impacts of building and operating the proposed two AP1000 units at the Putnam site include direct radiation and liquid and gaseous radioactive effluents. Releases of radioactive materials and all pathways of exposure would produce low doses to people and biota offsite, well below regulatory limits. The impacts are expected to be similar to those estimated for the LNP site. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Putnam site. This conclusion is based on the radiological monitoring programs conducted around currently operating nuclear power plants.

Based on the information provided by PEF and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the two proposed AP1000 units and other past, present, and reasonably foreseeable projects and actions in the geographic area of interest around the Putnam site would be SMALL.

9.3.5.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for two nuclear units at the Putnam site. The analysis also considers other past,

present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including other Federal and non-Federal projects and the projects listed in Table 9-24. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Putnam site. As described in Section 9.3.5, the Putnam site is less 100 mi from the existing CREC power plant site; there is one nuclear facility at the CREC site. There are no proposed reactors that have the potential to increase the probability-weighted consequences from a severe accident at any location within 50 mi of the Putnam site.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the LNP site would be minimal for AP1000s. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet the NRC safety criteria. The AP1000 design is independent of site conditions and the meteorological conditions of the Putnam and LNP sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Putnam site would be minimal.

Assuming the meteorology, population distribution, and land use for the Putnam site are similar to those at the LNP site, risks from a severe accident for an AP1000 reactor located at the Putnam site are expected to be similar to those analyzed for the LNP site. These risks for the LNP site are presented in Tables 5-17 and 5-18 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For the existing plant within the geographic area of interest, namely CREC Unit 3, the Commission has determined that the probability-weighted consequences of severe accidents are SMALL (10 CFR Part 51, Appendix B, Table B-1). The planned 20-percent power uprate at CREC Unit 3 will only be approved by the NRC if the probability-weighted consequences of severe accidents would continue to meet NRC's regulatory requirements. Therefore, the impact would continue to be SMALL. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Putnam site would be SMALL.

9.3.6 Comparison of the Impacts of the Proposed Action and Alternative Sites

This section summarizes the review team's characterization of the cumulative impacts related to locating a two-unit AP1000 nuclear power facility at the proposed LNP site and at each alternative site. The four sites selected for detailed review as part of the alternative sites environmental analysis are the Crystal River, Dixie, Highlands, and Putnam sites in Florida. Comparisons are made between the proposed and alternative sites to evaluate if one of the alternative sites would be environmentally preferable to the proposed site. The NRC's determination is independent of the USACE's determination of a LEDPA pursuant to the Clean Water Act Section 404(b)(1) Guidelines at 40 CFR Part 230. While the USACE concurs as part of the review team with the designation of impact levels for terrestrial or aquatic resource areas

in this EIS; in so far as waters of the United States are concerned, the USACE must conduct a quantitative comparison of impacts on waters of the United States as part of the LEDPA analysis. The USACE will conclude its analysis of both offsite and onsite alternatives in its Record of Decision. The need to compare the proposed site with alternative sites arises from the requirement in Section 102(2)(c)(iii) of NEPA (42 USC 4332) that EISs include an analysis of alternatives to the proposed action. The NRC criteria to be used in assessing whether a proposed site is to be rejected in favor of an alternative site is based on whether the alternative site is "environmentally preferable" and if so whether it is "obviously superior" to the site proposed by the applicant (Public Service Company of New Hampshire 1977). An alternative site is "obviously superior" to the proposed site if it is "clearly and substantially" superior to the proposed site (Rochester Gas & Electric Corp. 1978). The standard of obviously superior "...is designed to guarantee that a proposed site will not be rejected in favor of an alternate unless, on the basis of appropriate study, the Commission can be confident that such action is called for" (New England Coalition on Nuclear Pollution 1978).

The "obviously superior" test is appropriate for two reasons. First, the analysis performed by the NRC in evaluating alternative sites is necessarily imprecise. Key factors considered in the alternative site analysis, such as population distribution and density, hydrology, air quality, aquatic and terrestrial ecological resources, aesthetics, land use, and socioeconomics are difficult to quantify in common metrics. Given this difficulty, any evaluation of a particular site must have a wide range of uncertainty. Second, the applicant's proposed site has been analyzed in detail, with the expectation that most adverse environmental impacts associated with the site have been identified. The alternative sites have not undergone a comparable level of detailed study. For these reasons, a proposed site may not be rejected in favor of an alternative site when the alternative site is marginally better than the proposed site, but only when it is obviously superior (Rochester Gas & Electric Corp. 1978). NEPA does not require that a nuclear plant be constructed on the single best site for environmental purposes. Rather, "...all that NEPA requires is that alternative sites be considered and that the effects on the environment of building the plant at the alternative sites be carefully studied and factored into the ultimate decision (New England Coalition on Nuclear Pollution 1978)."

Section 9.3.6.1 reviews the cumulative environmental impacts of building and operating a two-unit nuclear power plant at the proposed LNP site. Cumulative impact levels from Chapter 7 (for the proposed LNP site), and the four alternative sites (from Sections 9.3.2 through 9.3.5) are listed in Table 9-31. Section 9.3.6.2 and Section 9.3.6.3 discuss the cumulative impacts of the proposed project located at the LNP site and at the alternative sites as they relate to a determination of environmental preference or obvious superiority.

Table 9-31. Comparison of Cumulative Impacts at the Proposed and Alternative Sites

Resource Area	Levy	Crystal River	Dixie	Highlands	Putnam
Land Use	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Water Related					
Surface-Water Use	SMALL	SMALL	MODERATE	MODERATE	MODERATE
Surface-Water Quality	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Groundwater Use	SMALL	SMALL	SMALL	SMALL	SMALL
Groundwater Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Ecology					
Terrestrial Ecosystems	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic Ecosystems	SMALL	SMALL	MODERATE	SMALL	SMALL
Socioeconomic[(a)]					
Physical	SMALL	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL	SMALL	SMALL
Taxes and Economy	SMALL (adverse) to LARGE (beneficial)	SMALL to MODERATE (beneficial)	LARGE (beneficial)	LARGE (beneficial)	LARGE (beneficial)
Housing	SMALL	SMALL	SMALL	SMALL	SMALL
Transportation	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Public Services and Education	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL
Aesthetics	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Recreation	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL	MODERATE	SMALL to MODERATE
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Nonradiological Health	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Radiological Health	SMALL	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	SMALL	SMALL	SMALL	SMALL	SMALL

(a) Ranges indicate differences in counties

9.3.6.1 Comparison of Cumulative Impacts at the Proposed and Alternative Sites

The following section summarizes the review team's independent assessment of the proposed and alternative sites. The team characterized the expected cumulative environmental impacts of building and operating new units at the LNP site and alternative sites; these impacts are summarized by resource area in Table 9-31.

The environmental resource areas listed in the following table have been evaluated using the NRC's three-level standard of impact significance: SMALL, MODERATE, or LARGE. These levels were developed using the CEQ guidelines and set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Full explanations of the specific cumulative impact characterizations are provided in Chapter 7 for the proposed site and in Sections 9.3.2, 9.3.3, 9.3.4, and 9.3.5 for the alternative sites. The staff's impact category levels are based on professional judgment, experience, and consideration of controls likely to be imposed under required Federal, State, or local permits that would not be acquired until an application for a COL is underway. The considerations and assumptions were similarly applied at each of the alternative sites to provide a common basis for comparison. In the following discussion, the review team compares the impact levels between the proposed site, and each alternative site.

9.3.6.2 Environmentally Preferable Sites

As shown in Table 9-31, the cumulative impacts of building and operating two new units at the proposed site and the alternative sites are characterized as SMALL for many resource areas. The resource areas for which the impact level at an alternative site is the same as that for the proposed site does not contribute to the alternative site being judged to be environmentally preferable to the proposed site. Therefore, these resource areas are not discussed further in determining whether an alternate site is environmentally preferable to the proposed site. The resource areas for which an alternative site has a different impact level than the proposed site are discussed further to determine if an alternative site is environmentally preferable to the proposed site. Where there is a range of impacts for a resource, the upper value of the impacts is used for the comparison. In addition, for the cases in which the cumulative impacts for a resource are greater than SMALL, consideration is given to those cases in which the impacts of

the project at the specific site do not make any significant contribution to the cumulative impact level. As shown in Table 9-31, there are some differences in impacts among the sites.

Crystal River Site

The LNP site is characterized more favorably than the Crystal River site in Table 9-31 for the resource areas of taxes and air quality. The Crystal River site is characterized more favorably than the LNP site for transportation. For taxes, the LARGE beneficial impact at the LNP site would be due to NRC-authorized construction. Building and operating two new nuclear units at the site would contribute significantly to the higher beneficial impact level. This difference favors the LNP site.

Regarding air quality, PEF has committed to stop operating CREC Units 1 and 2, two coal-fired plants, if LNP Units 1 and 2 commence commercial operation in a timely manner. NRC assumes this same commitment would apply if PEF constructs the proposed new units at the Crystal River Alternate Site. The MODERATE impact at the Crystal River site relates to criteria pollutants in the geographic area of interest resulting from the continuing operation of the two remaining coal units at CREC, Units 4 and 5, and as a result of greenhouse gas emissions, both of which are effects from projects other than the nuclear units. Nuclear plants do not contribute significantly to air quality impacts. So the apparent difference in the impacts for this resource is not meaningful in terms of the proposed action.

For land use, terrestrial ecosystems, public services and education, and aesthetics at both sites, the project would be a significant contributor to the incremental MODERATE impact level. Ongoing and planned development projects at these sites also contribute to the impact level. For transportation, the MODERATE cumulative impact at the LNP site relates to the combined impact of the large construction and preconstruction work forces and traffic from mining activities.

Based on the results and comparison of the resource areas and associated impact characterizations, the review team concludes that the Crystal River site would not be environmentally preferable to the LNP site for two new nuclear generating units.

Dixie Site

The LNP site is characterized more favorably than the Dixie site in Table 9-31 for the resource areas of surface-water use, surface-water quality, aquatic ecosystems, transportation, and air quality. Conversely, the Dixie site is not characterized by the review team as more favorable than the LNP site in Table 9-31 for any resource area. For all of the resource areas for which the LNP site is characterized more favorably, except air quality, the differences relate directly to the impacts of the proposed project at the two sites. For air quality, the higher impact at the Dixie site relates to other projects and NRC-authorized construction would not contribute significantly to the impact level. For land use, terrestrial ecosystems, and aesthetics, building

and operating two new nuclear units would be a significant contributor to the MODERATE impact levels at both sites.

Based on the results and comparison of the resource areas and associated impact characterizations, the review team concludes that the Dixie site would not be environmentally preferable to the LNP site for two new nuclear generating units.

Highlands Site

The LNP site is characterized more favorably than the Highlands site in Table 9-31 for the following resource areas: surface-water use, transportation, environmental justice, and air quality. Conversely, the Highlands site is characterized by the review team as more favorable than the LNP site in Table 9-31 for the resource areas of public services and education.

For surface-water use, building and operating the proposed plant at the Highlands site would be a significant contributor to water use because the amount of water needed to operate two units would represent a significant portion of the river flow. For transportation, the MODERATE impact at the Highlands site is because Highlands is a greenfield site in a rural area with no existing facilities to share with new units. The higher impact level for environmental justice at the Highlands site relates to potential effects from subsistence fishing and construction of transmission lines along the conceptual corridor. For air quality at the Highlands site, the MODERATE impacts are based on the effects of projects other than the nuclear units. Nuclear plants don't contribute significantly to air quality impacts. So the apparent difference in impact for this resource is not meaningful in terms of the proposed action.

For public services and education at the LNP site, the MODERATE impact level is a result of short-term adverse effects on police, emergency service, fire-protection services, and schools in specific local communities during peak construction and preconstruction. The review team's finding of a MODERATE impact for the two resource areas at the LNP site is based on the fact that specific community public services were either at capacity or otherwise limited. The higher impact level for public services and education at LNP is directly related to peak construction and preconstruction of two new nuclear units at the site.

For land use at Highlands, building two new reactor units at the site is a significant contributor to the MODERATE impact assessment because of the disturbance of a substantial amount of land for the power plant, reservoir, and transmission lines. The review team concluded that cumulative land-use impacts also are MODERATE at the LNP site, but would not contribute significantly to the impact level because the higher impact level is based on the effects of projects other than the nuclear units. For terrestrial ecosystems at both sites, the MODERATE impacts are based on the alteration of natural habitats.

Based on the results and comparison of the resource areas and associated impact characterizations, the review team concludes that the Highlands site would not be environmentally preferable to the LNP site for two new nuclear generating units.

Putnam Site

The LNP site is characterized more favorably than the Putnam site in Table 9-31 for the following resource areas: transportation, environmental justice, and air quality. Conversely, the Putnam site is characterized more favorably than the LNP site in Table 9-31 for public services and education.

For the resource areas for which the LNP is characterized more favorably, building and operating two new nuclear units at the Putnam site would not contribute significantly to the higher impact level. At the Putnam site, the MODERATE impact for transportation is related to short-term impacts on roads and traffic from project construction and preconstruction as well as mining activities. For environmental justice, the MODERATE level is based on a potentially disproportionate impact on subsistence fishing. The primary reason for the MODERATE impact for air quality at the Putnam site is related to emissions from other projects. Nuclear plants don't contribute significantly to air quality impacts. So the apparent difference in air quality impacts between the two sites is not meaningful in terms of the proposed action.

At the LNP site, the review team's finding of a MODERATE impact assessment for public services and education is based on the fact that, during construction, existing community public services would be stressed because they are at capacity or otherwise limited. Operating two new units at the LNP site would not contribute significantly to long-term public service and education impacts.

For land use, terrestrial ecosystems, and aesthetics, although the two sites have essentially the same cumulative impact levels, building and operating two new nuclear units would be a significant contributor to the impact level at the Putnam site. This is because of the substantial amount of land needed for the proposed power plant, supplemental cooling reservoir, and transmission infrastructure and the long-term impacts along transmission lines and corridors.

Based on the results and comparison of the resource areas and associated impact characterizations, the review team concludes that the Putnam site would not be environmentally preferable to the LNP site for two new nuclear generating units.

Summary

Although there are differences and distinctions between the cumulative environmental impacts of building and operating two new nuclear generating units at the proposed LNP site and the alternative sites, the review team concludes that none of these differences is sufficient to determine that any of the alternative sites would be environmentally preferable to the proposed site for building of two new nuclear generating units.

9.3.6.3 Obviously Superior Sites

None of the alternative sites was determined to be environmentally preferable to the proposed LNP site. Therefore, the NRC staff concludes that none of the alternative sites would be obviously superior to the LNP site. As discussed in Section 9.0, the USACE will conclude its analysis of both offsite and onsite alternatives in its Record of Decision.