Harris Advanced Reactor (HAR)
Section 404(b)(1) Alternatives Analysis
Revision 1
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Prepared for:

Progress Energy

Raleigh, North Carolina

US Army Corps of Engineers®

Wilmington District

Prepared by:

Environmental Services, Inc.
Raleigh, North Carolina
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Executive Summary

Progress Energy Carolinas, Inc., (PEC) is proposing to add two Westinghouse AP 1000 advanced nuclear reactors to the Shearon Harris Nuclear Power Plant site (Harris site) to meet growing demand for electrical power in its primary customer region. As part of the approval process with the Nuclear Regulatory Commission (NRC), PEC has also completed an Environmental Report (ER) for the Shearon Harris Nuclear Plant Units 2 and 3 Combined Operating License (COL) application.

PEC has evaluated a number of alternatives for achieving new baseload generation that is reliable and proximate to PEC's major customer base. The no-action alternative would not meet the stated purpose and need and was eliminated from consideration. Non-nuclear alternative energy sources were evaluated and found to not meet the stated purpose and need and were eliminated from further consideration. PEC evaluated 11 sites for potential use for adding the nuclear baseload required to meet purpose and need; 7 of these sites were eliminated through exclusionary criteria during the siting study. Of the four carried forward for further consideration (Marion site, Robinson site, Brunswick site, and Harris site), the Harris site was selected as the applicant's preferred alternative based on results of PEC's technical evaluation, strategic considerations, and transmission study.

Review of potentially adverse impact on the aquatic ecosystem indicated that the Marion site and Robinson site both would result in substantially greater impacts to wetlands and streams compared to the preferred alternative, the Harris site, both for construction of drought mitigation reservoirs and for transmission line upgrades. Neither the Marion nor the Robinson site constitute an environmentally preferred alternative to the Harris site based on the greater environmental impacts to the aquatic ecosystem. The Marion and Robinson sites were dropped from further evaluation.

The Brunswick alternative would result in greater impact to wetlands through conversion of forested wetlands to herbaceous wetlands along the new transmission line upgrades than the Harris alternative would impact though inundation and conversion of wetland habitats to lake habitats through reservoir expansion and conversion of forested wetlands along the new transmission line upgrades. However, the Harris site would result in greater impacts to streams through inundation by the expanded reservoir and conversion of intermittent and perennial stream habitats to lake habitats. Because neither alternative provided a clearly preferable environmental alternative based on potential impacts to the aquatic ecosystem, the Brunswick site was carried forward for more detailed evaluation against the Harris site.

No other significant adverse environmental consequences were identified among the other public interest factors for either the Harris or Brunswick sites, other than for potential for impacting endangered and threatened species. The Brunswick alternative has greater potential adverse impacts to habitat for the federally endangered red-cockaded woodpecker along the new transmission line upgrades, and potential adverse impacts

through increased incidental take of federally threatened and endangered sea turtles within the intake canal as flows are increased to provide water for the new units.

Based on the difference in types of aquatic ecosystem impacts and the difference in functions lost or gained, the Brunswick alternative does not constitute an alternative demonstrating less adverse impact on the aquatic ecosystem in comparison to the preferred alternative, the Harris site. Because the Harris site has the least overall impact on the aquatic environment and no other significant adverse environmental consequences, the Harris site is the least environmentally damaging preferred alternative.

I. Proposed Action

A. Project Background Information

Progress Energy Carolinas, Inc., (PEC) is proposing to add two Westinghouse AP 1000 advanced nuclear reactors to the Shearon Harris Nuclear Power Plant site (Harris site) to meet growing demand for electrical power in its primary customer region. As part of the approval process with the Nuclear Regulatory Commission (NRC), PEC has also completed an Environmental Report (ER) for the Shearon Harris Nuclear Plant Units 2 and 3 Combined Operating License (COL) application. The two units will be referred to as HAR-2 and HAR-3, respectively, in this document. The existing Shearon Harris Nuclear Power Plant Unit 1 will be referred to as HNP is this document. The ER provides detailed information on the proposed plan to add two advanced nuclear reactors to the existing Harris site. Also provided in the ER is information resulting from a proprietary siting study conducted in 2006 that identified potential sites and assessed each against numerous parameters to identify the four alternative sites described herein.

PEC is committed to a long-term, balanced solution to meeting growing energy needs – a solution that includes three main components: (1) increased energy efficiency; (2) investments in renewable energy sources and other emerging energy technologies; and (3) upgrading of existing power plants and investments in new plants when needed.

B. Proposed Action

PEC proposes to install two advanced nuclear reactors at the Harris site. The Harris Advanced Reactor (HAR) project includes the construction of the facility itself, the construction of an intake structure and pipeline to supply make-up water from the Cape Fear River, placement of a second make-up discharge structure within Harris Lake, upgrades to transmission lines and roadways, and increasing the normal pool elevation of Harris Lake from 220 feet NGVD29 to 240 feet NGVD29 to mitigate potential impacts to downstream users of the Cape Fear River from drought conditions.

C. Specific Activity Requiring Department of the Army Permit

The discharge and intake structures constitute activities that may be considered water dependent. The remaining activities involve unavoidable impacts to jurisdictional wetlands and streams that are subject to the rebuttable presumption concerning non-water dependent activities pursuant to Section 404 regulations under the Clean Water Act (CWA). The purpose of the 404(b)(1) Guidelines is to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredge or fill material. Direct discharges of dredge or fill material will result only from the construction of the HAR-3 cooling tower, intake structures, and temporary discharges associated with the makeup water pipeline. The inundation of wetlands and streams around Harris Lake is not a direct discharge of dredge or fill material, but will result in a conversion of habitat type and specific function through flooding, including conversion of upland areas to waters of the United States.

D. Analysis Methodology

The primary sources of information summarized within this analysis are the COL Application Environmental Report (COLA ER) and a proprietary siting study (PEC 2006). Information from these sources as well as additional information obtained from other PEC documents and supplemented by other available information from various sources was used to summarize potential impacts (direct, secondary, and cumulative) to resources that may be reviewed by the U.S. Army Corps of Engineers (USACE) to determine the least environmentally damaging practicable alternative (LEDPA).

The primary consideration of this analysis was to summarize potential impact on the aquatic ecosystem as well as other potential environmental consequences. Direct impacts considered included potential siting location of the new facility, new or expanded cooling water sources, intake pipes, and related infrastructure improvements including new or relocated roads and transmission lines. This analysis also includes potential impacts on the following parameters, consistent with the 404(b)(1) guidelines: conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and in general, the needs and welfare of the people. Non-nuclear alternatives and alternative sites were reviewed for practicability for meeting purpose and need; alternatives not meeting purpose and need or determined to be impracticable, or determined to result in greater adverse impact on the aquatic ecosystem than the preferred alternative were eliminated from further consideration at appropriate stages in the evaluation, as described in the following sections.

Desktop evaluation techniques and limited field evaluations were employed to supplement information available in the COLA ER and siting study to assist with identifying potential impacts to aquatic resources and other public interest factors. GIS and Data Management Tasks were completed using MS Access GeoDatabases and ESRI ArcGIS software with Spatial Analyst and 3D Analyst Extensions. The goal of this evaluation was to derive comparisons of the environmental factors at each of the four alternative sites carried forward from the siting study and COLA ER. This study was undertaken at three different levels of resolution: 400-acre potential power block impact zones, localized watersheds, and transmission lines.

Additional data were collected for the purpose of determining potential impacts to wetlands and streams. Following compilation and preliminary review of available GIS data, limited field evaluations were undertaken to refine the GIS-based aquatic resource impact estimates. Based on training data collected in the field, the estimated location and extent of wetlands were refined for comparable areas exhibiting similar landform, soils, vegetation, and hydrologic influence. Wetland habitats were characterized by the North Carolina Wetlands Assessment Method dichotomous key for determining wetland types to facilitate comparison. Following refinement of wetlands approximations, site visits

were conducted to review general accuracy at sites that had not been visited previously, with collection of additional training data as needed for further refinement of approximations. A field visit was held on August 18, 2009 with the USACE to review methodology and preliminary results of the wetland approximations.

A 400-acre project study area (power block) serves as a surrogate for onsite impacts that may result from build-out of the nuclear facility as well as attendant onsite infrastructure needs. To estimate impacts for the 400-acre potential power block area, the latitude and longitude coordinates for the alternative sites were provided by PEC and 400-acre circles were created outward from each of the center points. Data were extracted and quantified in Geodatabases from National Hydrology High Resolution Dataset, National Wetlands Index Wetlands and Watershed Polygons, USGS Land Use Land Cover Grids, and the National Resources Conservation Service SSURGO Soils. These data were overlaid onto USGS Topographic Digital Raster Graphics and 2008 National Aerial Imagery Program 1 meter Orthoquads, and supplemented by USGS National Map Seamless Server LiDAR derived elevation files to develop a general picture of site condition. FEMA Flood data were not used for comparisons due to unavailability for Marion County.

Volume and flood data for cooling water supply expansion had previously been estimated for the Harris site but not for Robinson or Marion sites. PEC provided estimates of storage volumes for the Robinson and Marion sites that would provide comparable cooling water for reliable operation during drought conditions to that determined for the Harris site, based on available inflow to each site. Grids of the 10 meter National Elevation Dataset were obtained for the Robinson and Marion site watersheds. These grids were converted to Triangulated Irregular Networks (TINs). Volumetric calculations were completed to assess the depth and aerial extent of water storage that would result at each site to provide the equivalent drought mitigation to Harris, and the impacts associated with the water storage footprints.

General routes for transmission line upgrades were digitized from aerial photography and topographic imagery as well as from data obtained from PEC transmission engineers and the siting study. Potential impacts to aquatic resources were determined for additional right-of-way (ROW) clearing limits extending 50 feet to either side of existing cleared ROWs for each new line co-located with an existing right-of-way. ROW clearing limits for new lines on new location were based on 100 foot widths. Impacts for transmission line upgrades are based on clearing for new ROW only, no changes were projected for existing cleared, maintained ROW.

North Carolina Natural Heritage Program Element Occurrence Representations were extracted within a 1-mile buffer from the 400-acre power block sites, new or expanded reservoir limits, and transmission line upgrade routes. Potential impacts to red-cockaded woodpeckers were estimated based on occurrences within 1.0 mile of the project component that would need additional evaluation if the alternative is selected. Potential impacts to other federal endangered or threatened species were estimated based on occurrences within 500 feet of the project component.

II. Public Interest Factors Considered

A. Basic Project Purpose and Water Dependency

The basic project purpose is to generate electrical power. Electric power generation itself is not a water dependent activity. As a result, the applicant must rebut the presumption that a project alternative is available that would not affect special aquatic sites.

The proposed project is the development of new nuclear baseload generating capacity to supply electricity to PEC's service area, using advanced technology to produce reliable generation that is located proximate to its major customer base and that minimizes overall impacts to the environment.

B. Overall Project Purpose for the 404(b)(1) Analysis

The overall project purpose is to develop new nuclear baseload generating capacity to reliably supply electricity to PEC's service area using advanced technology. In this instance, advanced technology indicates nuclear power generation using advanced reactor technology. The purpose of this 404(b)(1) analysis is to evaluate the applicant's demonstration that its preferred alternative is the least environmentally damaging practicable alternative that meets the project purpose.

C. Project Need

The new nuclear baseload generation needs to be reliable and proximate to PEC's major customer base. The project also needs to minimize overall environmental impacts as much as practicable. An increased volume of cooling water is needed to safely and reliably produce this baseload amount during drought conditions. As a result, the normal pool elevation of Harris Lake is proposed to be raised from 220 feet NGVD29 to 240 feet NGVD29 to provide this additional capacity.

III. Alternatives

A. Development of Alternatives

Headquarters of the U.S. Army Corps of Engineers (HQUSACE) guidance from 22 April 1986 and November 1992 requires that alternatives be practicable to the applicant and that the purpose and need for the project must be the applicant's purpose and need. This guidance also states that project purpose is to be viewed from the applicant's perspective rather than only from the broad, public perspective. The essential point of the HQUSACE policy guidance is that under the Section 404(b)(1) Guidelines, an alternative must be available to the applicant to be a practicable alternative. Section 40 CFR 230.10 (a) of the Guidelines state that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant environmental consequences". Pursuant to 40 CFR 230.10(a)(2) practicable alternatives are those alternatives that are "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purpose". The 404(b)(1) Guidelines Preamble, "Economic Factors", 45 Federal Register 85343 (December 24, 1980) states, "if an alleged alternative is unreasonably expensive to the applicant, the alternative is not practicable".

Although sufficient information must be developed to determine whether the proposed activity is in fact the least environmentally damaging practicable alternative (LEDPA), the Guidelines do not require an elaborate search for practicable alternatives where, as here, it can be reasonably anticipated that there are only minor differences between the environmental impacts of the proposed activity and potentially practicable alternatives. Those alternatives that do not result in discernibly less impact to the aquatic ecosystem may be eliminated from the analysis since section 230.10(a) of the Guidelines only prohibits discharges when a practicable alternative exists which would have less adverse impact on the aquatic ecosystem. Since evaluating practicability is generally the more difficult aspect of the alternatives analysis, this approach should save time and effort for both the applicant and the regulatory agency. By initially focusing the alternatives analysis on the question of impacts to the aquatic ecosystem, it may be possible to limit, or eliminate altogether, the number of alternatives which have to be evaluated for practicability.

Section 404 authorization cannot be granted for jurisdictional impacts resulting from the discharge of dredge or fill material if there is a practicable alternative to the proposed action which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have any other significant adverse environmental consequences. The alternatives analysis must rigorously explore and objectively evaluate reasonable and practicable alternatives capable of achieving the overall project purpose.

B. Sequenced Search for Less Environmentally Damaging Alternatives

1. No-Action Alternative

The no-action alternative is a scenario under which the NRC denies the application and HAR 2 and HAR 3 (HAR), as described in COLA ER Chapter 2, is not constructed and no other generating station, either nuclear or non-nuclear, is constructed and operated. As stated in NUREG-1555, *Standard Review Plans for Environmental Reviews of Nuclear Power Plants*:

> The no-action alternative would result in the facility not being built, and no other facility would be built or other strategy implemented to take its place. This would mean that the electrical capacity to be provided by the project would not become available.

The most significant effect of the no-action alternative would be the loss of the potential 2000 megawatts electric (MWe) of energy, which could lead to a reduced ability of existing power suppliers to maintain reserve margins and supply lower-cost power to customers. COLA ER Chapter 8 describes the evaluation of the need for power and discusses a 2-percent annual increase in electricity demand in North Carolina over the next 10 years. The no-action alternative would restrict the ability of PEC to provide safe, reliable baseload power within North Carolina and South Carolina to meet the projected demand obligations of approximately 900 megawatts (MW) additional baseload every 4 years as discussed in COLA ER Section 8.4. Under the no-action alternative, PEC would not be able to satisfy the concerns about climate change and greenhouse gas reductions in North Carolina and the southeastern United States. As discussed in COLA ER Chapter 8 and COLA ER Subsection 9.2.1, because this area of the country already imports a portion of its electricity, the ability to import additional resources in a cost-effective manner is limited.

The options outlined above are not optimal from the standpoint of the cost of operation or the cost of supplied power. PEC's fuel supply within the Region of Interest (ROI) could become increasingly dependent on fossil-fuel generation and other alternatives. Without additional capacity, the region would not only remain heavily dependent on fossil fuel generation, it would not recognize the role of fuel diversity in the overall reliability of the State's power system, as discussed in COLA ER Section 8.4. If PEC took no action at all to meet growth demands, the ability to supply low-cost, reliable power to their customers would be impaired. PEC would not be able to support national goals, as established by the Energy Policy Act (EPACT) of 2005, to advance the use of nuclear energy.

In addition to the benefits in COLA ER Section 10.4, additional benefits of the construction and operation of the HAR include economic and tax impacts to the surrounding region that are described in COLA ER Subsections 4.4.2, 4.4.3, 5.8.2.1, and 5.8.2.2. Under the no-action alternative, none of the benefits of the proposed project as described in the COLA ER would be realized.

Under the no-action alternative, the predicted impacts from the project would not occur at the site. Impacts would result primarily from the construction of the facilities, increasing the operating level of Harris Reservoir and the withdrawal of water from the Cape Fear River. The impacts from construction of the HAR include impacts to land use, water-related impacts, ecological impacts, and socioeconomic impacts as summarized in Table 4.6-1 of the COLA ER. Impacts resulting from operation are summarized in Table 5.10-1 of the COLA ER. The benefits of implementing the no-action alternative would include avoiding the impacts resulting from the project as described in the COLA ER sections referenced above; however, none of the project objectives would be realized.

The no-action alternative does not meet the applicant's stated purpose and need and is not a viable alternative. As such, the no-action alternative was dropped from further consideration.

2. Other Project Designs

The Environmental Report (COLA ER) identified alternatives that would require the construction of new generating capacity, such as wind, geothermal, oil, natural gas, hydropower, municipal solid wastes, coal, photovoltaic cells, solar power, wood waste/biomass, and energy crops, as well as any reasonable combination of these alternatives. In addition, alternatives that would not require new generating capacity were evaluated, including initiating energy conservation measures and Demand-Side Management (DSM), reactivating or extending the service life of existing plants within the power system, and purchasing electric power from other sources. Section 9.2 of the COLA ER discusses these alternatives. All but coal and natural gas were eliminated from further consideration based on availability in the region, overall feasibility, and environmental consequences.

For coal, impacts to the aquatic environment would not be less than the preferred alternative, and coal would also have additional significant adverse environmental consequences (COLA ER 9.2.3.1). The nuclear plant would require a dry land footprint of 400 acres compared to 1,700 acres required for a coal–fired plant. Both types of facilities would require a similar amount of inundated footprint for cooling water. Transmission line upgrades would be similar for both types of facilities. Conventional coal systems produce emissions resulting in carbon footprint approximately 200 times higher than a nuclear power generation facility. Human health effects from coal combustion are also greater, and acid rain is a potential impact. Coal was dropped from further consideration.

For natural gas, impacts to the aquatic environment would not be less than the preferred alternative, and gas would also have additional significant adverse environmental consequences (COLA ER 9.2.3.2). The gas-fired alternative would require a footprint of 110 acres, plus at least an additional 3,600 acres of land required for wells, collection stations, and pipelines to bring the natural gas to the generating facility. The natural gas facility would also require significant cooling water (COLA ER 9.2.3.2.3). Transmission line upgrades would be similar for both types of facilities. Current gas-powered

electricity generation has a carbon footprint that is about half that of coal, but still approximately 100 times higher than the carbon footprint of a nuclear power generation facility. Natural gas was dropped from further consideration.

Based on environmental impacts and economics, PEC has concluded that nuclear power is a suitable electric generating power source (COLA ER 10.4.1.2). For the remaining analysis, nuclear will be considered the technology of choice.

3. Alternative Sites

PEC has identified the need for new base load generation through advanced reactor technology to begin commercial operation in 2018 or later for HAR-2 and 2019 or later for HAR-3 (COLA ER 1.1.7). During the evaluation process certain key assumptions and/or criteria were used to aid in locating and optimal site for building and operating an advanced reactor for new nuclear base load generation. They are as follows:

- The new nuclear plant siting location must be suitable to envelope the range of specific design parameters contemplated for deployment of a standard plant design as certified by the NRC.
- The location must be compatible with PEC's System Operation and Transmission Delivery capabilities.
- The recommended site's expected licensing path and regulatory outlook must reduce PEC's schedule and financial risk for establishing new nuclear base load generation.
- The cost of the new nuclear generation as impacted by the location must be reasonable and fair, and methods to ensure greater certainty of the cost/schedule during the licensing, design engineering, and construction phases of the project must be included.
- Evaluation criteria and methodology established as part of the EPRI Early Site Permit Demonstration Program will be employed in the nuclear plant site selection process. Specifically, the EPRI Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application dated March 2002 will be utilized.
- The evaluation and selection process will include "greenfield" (e.g., locations with no current generation facilities), existing nuclear generation plant locations, and other potentially suitable sites.
- Compliance with current NRC regulations and NRC guidance (as of November 2005), including 10 CFR Part 50 – "Domestic Licensing of Production and Utilization Facilities", 10 CFR Part 52- "Early Site Permits, Standard Design Certifications, and Combined Licenses for Nuclear Power Plants", SECY-05-0139, "Semi-annual Update of the Status of New Reactors Licensing Activities and Future Planning for New Reactors", dated August 4, 2005.
- Compliance with NEPA – National Environmental Policy Act requirements.

In accordance with the EPRI Siting Guide, the site selection process typically involves sequential application of exclusionary, avoidance, and suitability criteria evaluation (includes site reconnaissance, topographic data collection), and technical screening by

application of scoring and associated weighting factors applied to the suitability criteria. The exclusionary, avoidance, and suitability criteria address a full range of considerations important in nuclear power facility siting, including health and safety, environmental, socioeconomic and land use, and engineering and cost aspects. The region of interest is screened using exclusionary criteria to identify the potential sites by eliminating areas in which it is not feasible to site a nuclear facility due to regulatory, institutional, facility design impediments, or environmental constraints (PEC 2006).

Eleven potential sites in North and South Carolina were evaluated by PEC using exclusionary and avoidance criteria (see COLA ER 9.3.1.1 for further details). Seven sites evaluated by PEC were eliminated from further consideration due to seismic criteria not able to be met (one site), tract of land not of suitable size (one site), soil liquefaction issues (one site), insufficient water supply (one site), location outside PEC's Service Territory and the ROI (one site), and being actively considered for new fossil plants and lacking sufficient off-site voltage to support a nuclear plant (two sites). Four alternative sites considered further included one greenfield (undeveloped) site (Marion site), and three locations with existing nuclear generating capabilities, Shearon Harris Nuclear Plant site (Harris site), H.B. Robinson Nuclear Plant site (Robinson site), and the Brunswick Steam Electric Plant site (Brunswick site).

The process then becomes one of comparing the alternative sites, and identifying a site that possesses the most favorable set of conditions for siting a nuclear power facility. The evaluation technique to this point ensures the remaining alternative sites have no fatal flaws that could result in extended licensing delays and increased costs. Thus, the remaining alternative sites are evaluated against suitability criteria, resulting in a transition from the elimination approach to an evaluation approach for the suitable sites. The objective of evaluation against suitability criteria is to rank the alternative sites for determination of the preferred site(s). The suitability criteria are grouped into four categories with features in each category relevant to the specific aspects of facility development that are weighted and scored to provide a relative comparison of the candidate sites. These categories are as follows: (1) health and safety; (2) environmental; (3) land use and socioeconomic; and (4) engineering and cost-related. The multiple features of the suitability criteria are combined into one composite value for each of the alternative sites (PEC 2006).

For each of the four alternative sites, PEC determined a 400-acre project study area (power block) would be used to identify the location where the facility footprint would be located. Each 400-acre power block for each alternative site was assessed against the suitability criteria identified earlier as well as other criteria consistent with 404(b)(1) guidelines as described in Section I.D, Analysis Methodology. Infrastructure required for the construction/operation of a nuclear site was also assessed during this phase of the evaluation, including drought mitigation water supply, and necessary transmission line upgrades. Potential impacts from transmission line upgrades likely will consist primarily of conversion of forested wetlands to cleared ROW. During transmission line design, PEC will employ measures to minimize impacts by avoiding siting of structures within wetlands, surface waters, and floodplains to the greatest degree practicable.

a. Marion Site

Site Description

The Marion site is currently undeveloped land (greenfield site) that lies adjacent to the Pee Dee River in Marion County, South Carolina. Approximately 94 percent of the 400-acre power block identified by PEC is forested. The remaining 6 percent consists of pasture, crops, and developed lands.

Approximately 40 percent (160 acres) of the forested land within the 400-acre power block may be wetlands. The forested wetlands are characterized as NCWAM types riverine swamp forest and bottomland hardwood forest. Approximately 1 acre of non-tidal freshwater marsh is also present in the 400-acre site, within the transmission ROW along the northern edge of the site. A previous study by PEC characterized the wetland types as comprising bottomland hardwoods, mixed-hardwood wetlands, depression wetlands, jurisdictional ditches, and an excavated pond (S&ME 2001). The Marion site has the greatest amount of wetlands occurring within the potential 400-acre power block of any of the four alternative sites. Approximately 0.56 mile of stream channel was identified within the northeastern portion of the site. Even with avoidance and minimization efforts within the site, the potential for direct impacts to wetlands as a result of site development is high and will likely result in the loss of wetland habitat. Marion site elevations appear to be at or slightly below the 100-year floodplain. As a result, construction on this site may also impact federally designated floodways. Additional wetland impacts and land disturbance would result from the construction of the necessary infrastructure to support the new facility at this location. This may include, but is not limited to, roadways, railroad spurs, transmission lines, etc. Large expanses of existing forested wetlands would have to be crossed to reach the site. Wetland areas would have to be crossed to connect a railroad with a spur line servicing any future facility.

Drought Mitigation Reservoir

Based on water storage projections that would provide adequate cooling water for reliable operation during drought conditions as determined for the Harris site, the calculated storage needed for the Marion site would be approximately 58,000 acre-feet; this is based on inflow available (7Q10) of 688 cfs for the Pee Dee River (PEC 2009c). Engineering studies have not been conducted for siting the potential dam, but a preliminary evaluation using Spatial Analyst and 3D Analyst indicates that a dam placed on the Pee Dee River just upstream from the proposed Marion site would require inundating more than 12 river miles of the Pee Dee River to achieve the necessary storage area. The generally flat topography associated with river and stream valleys in this area could result in the reservoir having depths of three feet or less in most areas. The shallow nature of the proposed reservoir could also lead ultimately to potential issues with water quality resulting from lack of thermal stratification, as found in deeper lakes, as well as potential oxygen depletion resulting from this lack of stratification and eutrophication. Eutrophication results from the decay of organic material and an increase in nutrient supply, often from runoff occurring upstream (Brewer 1994). The extensive wetland areas that would be inundated by the proposed reservoir would tend to provide a large amount of organic matter that would support the eutrophication process. The Pee Dee

River itself would likely provide increased nutrient inputs from upstream runoff that would, at least temporarily, be held within the reservoir further contributing to the eutrophication process. Additionally, although the reservoir would be located upstream from the facility, the facility would be at an elevation lower than the normal pool of the reservoir, which would present a hazard during flood events without extensive dike construction or raising the power block. The process of creating a reservoir on the Pee Dee River, which is classified as a Navigable Water through the area to be inundated, would also require extensive permitting with state and federal agencies and would likely be a multi-year process involving extensive analysis as part of the Section 10 permitting process for the dam. In addition to impeding navigation, the dam on the Pee Dee River would also impede natural movement of resident and anadromous fish species up and down the river.

The approximately 28,000-acre reservoir could impact approximately 20,714 acres of wetlands and 33.34 miles of stream channel. Dominant wetland types potentially impacted by inundation include bottomland hardwood forest and riverine swamp forest wetlands along the Pee Dee River and its tributaries. The western side of the Pee Dee River is slightly lower in elevation than the east side and as a result, the wetland areas are more extensive with some areas of potential wetland extending up to three miles across the landscape on the west side of the river. The loss of riparian habitat along the Pee Dee River would be detrimental to the aquatic and wetland dependant species occupying that habitat. Riparian areas provide food resources for animals throughout the food web. Riparian vegetation along streams is critical as a primary food source to invertebrates that form the base of the food web (National Research Council 2002). Although the creation of this reservoir on the Pee Dee River has the potential to negatively affect special aquatic sites, it is reasonable to assume that the creation of new special aquatic sites (primarily non-tidal freshwater marsh and aquatic beds) would likely result from the inundation in those areas where conditions are suitable. Factors such as topography and soil type would dictate where wetlands would reform around the new reservoir.

Transmission Line Upgrades

Necessary transmission upgrades would include the following new transmission lines: Marion to Whiteville 230-kV line; Marion to Cumberland 230-kV line; Whiteville to Wallace 230-kV line; Fort Bragg Woodruff Street to Raeford 230-kV line; and several transformer replacements (PEC 2006). The new transmission lines total approximately 221.6 miles in length. New transmission lines are anticipated to be co-located along existing ROWs where practicable, but are anticipated to require clearing of an additional 100 feet of new ROW width. Approximately 639 acres of wetlands may be present within the new ROW clearing limits. The new ROW clearing could result in conversion of approximately 397 acres of riparian forested wetlands (headwater forest, bottomland hardwood forest, riverine swamp forest, and floodplain pool wetlands) and approximately 241 acres of non-riparian forested wetlands (hardwood flat, pine flat, pocosin, seep, and small basin wetland) to wetlands maintained at the herbaceous level. No changes would be expected for the approximately 1 acre of non-tidal freshwater marsh or 10 acres of surface waters identified in the new clearing limits. The new clearing limits would

encompass approximately 20.64 miles of stream channel, but the transmission lines are expected to span streams and no direct impacts to stream channels are expected.

Marion Summary

Table 1. Estimated Wetlands and Streams within each Marion Project Component.

Aquatic Resource	400-acre Site	Drought Mitigation Reservoir	Transmission Upgrades
Wetlands (ac)			
Headwater Forest	0	0	96
Bottomland Hardwood Forest	37	12,157	85
Riverine Swamp Forest	123	8,467	216
Floodplain Pool	0	0	<1
Subtotal Riparian Forested Wetlands	160	20,624	397
Hardwood Flat	0	0	1
Pine Flat	0	0	141
Pocosin	0	0	98
Seep	0	0	<1
Small-basin Wetland	0	0	1
Subtotal Non-riparian Forested Wetlands	0	0	241
Non-tidal Freshwater Marsh	1	90	1
Subtotal Non-forested Wetlands	1	90	1
Total Wetlands	161	20,714	639
Non-linear Surface Waters	0	816	10
Streams (mi)			
Perennial Channel	0.52	18.38	9.80
Intermittent Channel	0.04	14.96	5.48
Naturalized Ditch/Canal	0	0	5.36
Total Streams	0.56	33.34	20.64

b. Robinson Site

Site Description

The H.B. Robinson Steam Electric Plant (Robinson site) is located on Lake Robinson, which was formed by impounding Black Creek in the late 1950s. Lake Robinson is approximately 7 miles long, 0.25 to 0.75 mile wide, and has approximately 20 miles of shoreline. It has a mean depth of 14.4 feet and a maximum depth of 44 feet at the dam (Robinson ER 2.2). The Robinson site is an existing PEC facility located on approximately 6,020 acres of property in northwestern Darlington and southwestern Chesterfield counties in South Carolina, including the 2,250-acre Lake Robinson. The site has an existing 710 MW nuclear reactor as well as fossil and combustion turbine generating capabilities. The 400-acre power block on the Robinson site, as identified by PEC, contains both terrestrial and open water areas. Land use impacts associated with the addition of two additional units to the Robinson site are expected to be minor due to the disturbed nature of approximately 50 percent of the 400-acre power block site evaluated.

Jurisdictional wetlands may account for approximately 18 acres and waters of the U.S. may account for approximately 93 acres of the 400-acre power block area, with Lake Robinson accounting for approximately 86 acres and other excavated ponds accounting for approximately 7 acres. Bottomland hardwood forest wetlands comprise approximately 18 acres and non-tidal freshwater marsh wetlands comprise less than 1 acre. Approximately 0.72 mile of stream channel was identified within the 400-acre site. Direct impacts to special aquatic sites within the 400-acre power block resulting from the additional units would be relatively small.

Drought Mitigation Reservoir

Based on water storage projections that would provide adequate cooling water for reliable operation during drought conditions as determined for the Harris site, the estimated storage needed for the Robinson site would be over 2,000,000 acre-feet; this is based on inflow available (7Q10) of 19 cfs for Black Creek (PEC 2009c). Engineering studies have not been conducted for siting the potential dam, but a preliminary evaluation using Spatial Analyst and 3D Analyst indicates that raising the existing dam would result in flooding the existing nuclear plant at the point in the landscape where only approximately 3% of the required additional storage is obtained. Increasing the reservoir to the full size needed to achieve the required additional storage capacity was determined to not be a viable option based on limited additional capacity that could be achieved without flooding out the existing facility. Additional constraints associated with Lake Robinson involve the lack of ownership of much of the land surrounding the lake. Lake expansion would require numerous land acquisitions and relocations. Raising the lake even to the point of achieving 3% of the additional storage capacity needed is likely to result in impacts to the residential homes encircling the lake edge. Large expanses of bottomland hardwood wetlands comprising hundreds of acres also occur in the headwater areas of Lake Robinson (ESI 2005).

Expansion of Lake Robinson was determined to not be viable and an alternative option was evaluated for a new reservoir upstream from the existing reservoir. Engineering studies were not conducted for siting the alternative reservoir, but a preliminary evaluation using Spatial Analyst and 3D Analyst indicates that a dam placed on Black Creek just upstream from US 1 could inundate approximately 4,870 acres before additional consideration would be needed to avoid flooding the adjacent watershed. At this level the alternative reservoir would only provide approximately 98,000 acre feet, or less than 5% of the additional new storage needed. At this level the new reservoir could impact approximately 1,814 acres of wetlands and 34.51 miles of stream channel. Dominant wetland types potentially impacted by inundation include bottomland hardwood forest and riverine swamp forest. The new reservoir would impact approximately 3,365 acres of the Carolina Sandhills National Wildlife Refuge and 56 acres of the Sandhills State Forest WMA. Negotiations with the U.S. Fish and Wildlife Service and State of South Carolina, respectively, for impacts to federal and state lands are expected to be lengthy processes.

Additional measures that would be required to obtain needed storage have not been evaluated since impacts to aquatic resources from the drought mitigation reservoir achieving 5% of the needed storage, along with the other project components, are much greater for the Robinson site than for the Harris (preferred) site.

Transmission Line Upgrades

Necessary transmission line upgrades would include the following new lines: Robinson to Camden 230-kV line; Robinson to Sumter 230-kV line; Robinson to Florence 230-kV line; Robinson to Laurinburg 230-kV line; and replacement of numerous transformers along several existing routes (PEC 2006). The new transmission lines total approximately 166.2 miles in length. New transmission lines are anticipated to be co-located along existing ROWs where practicable, but are anticipated to require clearing of an additional 100 feet of new ROW width. Approximately 288 acres of wetlands may be present within the new ROW clearing limits. The new ROW clearing could result in conversion of approximately 187 acres of riparian forested wetlands (headwater forest, bottomland hardwood forest, and riverine swamp forest) and approximately 97 acres of non-riparian forested wetlands (hardwood flat, pine flat, and pocosin) to wetlands maintained at the herbaceous level. No changes would be expected for the approximately 4 acres of non-tidal freshwater marsh wetlands or 8 acres of surface waters identified in the new clearing limits. The new clearing limits would encompass approximately 12.08 miles of stream channel, but the transmission lines are expected to span streams and no direct impacts to stream channels are expected.

Robinson Summary

Table 2. Estimated Wetlands and Streams within each Robinson Project Component.

Aquatic Resource	400-acre Site	Drought Mitigation Reservoir [a]	Transmission Upgrades
Wetlands (ac)			
Headwater Forest	0	0	30
Bottomland Hardwood Forest	18	1,761	105
Riverine Swamp Forest	0	53	52
Subtotal Riparian Forested Wetlands	18	1,814	187
Hardwood Flat	0	0	7
Pine Flat	0	0	23
Pocosin	0	0	67
Subtotal Non-riparian Forested Wetlands	0	0	97
Non-tidal Freshwater Marsh	<1	0	4
Subtotal Non-forested Wetlands	<1	0	4
Total Wetlands	18	1,814 [a]	288
Non-linear Surface Waters	93	86	8
Streams (mi)			
Perennial Channel	0.04	24.92	3.67
Intermittent Channel	0.68	9.59	7.46
Naturalized Ditch/Canal	0	0	0.95
Total Streams	0.72	34.51 [a]	12.08

[a] Estimates are for reservoir that achieves only 5% of needed capacity; additional measures to obtain remaining 95% of capacity would incur additional impacts.

c. Brunswick Site

Site Description

The Brunswick site is located on approximately 1,200 acres in Brunswick County, North Carolina. The site has two existing nuclear units (Units 1 & 2). The Brunswick site is on land already owned by PEC and is already zoned for uses compatible with the development of new units. The 400-acre power block identified by PEC contains both terrestrial and open water areas. Land use impacts associated with the addition of two additional units are expected to be minor.

Jurisdictional wetlands and waters of the U.S. may account for approximately 42 acres of the 400-acre power block area, with the intake canal accounting for approximately 20 acres. Headwater forest wetlands comprise approximately 3 acres and salt/brackish marsh and tidal freshwater marsh wetlands comprise approximately 19 acres. Approximately 0.38 mile of stream may be present within the 400-acre area. Direct impacts to special aquatic sites within the 400-acre power block resulting from the additional units would be expected to be relatively small. Impacts to most of the wetlands and surface waters may be able to be avoided or minimized.

Drought Mitigation Reservoir

Due to the nature of the intake and proximity to the Atlantic Ocean, there are no practical flow constraints (PEC 2006). The flow at the mouth of the Cape Fear River draws upon a drainage area of 9,140 square miles. Of this, stream flow from about 6,000 square miles is gauged continuously by USGS. Average daily freshwater discharge rate of the river at the mouth is estimated to be between 8,100 and 10,000 cubic feet per second (cfs) (PEC 2006). As such, no drought mitigation reservoir would be required for the Brunswick site, and no wetland or stream impacts would be required for this component which would be required by the other three sites.

Transmission Line Upgrades

The necessary transmission upgrades would include the following new transmission lines: Brunswick to Cumberland 230-kV line; Brunswick to Clinton 230-kV line; Brunswick to Jacksonville 230-kV line; and Brunswick to Wommack 230-kV line. The new transmission lines total approximately 359.7 miles in length. New transmission lines are anticipated to be co-located along existing ROWs where practicable, but are anticipated to require clearing of an additional 100 feet of new ROW width. Approximately 1,452 acres of wetlands may be present within the new ROW clearing limits. The new ROW clearing could result in conversion of approximately 662 acres of riparian forested wetlands (headwater forest, bottomland hardwood forest, and riverine swamp forest) and approximately 761 acres of non-riparian forested wetlands (hardwood flat, pine flat, pocosin, pine savannah, non-riverine swamp forest, seep, and small-basin wetland) to wetlands maintained at the herbaceous level. No changes would be expected for the approximately 29 acres of tidal freshwater marsh and non-tidal freshwater marsh wetlands or 27 acres of surface waters identified in the new clearing limits. The new clearing limits would encompass approximately 24.84 miles of stream channel, but the

transmission lines are expected to span streams and no direct impacts to stream channels are expected.

Brunswick Summary

Table 3. Estimated Wetlands and Streams within each Brunswick Project Component.

Aquatic Resource	400-acre Site	Drought Mitigation Reservoir [a]	Transmission Upgrades
Wetlands (ac)			
Headwater Forest	3	NA	127
Bottomland Hardwood Forest	0	NA	94
Riverine Swamp Forest	0	NA	441
Subtotal Riparian Forested Wetlands	3	NA	662
Hardwood Flat	0	NA	6
Pine Flat	0	NA	291
Pocosin	0	NA	422
Pine Savanna	0	NA	38
Non-riverine Swamp Forest	0	NA	2
Seep	0	NA	<1
Small-basin Wetland	0	NA	2
Subtotal Non-riparian Forested Wetlands	0	NA	761
Non-tidal Freshwater Marsh	0	NA	2
Tidal Freshwater Marsh	5	NA	24
Salt/Brackish Marsh	14	NA	3
Subtotal Non-forested Wetlands	19	NA	29
Total Wetlands	22	NA	1,452
Non-linear Surface Waters	20	NA	27
Streams (mi)			
Perennial Channel	0.30	NA	9.30
Intermittent Channel	0.08	NA	14.03
Naturalized Ditch/Canal	0	NA	1.51
Total Streams	0.38	NA	24.84

[a] No drought mitigation reservoir required.

d. Harris Site (Preferred Action)

Site Description

The Harris site is an existing PEC facility that currently generates electrical power with one nuclear reactor (Unit 1). The actual plant site currently covers approximately 440 acres and the proposed addition of the HAR-2 and HAR-3 will affect up to approximately 400 additional acres. PEC owns 10,744 acres at the site which was originally planned to support four operating units with a larger reservoir. Land use within the 400-acre power block area identified by PEC at the Harris site consists primarily of developed land (51%) with the next highest land use being open water (17%). The construction of HAR-2 and HAR-3 will also require appurtenant facilities including electric transmission lines, an electric switchyard, and modifications to the Harris Lake dam, intake structures and pumphouse, the Harris Lake makeup water system pipeline, a discharge structure on Harris Lake, and blowdown pipelines from HAR-2 and HAR-3 into Harris Lake. The existing infrastructure at the Harris site, including Harris Lake, combines to make this the Preferred Action for PEC. Although PEC proposes to raise the level of Harris Lake to provide a reliable cooling water source during drought conditions for HAR-2 and HAR-3, PEC believes that this site can be defined as the LEDPA pursuant to Section 404(b)(1) when compared to the overall impacts to aquatic resources that would result from any of the other three alternative sites.

Jurisdictional wetlands and waters of the U.S. account for approximately 72 acres of the 400-acre power block area originally identified for site evaluation, with surface waters primarily associated with Harris Lake accounting for approximately 67 acres. Based on GIS evaluation with limited field review of the preliminary 400-acre power block, headwater forest wetlands comprise approximately 1 acre and non-tidal freshwater marsh wetlands comprise approximately 4 acres. Approximately 0.04 mile of stream may be present within the 400-acre area. Direct impacts to wetlands and streams within the 400-acre power block resulting from the additional units would be expected to be relatively small.

Drought Mitigation Reservoir

To provide a reliable water source for HAR-2 and HAR-3 during drought conditions, the normal pool elevation of Harris Lake is proposed to be increased from 220 feet NGVD29 to 240 feet NGVD29. The original discharge that served to create Harris Lake occurred during construction of the Harris Lake Dam pursuant to the ACOE permit (SAWCO77-N-019-0441) issued in 1977. Harris Lake was originally formed between the period 1980-1983 when approximately 4,000 acres were flooded as a result of dam construction across Buckhorn Creek. The dam was designed for a maximum water level elevation of 239.1 feet NGVD29 based on the original permit schematics; however, it was only filled to an elevation of 220 feet NGVD29. Harris Lake's additional water capacity will come from a combination of natural fill due to rain and from water withdrawal from the Cape Fear River. The proposed rise in normal pool elevation of Harris Lake will inundate special aquatic sites including intermittent and perennial streams along with wetlands that occur between the 220 feet NGVD29 and 240 feet NGVD29 contours. Additionally,

aquatic beds that occur below the 220 feet NGVD29 contour will also be inundated but may reestablish at new elevations over time once the new lake elevation stabilizes.

The approximately 7,633-acre reservoir could impact approximately 502 acres of wetlands and 24.40 miles of stream channel. The dominant wetland type potentially impacted by inundation is non-tidal freshwater marsh, representing approximately 73% of the wetlands affected. Non-tidal freshwater marsh is found within the existing normal pool of the reservoir and along the fringes of the normal pool. The remaining wetlands to be inundated include riverine swamp forest located within the influence of the normal pool of the existing reservoir, and bottomland hardwood forest and headwater forest located along tributaries feeding the reservoir. The loss of riparian habitat associated with raising the lake elevation would be detrimental to the aquatic and wetland dependant species occupying that habitat. Riparian areas provide food resources for animals throughout the food web. Riparian vegetation along streams is critical as a primary food source to invertebrates that form the base of the food web (National Research Council 2002). However, raising the normal pool of the lake is not expected to result in as great a functional change as that which occurred historically when the original reservoir was created which resulted in the isolation of remaining stream habitats by intervening lake habitat. Although the expansion of Harris Lake has the potential to negatively affect special aquatic sites, it is reasonable to assume that the creation of new special aquatic sites (primarily non-tidal freshwater marsh and aquatic beds) would likely result from the inundation in those areas where conditions are suitable. Factors such as topography and soil type would dictate where wetlands would reform around the new reservoir normal pool.

Transmission Line Upgrades

The necessary transmission line upgrades would include the following new lines: Harris to Wake 230-kV line, Harris to Erwin 230-kV line and Harris to Fort Bragg Woodruff Street 230-kV line. The new transmission lines total approximately 103 miles in length. New transmission lines are anticipated to be co-located along existing ROWs where practicable, but are anticipated to require clearing of an additional 100 feet of new ROW width. Approximately 99 acres of wetlands may be present within the new ROW clearing limits. The new ROW clearing could result in conversion of approximately 92 acres of riparian forested wetlands (headwater forest, bottomland hardwood forest, riverine swamp forest, and floodplain pool) and approximately 4 acres of non-riparian forested wetlands (pocosin) to wetlands maintained at the herbaceous level. No changes would be expected for the approximately 3 acres of non-tidal freshwater marsh wetlands or 23 acres of surface waters identified in the new clearing limits. The new clearing limits would encompass approximately 11.01 miles of stream channel, but the transmission lines are expected to span streams and no direct impacts to stream channels are expected.

Harris Summary

Table 4. Estimated Wetlands and Streams within each Harris Project Component. [a]

Aquatic Resource	400-acre Site	Drought Mitigation Reservoir	Transmission Upgrades
Wetlands (ac)			
Headwater Forest	1	15	20
Bottomland Hardwood Forest	0	95	67
Riverine Swamp Forest	0	26	4
Floodplain Pool	0	0	<1
Subtotal Riparian Forested Wetlands	1	136	92
Pocosin	0	0	4
Subtotal Non-riparian Forested Wetlands	0	0	4
Non-tidal Freshwater Marsh	4	366	3
Subtotal Non-forested Wetlands	4	366	3
Total Wetlands	5	502	99
Non-linear Surface Waters	67	3,384	23
Streams (mi)			
Perennial Channel	0	8.73	3.27
Intermittent Channel	0.04	15.67	7.74
Total Streams	0.04	24.40	11.01

[a] Numbers presented in Table 4 are based on GIS modeling with limited field verification for comparison with other three alternatives. PEC authorized a comprehensive wetland delineation for the jurisdictional features that occur between the 220 feet NGVD29 and 240 feet NGVD29 contours to quantify potential impacts to special aquatic sites. This delineation effort occurred between November 2008 and February 2009. Wetland types identified in the delineation report include emergent wetlands, lacustrine fringe wetlands, and terrestrial forested and herbaceous wetlands. The emergent wetlands were defined as those occurring in the littoral zone (waterward of the normal 220 feet NGVD29 contour). Lacustrine fringe wetlands were defined by their location on the landward edge of the lake with their hydrology being primarily driven by the lake surface. Terrestrial forested and herbaceous wetlands are located inland from the shoreline. The emergent wetlands, fringe wetlands, and terrestrial herbaceous wetlands correspond to NCWAM wetland type non-tidal freshwater marsh. The terrestrial forested wetlands correspond to NCWAM wetland types riverine swamp forest, bottomland hardwood forest, and headwater forest, depending on landscape position and degree and duration of surface inundation. The results of the delineation effort indicate that the following special aquatic sites will be affected by inundation resulting from raising the normal pool elevation of Harris Lake to 240 feet NGVD29 (CH2M-Hill 2009):

- Terrestrial wetlands - approximately 180 acres will be converted to lentic habitat;
- Emergent wetlands and aquatic bed – approximately 340 acres will be affected;
- Fringe wetlands – approximately 60 acres will be affected;
- Open water (ponds) – approximately 15 acres;
- Intermittent streams – approximately 65,600 linear feet (12.42 miles) converted to lentic habitat; and
- Perennial streams – approximately 70,200 linear feet (13.30 miles) converted to lentic habitat.

4. Summary and Alternatives Carried Forward

Four alternative sites were evaluated for potential impacts to aquatic resources to determine which, if any, would clearly result in greater impacts to wetlands and streams than would result from the preferred alternative (Harris site). Table 5 provides a summary of the potential wetland and stream impacts for the 400-acre power block, drought mitigation reservoir, and transmission line upgrades identified for each of the four alternatives.

Table 5. Estimated Wetlands and Streams within each Alternative Project Component

Project Component	Feature	Alternative Site			
		Marion	Robinson [a]	Brunswick	Harris [b]
400-acre Site	Wetlands (ac)	161	18	22	5
	Streams (mi)	0.56	0.72	0.38	0.04
Drought Mit. Reservoir	Wetlands (ac)	20,714	1,814 [a]	0	502
	Streams (mi)	33.34	34.51 [a]	0	24.40
Transmission Upgrades	Forested Wetlands (ac) [c]	638	284	1,423	96
	Non-forested Wetlands (ac) [d]	1	4	29	3
	Streams (mi)	20.64	12.08	24.84	11.01
Total Wetlands (ac)		21,514	2,120 [a]	1,474	606
Total Streams (mi)		54.54	47.31 [a]	25.22	35.45

[a] Estimates provided for new Robinson reservoir are for reservoir that would only partially achieve necessary drought mitigation storage; site constraints for potential site located upstream from existing Lake Robinson would allow achieving only 5% of necessary storage without breaching interstream divide into adjacent watershed. Additional measures will be required to obtain needed storage but have not been evaluated since Robinson impacts would be higher than Harris even with partial drought mitigation efforts.

[b] Wetlands and streams for Harris alternative project components presented in Table 5 are estimates based on same methodology used for other three sites to provide direct comparison; refined numbers based on preliminary delineation results are provided in the COLA ER.

[c] Only includes forested wetlands (riparian and non-riparian) subject to conversion to non-forested wetlands for new ROW clearing.

[d] Non-forested wetlands present in new ROW clearing, no impacts expected.

The numbers reported for the Harris alternative in Table 5 are based on the same methodology used to estimate numbers for the other three alternatives (see Section I.D for methodology) for use in direct comparison with the same approximate degree of reliability. The COLA ER presents potential impacts for the Harris alternative based on refined numbers with a greater degree of accuracy based on preliminary delineation results for the individual components of the Harris project facility and proposed lake expansion. Comparable efforts have not been undertaken for the other three alternatives, requiring the use of the GIS-based evaluation with limited field review to make this initial comparison among the four alternatives.

Wetlands and streams present within the preliminary 400-acre power block areas evaluated may be able to be avoided or impacts minimized for the Harris, Brunswick, and

Robinson sites. The Marion site is likely to incur wetland impacts for the site facility based on the prevalence of wetlands in and near the site.

Additional water storage capacity was identified as needed for the Marion, Robinson, and Harris sites to provide reliable cooling water during drought conditions. New or expanded reservoirs at these three sites would result in substantial wetland and stream impacts. The Brunswick site was identified as having sufficient water supply to meet the needs of the new units without additional water storage required.

Transmission line upgrades will be required for all four alternatives. PEC has demonstrated through numerous other transmission line construction projects that detrimental impacts to wetlands streams from ROW construction from fill or surface disturbance are minimal because most areas can be spanned completely. If discharges are necessary, they are typically limited to footings for support structures. Impacts from line expansions are expected to be primarily from clearing and converting forested wetland types to herbaceous wetlands within the new ROW limits. Conversion of mature forested wetland habitat to herbaceous wetland habitat results in reductions of many wetland functions.

Based on the evaluation of the potential impacts, in comparison to the preferred alternative (Harris site), the Marion and Robinson alternatives have substantially greater impacts to both wetlands and streams for the required drought mitigation reservoir and substantially greater impacts through conversion of forested wetlands for the transmission line upgrades. The Marion and Robinson alternatives are eliminated as viable alternatives since neither will result in less impact to wetland or streams than the preferred alternative and neither is environmentally preferable to the Harris site.

Although the Brunswick site potentially has a larger amount of wetlands and streams present within the 400-acre power block than does the Harris site, avoidance and minimization efforts are possible at both sites for siting the individual facility components. The Brunswick alternative will impact substantially greater acreage of forested wetlands through conversion for the transmission line upgrades than the Harris alternative, but will not require construction of a drought mitigation reservoir. Based on the impacts to wetlands and streams from the increased lake elevation at Harris, the Brunswick site was not eliminated from further consideration. Therefore, the Brunswick site is being carried forward for further evaluation and comparison to the preferred alternative (Harris site) pursuant to Section 404(b)(1).

IV. EVALUATION

This section of the document will evaluate in greater detail the anticipated changes to the physical, chemical and biological characteristics of the aquatic environment as well as human use characteristics and impacts that may result from the construction of new reactors at either the Brunswick site or the Harris site.

A. Anticipated Changes to the Physical/Chemical Characteristics of the Aquatic Environment

1. Substrate

Brunswick
Impacts to the substrate within the 400-acre power block would consist of filling all or a portion of the approximately 22 acres of wetlands present within the 400-acre power block. Because these wetlands are located primarily around the periphery of the 400-acre power block area evaluated, most impacts may be able to be avoided or minimized. The filling of wetlands would be an adverse impact for this alternative.

Harris
The impacts to the substrate for the HAR-2 and HAR-3 sites includes impacting 2 of the 5 acres of wetlands within the 400-acre power block for construction of HAR-3; temporary impacts to wetlands for construction of the 2.6 mile pipeline from the Cape Fear River to Harris Lake; and dredging of an intake structure on the Cape Fear River above the Buckhorn Dam. The filling of wetlands would be an adverse impact for this alternative.

The addition of 20 feet of additional water in Harris Lake would inundate areas that are currently located above the normal pool elevation. The inundation of the areas above the current normal pool elevation would likely cause resorting of sediments beneath the water surface and some shoreline erosion due to wave action. These newly inundated areas would be expected to reach steady-state conditions relatively quickly.

2. Currents, circulation or drainage patterns

Brunswick
There is not expected to be a significant effect on currents, circulation or drainage patterns from the filling of wetland areas within the 400-acre power block. The new cooling water intake for the new units may result in temporary hydrologic alterations as well as minor changes in circulation of the intake canal. No adverse environmental consequences are anticipated for this alternative.

Harris
The filling of wetlands within the HAR-2 and HAR-3 development areas is not expected to have a significant effect on currents or circulation. Drainage patterns within the fill

areas will be changed to meet site grading requirements. Drainage of the HAR-2 and HAR-3 development areas will be toward Harris Lake and the auxiliary reservoir.

The construction of the new makeup water intake structure will have temporary hydrological alterations consisting of sedimentation. Construction areas for the intake will be isolated by dewatering with the water being pumped to a sedimentation basin and allowed to drain back into the river. However, the work will be performed under a sediment and erosion control plan and NPDES permit. The construction of the intake structure would have a temporary adverse environmental consequence for this alternative.

3. Suspended particulates, turbidity

Brunswick

There are no expected long-term effects from suspended particles or turbidity on the wetlands, canals or streams from the construction of the facility. The facility currently operates under an active NPDES permit which would be expanded to include the new development area. Sedimentation during construction will be minimized by performing the work in accordance with an erosion and sediment control plan. No adverse environmental consequences are anticipated for this alternative.

Harris

There are no expected long-term effects from suspended particulates or turbidity on the freshwater streams, the Cape Fear River or Harris Lake and impoundments. The current facility operates under an NPDES permit and the permit will be revised to include the new HAR-2 and HAR-3 facilities.

The only potential source of suspended particles, turbidity for the Cape Fear River would be during construction of PEC's surface water intake near Buckhorn Dam. The increased suspended particles and turbidity during the construction of PEC's surface water intake may have a temporary impact on a canoe input located downstream of Buckhorn Dam. There would be an impact to the Cape Fear River Floodplain during construction of PEC's intake structure. Construction techniques could minimize this impact. Sediment built up as a result of construction activities will be removed. Appropriate USACE Section 404, NCDENR 401 Water Quality Certification, and NPDES permits will be obtained (COLA ER 4.2.1.2 and 4.2.2.1).

Increased suspended particles and turbidity will be expected for Harris Lake and impoundments during construction of HAR-2 and HAR-3. PEC will perform the construction activities in accordance with an erosion and sediment control plan to limit the amount of sediment in stormwater. Water collected during the dewatering of the construction area will be allowed to settle and be filtered before it is returned to Harris Lake or impoundments (COLA ER 4.2.2.2).

Clearing of trees around the Harris Lake prior to raising the water level may have an effect on the amount of sediment runoff. However, silt fences and other erosion control devices will be used to minimize the impact.

4. Water quality

Brunswick

The Brunswick site uses a once-through cooling system that withdraws water from the Cape Fear River and discharges the water into the Atlantic Ocean. Based on the Brunswick ER, the site operates under a National Pollutant Discharge Elimination System (NPDES) permit that requires semi-annual temperature readings at the discharge point. The two new units at the Brunswick site would employ a closed cycle cooling system that would draw much less flow than once-through cooling, but would result in incremental increase in the amount of water withdrawn from the river. Based on the ER, potential effects of heat shock caused by the thermal discharge into the Atlantic Ocean are not a significant factor for the Brunswick Site (COLA ER 9.3.2.2.2.5).

Potential contaminants in the Cape Fear River are related to its use for ship traffic to the Port of Wilmington and to the industrial plants located upstream to the north. The FSAR noted that pollution of the river with industrial and sanitary sewage is to such an extent that oysters harvested in the lower river areas are taken by the North Carolina Division of Fisheries for transplanting in cleaner waters for natural purging prior to human consumption (FSAR 2.4.1.2.3).

There are no expected changes to salinity for the facility as there will be no changes to the locations of the intake and discharge canals.

Harris

PEC will continue to employ a closed-loop, cooling tower-based, heat dissipation system rather than a once-through system. Therefore, the issue of heat shock should not be a factor in Harris Reservoir (COLA ER 9.4.2.1.2). Because the HAR site is located on a large reservoir system that will provide sufficient heat rejection capacity for the two new units, plant operation is not expected to have significant thermal impacts to aquatic ecology and water quality (COLA ER 5.3.2.1). Additionally, all discharges in the small mixing zone of the reservoir are required to meet the state NPDES requirements.

Based on the COLA ER, it is expected that normal discharges from the Harris site will have negligible effects on surface and groundwater uses and will be in compliance with an approved NPDES permit issued by the North Carolina Department of Environment and Natural Resources (NCDENR). This permit requires that discharges are controlled from systems (such as discharge lines, sewage treatment facilities, radwaste treatment systems, activated carbon treatment systems, water treatment waste systems, facility service water, and stormwater runoff) to Harris Lake. The effect on water quality in Harris Lake due to the operation of the Harris Site will be monitored to ensure compliance with the issued NPDES permits for construction and operation (COLA ER 3.3). No adverse environmental consequences are anticipated for this alternative.

5. Flood control functions

Brunswick
The nominal elevation of the existing facility is 20 feet mean sea level (MSL). The elevation of the maximum storm event is expected to reach 22 feet MSL. As such, water levels would be expected at two feet above grade. Buildings at the facility are waterproofed to an elevation of 22 feet MSL. Flood control for the canals is managed by levees located at elevations of 22 feet MSL. There is a potential adverse impact for flooding, but only related to extreme storm events and not under normal weather conditions.

Harris
The final floor elevations for HAR-2 and HAR-3 are proposed to be 261 feet National Geodetic Vertical Datum of 1929 (NGVD29). The main plant areas of HAR-2 and HAR-3 calculated Probable Maximum Flood (PMF) elevations are below the proposed final floor elevations (FSAR 2.4.2 and 2.4.3.6.4).

The uncontrolled ogee spillway on the main dam of Harris Lake has a current elevation 220 feet NGVD29, but is proposed to be raised to an elevation of 240 feet NGVD29. The auxiliary reservoir has an elevation of 252 feet NGVD29 and is not proposed to be raised. The main dam of Harris Lake and the auxiliary reservoir both are at elevations of 260 feet NGVD29 (FSAR 2.4.3). Flooding on Buckhorn Creek above the main dam is expected to be controlled by the ogee spillway of the dam. At the PMF elevation, only 16 percent of the Buckhorn Creek drainage basin would be flooded (FSAR 2.4.3 a). There are no significant adverse environmental consequences related to flooding for the Harris site.

6. Storm, wave and erosion buffers

Brunswick
The nominal elevation of the existing facility is 20 feet MSL. The elevation of the maximum storm event is expected to reach 22 feet MSL. As such, water levels would be expected at two feet above grade. Buildings at the facility are waterproofed to an elevation of 22 feet MSL. Wave action from the maximum water depth of two feet would yield a wave height elevation of 25.6 feet MSL (1.6 foot wave run-up has a vertical face of 3.6 feet). All doors are designed to prevent leakage and the buildings are designed as Seismic Class 1 and could withstand the static and dynamic effects of a 1.6 foot wave (FSAR 2.4.5).

Water elevations within the intake and outflow canal during maximum storm events would be expected to be 22 feet MSL. Wave heights are expected to be three feet (25 feet MSL) with a wave run-up height of 25.3 feet MSL. There is a potential adverse impact for storm and wave buffers for this alternative, but only related to extreme storm events and not under normal weather conditions.

Harris
The safety-related structures at the HAR-2 and HAR-3 facilities are protected from high water levels up to elevation 261 feet NGVD29, which is higher than anticipated flood levels due to wave run-up in the reservoirs or direct rainfall at the plant site. The upstream face of the Main Dam and both upstream and downstream faces of the Auxiliary Dam are protected by riprap designed for the worst calculated wave action. The downstream face of the Main Dam is protected by a layer of oversized rock. The backwater effects of Buckhorn Creek on the downstream face of the Main Dam are not expected to be significant. However, protection of the downstream face serves as an additional safety precaution (FSAR 2.4.5.5). There is no expected adverse impact for storm and wave buffers for this alternative.

7. Aquifer recharge

Brunswick
The development of the 400-acre power block is not expected to have an impact on aquifer recharge. The surficial aquifer beneath the site has been reported to be located at a depth of between 2 and 10 feet. The localized groundwater flow direction may be impacted due to the construction of the subsurface structures for the reactors; however, due to the sandy nature of surface soils, infiltration in the areas around the reactor units would help minimize the loss of the shallow aquifer area. Small individual potable wells in the area are located in the surficial aquifer. The Castle Hayne Aquifer is the primary drinking water source for the area (community and municipal drinking water wells). There are no known Castle Hayne Aquifer primary recharge areas in the vicinity of the property. As such, the construction of the facility should not have an effect on the recharge for the Castle Hayne Aquifer. No adverse environmental consequences are anticipated for this alternative.

Harris
The construction of HAR-2 and HAR-3 is not expected to have an impact on aquifer recharge. The Harris site is underlain by the surficial aquifer that lies at depths ranging from 2 to 30 feet below the land surface. Rain water percolates through the residual soil and into the surficial aquifer which generally discharges to one of the reservoirs or surface water. The surficial aquifer is underlain by a low permeability bedrock aquifer (FSAR 2.4.13.1.1 and 2.4.12.1.2). Development of the site will have a minor effect on surficial groundwater recharge due to increased impervious area. However, since there is a hydraulic connection between Harris Lake and the surficial aquifer, the overall effect of loss in pervious area should be minimal. The bedrock aquifer has a hydraulic connection with Harris Lake with recharge occurring through bedding plains, fractures and joints beneath the water surface of the lake. Increased water levels on Harris Lake are not expected to negatively affect aquifer recharge. No adverse environmental consequences are anticipated for this alternative.

8. Baseflow

Brunswick
The base flow of the Cape Fear River in the vicinity of the Brunswick site has been measured at 8,100 to 10,000 cubic feet per second (cfs). The cooling water discharges to the Atlantic Ocean which has no discharge flow constraints (COLA ER 9.3.2.2.3). The increased withdraw of water from the Cape Fear River is not expected to significantly impact the base flow of the Cape Fear River. No adverse environmental consequences are anticipated for this alternative.

Harris
The current normal pool level for the Harris Lake is 220 feet NGVD29 and the auxiliary reservoir is 252 feet NGVD29. The pool elevation of the Harris Lake is proposed to be 240 feet NGVD29 with no change in pool elevation for the auxiliary reservoir (COLA ER Section 2.3).

The current Cape Fear River base flow is 3,384 cubic feet per second (cfs), based on data collected each month between 1924 and 2004, and is not expected to be affected by water withdrawal for the Harris Site (FSAR 2.4.1-204) assuming a maximum withdrawal rate of 133.68 cfs (COLA ER 2.3). The withdraw of makeup water from the Cape Fear River is estimated to be 3.6 percent of the average daily flow reported at the Lillington Gauging Station (COLA ER 9.3.2.2.1.5).

Limited hydrologic alterations will occur on Harris Lake and its tributaries near HAR-2 and HAR-3 and, subsequently, on Buckhorn Creek downstream of Harris Lake. The alterations related to Harris site preparation and construction will generally increase the volume of runoff to the lake and may temporarily alter the quality of runoff to the lake, particularly related to sediment. No adverse environmental consequences are anticipated for this alternative.

9. Mixing zone

Brunswick
Thermal effluent from the Brunswick site discharges through two 13-foot diameter, 2000-foot long submerged pipes that extend into the Atlantic Ocean. Water depth at the point of discharge is approximately 10 feet. The ocean floor near the discharge pipes is sandy, with no hard bottom outcroppings or attached vegetation that might attract fish. There is a strong westerly tidal and longshore flow in this region. Although aquatic species might use the nearshore area around the discharge location, the slight increase in temperature above ambient ocean temperature is not enough to cause heat shock (COLA ER 9.3.2.2.2.5).

Harris
For the HAR, heated water discharged to Harris Lake will be from blowdown of the two new cooling towers and the service water system to control dissolved solids in the closed cycle system. The cooling tower blowdown water will be discharged into Harris Lake

through two new blowdown pipes, one for each of the new cooling towers, installed parallel to the existing discharge pipe for the HNP cooling tower blowdown water. The results of modeling indicate that the discharge plume is approximately 300 feet in diameter. The temperature difference between the plume and ambient water temperature is less than 0.5°F, which meets the NPDES criterion of no increase greater than 5°F (COLA ER 5.3.2.1). Because the HAR site is located on a large reservoir system that will provide sufficient heat rejection capacity for the two new units, plant operation is not expected to have significant thermal impacts to aquatic ecology and water quality (COLA ER 5.3.2.1).

B. Biological Characteristics and Anticipated Changes

1. Special aquatic sites

Brunswick

The Brunswick site is located on the Lower Cape Fear River estuary, which includes 22,000 acres of salt marsh and 18,000 acres of tidal flats and small tidal streams. This section of the Lower Cape Fear River near the Brunswick site ranges from one to two miles wide and is mostly shallow except for a shipping channel maintained by the U.S. Army Corps of Engineers (Brunswick ER 2.2). Special aquatic sites known to occur on the Brunswick site include wetlands, mudflats, and vegetated shallows.

Potential impacts to wetlands and streams resulting from the project, including transmission line upgrades are presented in Section III.B.3.c and Section III.B.4, and summarized in Table 6.

Harris

The Harris site is located in the Piedmont portion of the Cape Fear River basin. Special aquatic sites known to occur on the Harris site, including Harris Lake and its perimeter, include wetlands, aquatic beds, and riffle/pool complexes.

Potential impacts to wetlands and streams resulting from the project, including transmission line upgrades are presented in Section III.B.3.d and Section III.B.4 and summarized in Table 6.

Summary

Table 6. Potential impacts to aquatic resources.

Aquatic Resource	Source of Potential Impact					
	400-ac Power Block		Water Supply		Transmission Upgrades [b]	
	Harris	Brunswick	Harris	Brunswick	Harris	Brunswick
Wetlands Affected	5 ac	22 ac	502 ac [a]	0	99 ac	1,452 ac
Streams Affected	0.04 mi	0.38 mi	24.40 mi [a]	0	11.01 mi.	24.84 mi

[a] Based on estimations using comparable methodology used for Brunswick alternative evaluation. Preliminary jurisdictional delineation results for the Harris site indicate reservoir expansion may impact up to 580 acres of wetlands and 25.72 miles of stream (COLA ER).

[b] Wetlands reported only include forested wetlands subject to conversion from clearing for new ROW. Streams reported are those present within the new ROW, but no impacts are expected.

Direct impacts to special aquatic sites at the Brunswick site resulting from construction in the power block area are expected to be minimal, however the potential wetland impacts associated with the transmission line upgrades for the Brunswick site are far greater than those impacts expected to result from the Harris site. Approximately 1,423 acres of forested wetlands would be converted as a result of ROW clearing for transmission line

upgrades for the Brunswick alternative. Functional changes resulting from conversion of forested wetlands to herbaceous wetlands may include:

- Likely little change in flood water attenuation function.
- Likely decrease in water storage function, dependent on proximity to stream or river, but woody wetlands typically allow for more water storage due to higher frictional resistance.
- Decrease in energy dissipation function, due to removal of more stable woody vegetation.
- Likely decrease in organic carbon export function, due to removal of large woody vegetation that contributes to the detritus that is decomposed.
- Likely decrease in bank and shoreline stabilization function, due to greater stability provided by woody vegetation.
- Potential change in pollutant removal function, depending on location and degree to which persistent emergent vegetation is established.
- Decrease in biodiversity function in most habitats.
- Possible increase in sediment trap function, dependent on density of herbaceous vegetation established.
- Likely decrease in spatial habitat function due to removal of woody vegetation.
- Likely decrease in aerial net primary productivity due to removal of woody vegetation.
- Wildlife habitat function will be affected through loss of forest-dependent species and replacement by species adapted to open and disturbed habitats and ecotonal areas.

Types of impacts associated with construction of the Harris site power block, water supply, and transmission lines consist of fill, inundation, and conversion. Power block impacts of approximately 2 acres of the 5 acres present will include the discharge of fill material and are considered to be permanent. Impacts from the inundation of special aquatic sites around Harris Lake are considered a loss of habitat type and functional value. They are not a direct discharge as occurs with fill material. However, approximately 366 acres of the aquatic site impacts around Harris Lake are non-tidal freshwater marsh occurring within the normal pool and along the fringe surrounding the normal pool. Although not quantifiable at this time in terms of extent or timing of establishment, similar wetland features are expected to re-establish under similar conditions in and surrounding the new normal pool, just as the existing wetlands formed following construction and filling of the current reservoir. PEC's Environmental Report for the Shearon Harris Nuclear Power Plant (CP&L, amended 1986) indicates that only 3% of the land inundated for the original reservoir was bottomland hardwood; the majority of the land inundated was upland pine and hardwood forests (75%), with the balance (22%) consisting of cutover and fields.

Functional changes will occur from conversion of stream habitats to lake habitat. Functional considerations from increasing the normal pool elevation of Harris Lake include:

- Most of the perennial stream footage has already been lost due to flooding up to the current normal pool elevation of 220 feet. The physical functions provided by those perennial streams have been lost due to flooding. Many aquatic life functions are still occurring in a lentic environment for more tolerant species.
- The biological connections that historically occurred in the area when all of the stream systems merged into Buckhorn Creek before flowing into the Cape Fear River have been already lost due to the existing lake. Therefore, these stream systems, along with all of their small tributaries, are discrete systems that are connected only by the surface waters of Harris Lake.
- The ability to convey water was not lost when the original perennial streams were converted nor was the ability to transport nutrients.
- Intermittent channels provide both physical and aquatic life functions.
- Intermittent streams contain half of the aquatic taxa and 57% of the aquatic diversity of small perennial streams. Therefore their aquatic functional value, although important, is not as high as that of perennial streams.
- Additionally, intermittent stream impacts undoubtedly occurred when the original lake was flooded. As a result it is likely that many of the aquatic life functions that were being provided by the original perennial and intermittent channels migrated upstream (upslope) as the water levels in Harris Lake gradually increased.
- Many of the intermittent streams identified in the zone proposed for inundation do not appear to be providing important aquatic function. The most common type of aquatic life observed along these intermittent channels were amphibians. This type of mobile aquatic life is expected to migrate upslope with the increased water level as current intermittent channel is converted to a lentic environment.
- The loss of intermittent channel resulting from flooding up to the newly proposed 240 contour will likely result in additional aquatic life migration upstream.
- The Ephemeral/Intermittent/Perennial continuum shifts up and down a given stream segment depending on season and wetness or dryness of the year. It can be reasonably expected that this continuum will also be evident, although maybe to a lesser degree, when water levels increase and flood existing perennial and intermittent streams.
- Headwater streams drain 55-85% of a watershed (Gregory 2000) and are important conveyances of water and chemical constituents. Headwater streams will remain after the lake reaches the new 240 elevation. No considerable loss of water and chemical conveyance is anticipated. Impacts resulting from the loss of this intermittent stream function should be minimal due to the downstream impoundment. The remaining intermittent stream channels and ephemeral channels not affected by flooding will continue to convey water and export carbon and nutrients.
- Intermittent channels contribute nutrients to downstream reaches from primary production and litter fall. The loss of this function should not be a significant impact due to the downstream impoundment.

- Much of the sediment eroded from hill slopes during a major storm may be stored in small intermittent channels, allowing it to be released gradually at levels that may not harm downstream environments. These sites can be particularly important as potential sediment sources. However, impacts resulting from the loss of intermittent stream sediment source and transport to the Cape Fear River should be minimal due to the existing impoundment.
- A watershed as small as 13 acres can form and support an intermittent stream in the Piedmont.

Overall, the Brunswick alternative would impact a substantially greater amount of wetlands than the Harris alternative, primarily through the conversion of forested wetlands for transmission line upgrades. The Harris alternative would result in lesser total wetland impact including both conversion of forested wetlands for transmission line upgrades and conversion of forested wetlands and herbaceous wetlands to open water lake habitat. Non-tidal freshwater marsh habitat would be expected to become re-established in the shallow portions of the lake and along the normal pool fringe subject to long-term saturation.

The Harris alternative would impact a substantially greater amount of streams through inundation from the reservoir expansion. Inundation results in a conversion from intermittent and perennial stream habitat functions to lake habitat functions. Raising the normal pool of the lake is not expected to result in as great a functional change as that which occurred historically when the original reservoir was created which resulted in the isolation of remaining stream habitats by intervening lake habitat.

Based on the difference in types of impacts and the difference in functions lost or gained, the Brunswick alternative does not constitute an alternative demonstrating less adverse impact on the aquatic ecosystem in comparison to the preferred alternative, the Harris site.

2. Habitat for fish and other aquatic organisms

Brunswick

The Lower Cape Fear River estuary and surrounding marsh and wetlands provide important habitat for fish and other aquatic organisms at various life cycle stages. The major categories of aquatic biota include phytoplankton, zooplankton, larvae and post larvae of fish and shellfish, and juvenile and adult fish and shellfish. The Cape Fear River up to Highway 421 is considered Essential Fish Habitat by the National Marine Fisheries Service (NMFS) for egg, larval, and/or juvenile life stages of the following species: red drum, bluefish, summer flounder, gag grouper, gray snapper, cobia, king mackerel, Spanish mackerel, black sea bass, spiny dogfish, brown shrimp, pink shrimp, white shrimp, plus twelve different shark species (NMFS 2009). The primary habitat types utilized by the aquatic organisms in the vicinity of the Brunswick site include the water column, shell bottom habitat, wetlands, and soft bottom habitat. Direct impacts to aquatic habitat resulting from the construction in the power block area are expected to be small.

However, the additional generating capacity resulting from the advanced reactors at the Brunswick site will require additional cooling water to be pumped from the existing canal. The Brunswick site currently operates two units with once through cooling. Cooling water is withdrawn from the Cape Fear River Estuary and discharged to the Atlantic Ocean via a 6-mile long discharge canal. The two new units would use closed cycle cooling with much less water flow required. The increase in water flow required for the closed cycle cooling systems, though nominal in comparison to once through cooling systems, could cumulatively increase the entrainment and impingement of aquatic organisms making this site less attractive as an alternative site. A fish diversion structure located at the mouth of the intake canal and fine-mesh traveling screens plus a fish return system have been installed to reduce the entrainment and impingement of aquatic organisms. Despite these intake modifications, additional flow would expose smaller aquatic organisms in this nursery area to increased risk of entrainment. Cooling water flow for all units flows along a single common intake canal. The design of the fish diversion structure was engineered for the existing two operating units only. Make-up water for two additional units could challenge the integrity of the diversion structure resulting in damaged diversion screens and extensive maintenance activities. Repairs are completed as quickly as possible. However, past data have indicated the temporary openings provide entry points for larger aquatic organisms including endangered and threatened species such as loggerhead, green, and Kemp's Ridley sea turtles. In addition to the possibility of increased impingement rates this increases the risk of increased incidental takes of sea turtles.

Increased cooling water flow rates may also jeopardize cooling water system reliability depending on the magnitude of the increase. Past operating experience has shown that increased velocity in the intake canal associated with sedimentation increases the occurrences of fine-mesh screen clogging events. In addition there are significant environmental challenges to plant operation in this estuarine setting that do not exist for the location of the Harris site. These include intake blockage resulting from large volumes of marine algae, dense concentrations of marine zooplankton, and the large bio-fouling community associated with marine waters (PEC 2009a).

The additional cooling water will also result in additional discharge through the existing pipes that extend into the Atlantic Ocean. The ocean floor surrounding the discharge pipes is sandy with no hard bottom outcroppings. This additional thermal discharge is expected to have a minimal effect on habitat for fish and other aquatic organisms due to the strong westerly and long shore flow in this area.

In summary, the effects on aquatic habitat and ecology resulting from new reactors at the Brunswick site could be significant relative to the other alternatives considered due to the increased volume of necessary cooling water. This would create additional entrainment and impingement impacts to aquatic organisms, including sea turtles as well as the increased possibility of blockages that are associated with the operation of such a system in brackish water. Increased blockages could pose significant health and safety issues for the plant and surrounding area (PEC 2009a).

Harris

An ecological study conducted on the Harris site in 2006 identified no significant aquatic habitat within the footprint of the proposed HAR-2 and HAR-3 facilities. There is a constructed pond of approximately 2 acres containing both submerged and emergent vegetation that would be filled within this area for the construction of the HAR-3 cooling tower (COLA ER 4.3.2.1). The 2006 study also identified seven sites within the Harris Lake expansion area that were selected for biotic sampling using NC-DENR sampling protocols. For aquatic macroinvertebrates, these evinced scores of less than or equal to 3 on the 5-point scale, thus indicative of overall fair-to-poor ecological conditions. It should be noted that at the time of sampling, the central Piedmont area of North Carolina was in a state of 'moderate drought' with corresponding reduction in stream flow; many of the aquatic taxa quantified in these assays require well-oxygenated flowing water and thus the drought may have temporarily depressed the abundance of these organisms. Sampling of piscine (fish) species via electro-shocking revealed a similar range of poor to good for the seven sampling sites.

Although inundation is not a direct discharge of dredge or fill material it does represent a loss of functional value of those streams and wetlands affected and a conversion of aquatic habitat types does occur. As such, quantifying this loss is required under Section 404. Increasing the normal pool elevation of Harris Lake will replace up to approximately 24.40 miles of lotic habitat (*i.e.*, streams) with lentic habitat (*i.e.*, lake) and replace approximately 136 acres of forested wetlands consisting of NCWAM types bottomland hardwood forest, headwater forest, and riverine swamp forest, with lentic habitat. Species inhabiting only stream habitats and not adapted to occupy lake habitats will either move to favorable stream conditions located above the 240-foot NGVD29 contour or perish. Some species individuals may experience a loss of habitat (COLA ER 4.3.2.2.3). However, other suitable stream habitat for these species occurs in the region, and no specific populations are expected to be lost from the region. The loss of these habitats is mitigatable through compensatory mitigation. Aquatic habitat loss will occur to approximately 366 acres of non-tidal freshwater marsh wetlands located below the 220-foot contour (*i.e.*, emergent wetlands and aquatic beds) and along the shoreline of the lake. Although not quantifiable in extent or timing of re-establishment, similar habitats will likely re-establish in areas with suitable conditions at the higher pool elevation and represent, at least in part, only a temporary loss of aquatic habitat.

The transmission line upgrades will result in wetland conversion due to ROW expansion; however, the overall loss of aquatic habitat is expected to be minimal. Other appurtenant facilities do not incur any significant loss of aquatic habitat, however the intake structure and pipeline that will supply makeup water to Harris Lake does have the potential to affect resident fish species in the Cape Fear River such as bluehead chub (*Nocomis leptocephalus*), bluegill (*Lepomis macrochirus*), redbreast sunfish (*L. auritus*), white shiner (*Luxilus albeolus*), and other common species. The impact on native fish resulting from the intake structure and makeup water line is expected to be minimal. The impingement and entrainment issues that would likely result from expansion of the Brunswick site are greater than those that would be experienced at the Harris site. In

summary, the increased capacity of Harris Lake will result in the conversion of significant stream and wetland habitat to a lentic system due to inundation, however, this impact should not result in any detrimental ecological effects to their receiving waters; Harris Lake, Buckhorn Creek, or the Cape Fear River.

Summary

Table 7. Impacts to fish and aquatic habitat

Site	Potential Impact			
	Impacts from Power Block Construction	Essential Fish Habitat	Entrainment/ Impingement Issues	Impacts from Transmission Upgrades
Brunswick	Yes	Yes	Yes- higher impacts	Yes – larger
Harris	Yes	No	Yes-lower impacts	Yes – smaller

Both sites will incur impacts to aquatic habitat either through direct conversion of habitat through transmission line upgrades or through inundation. However, the potential effect on aquatic organisms as a result of increased water flow through the Brunswick site may result in greater detrimental effects on the aquatic ecosystem as a whole based on the diversity and value of estuarine organisms that may be affected compared to the more limited diversity and value of freshwater organisms at the Harris site. Compliance with CWA 316 should avoid significant impacts. The loss of approximately 366 acres of non-tidal freshwater marsh habitat and 136 acres of forested wetland habitat at the Harris site is expected to be offset through mitigative measures. Aquatic bed habitat and nontidal freshwater marsh wetlands, similar to those becoming established in Harris Lake following construction and inundation of the original reservoir, are expected to become re-established over time at suitable elevations within the expanded reservoir. The expanded reservoir will also increase open water habitat through inundation and conversion of approximately 3,747 acres of upland habitats to lake habitat.

3. Wildlife habitat

Brunswick

Potential impacts to wildlife habitat at the Brunswick site should be relatively minor as most of the site construction would utilize previously disturbed portions of the site. Impacts to wildlife habitat resulting from the transmission line upgrades could involve an estimated 4,360 acres of new ROW required. The four new Brunswick lines are anticipated to be located adjacent to existing transmission line ROWs and impacts to most wildlife habitat would be considered minimal. Potential impacts to threatened and endangered species habitat are treated in Section 4 below.

Harris

There will be little wildlife habitat impact arising directly from the footprint of HAR-2 and HAR-3. HAR-2 will be built on a primarily paved and gravel-covered area that also contains non-native grasses. HAR-3 will be built on an area recently clear cut and replanted with loblolly pine (*Pinus taeda*) [COLA ER 4.3.1.1.1). The saplings are less

than 10 years old. Because of the low habitat quality, low vegetative diversity, and ongoing timber management within the Harris site, conversion of these areas to HAR-2 and HAR-3, with their supporting infrastructure, should have minimal effects to wildlife habitat. The North Carolina Wildlife Resources Commission (NCWRC) "Guidance Memorandum to Address and Mitigate Secondary and Cumulative Effects to Aquatic and Terrestrial Wildlife Resources and Water Quality" will be used when developing sediment and erosion plans and to manage buffer zones following construction.

Increasing the pool elevation of Harris Lake will expand the lake to approximately 7,633 acres by inundating approximately 4,250 acres of upland and wetland habitats. However, none of the impacted forest types (as identified in the 2006 field study) are considered uncommon in the North Carolina Piedmont. Historically, all of the areas have been harvested or cleared. PEC has indicated its intent to maintain uncut buffer zones of approximately 100' along the reservoir edge and along stream courses, where possible; these areas can serve as important migratory corridors for the movement of motile terrestrial species out of the impacted area. Approximately 13,227 acres of PEC land around Harris Lake has been enrolled in the North Carolina Game Land Program (COLA ER 4.3.1.2.1). Additional undeveloped land adjacent to the PEC property will provide habitat outside the affected area, but some species may ultimately overpopulate the area. Adverse effects will be most evident for less mobile species that cannot easily relocate. Possible actions to reduce mortality of these species include the timing of construction activities to accommodate life cycles of less mobile species. There is evidence of a blue heron (*Ardea herodias*) rookery in the southeastern portion of the reservoir; this species is not endangered but is protected under the Migratory Bird Treaty Act. PEC has outlined protective measures in the Harris ER that will minimize adverse effects to the rookery including establishment of a buffer zone, timing of construction, and timing of rise in pool elevation (COLA ER 4.3.1.2.2).

Approximately 26 acres will be cleared for the pipeline corridor. The majority of this area has been previously disturbed. Little existing terrestrial wildlife habitat will be permanently disturbed as a result of the pipeline corridor.

Impacts to wildlife habitat resulting from the transmission line upgrades could involve an estimated 1,248 acres of new ROW required, of which approximately 90 percent is either agricultural or undisturbed. NCWRC indicates that part of the proposed transmission line upgrades will cross a Significant Natural Heritage Area known as Buckhorn Bluffs and Levees. A small portion of NCWRC's Urban Wildlife Conservation Corridor will also be impacted by inundation from rising lake levels. Potential impacts to threatened and endangered species habitat are treated in Section 4 below.

4. Endangered or threatened species

Brunswick

There are no USFWS designated critical habitats occurring within the 400-acre power block. Federally protected species listed for Brunswick County by USFWS include the following: American alligator (*Alligator mississippiensis*), bald eagle (*Haliaeetus*

leucocephalus), Eastern puma (*Puma concolor couguar*), green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), piping plover (*Charadrius melodus*), red-cockaded woodpecker (RCW) (*Picoides borealis*), shortnose sturgeon (*Acipenser brevirostrum*), West Indian manatee (*Trichechus manatus*), wood stork (*Mycteria americana*), Cooley's meadowrue (*Thalictrum cooleyi*), rough-leaved loosestrife (*Lysimachia asperulaefolia*), and seabeach amaranth (*Amaranthus pumilus*). Federally protected species that could potentially be affected by future facility expansion include the red-cockaded woodpecker, Cooley's meadowrue, and rough-leaved loosestrife. Nesting habitat for the red-cockaded woodpecker does not occur on the plant site, but the birds may forage on the site. In addition to the potential for protected species on the site itself, there are also considerations that must take into account the possibility of protected species occurrences and impacts associated with the transmission line upgrades, which extend beyond Brunswick County. Cooley's meadowrue and rough-leaved loosestrife occur along existing PEC transmission line ROWs. Golden sedge (*Carex lutea*), which is not listed for Brunswick County, also occurs in PEC transmission lines in Pender and Onslow Counties (Brunswick ER 2.5). PEC typically manages the suitable habitat for protected plant species that occur in their powerline corridors per USFWS and NCWRC guidelines. In 1993, PEC signed a Memorandum of Agreement with NCDENR to preserve and protect rare, threatened, and endangered species and sensitive natural areas occurring on transmission ROWs. PEC also follows best management practices for the ongoing management of rare plants on its ROWs (Brunswick ER 2.5).

Expansion of existing transmission line rights-of-way by an additional 100 feet to accommodate each new Brunswick transmission line may result in adverse impacts where the new transmission lines may pass through red-cockaded woodpecker (RCW) habitat, particularly where two or three of the new lines share a common route, resulting in anticipated new clearing of 200 and 300 feet respectively for new ROWs. RCW nesting habitat consists of primarily old-growth pine forest with relatively open understory, but they forage in pine stands as young as 30 years within 0.5 mile of the nesting cavity trees. Gaps in suitable habitat, particularly openings greater than 200 feet separating RCW habitat are considered a barrier for RCWs and the USFWS considers creation of such gaps to be an adverse impact within occupied habitat due to higher risk of predation. The RCW is listed for Brunswick County and also for the counties into which new transmission lines would be built. NCNHP data indicates that 46 RCW occurrences have been documented within approximately 1.0 mile of the new transmission line routes. The preliminary routes identified for three of the new lines would be co-located along an existing transmission line ROW from the Brunswick substation to a point north of the Sutton substation where one line would continue on to the Clinton substation and the other two would continue co-located along existing right-of-way to the Jacksonville substation, where one terminates and the other continues on to the Wommack substation. NCNHP data indicates that up to 39 RCW occurrences may be present along the new transmission line routes where two or three of the new lines would follow a similar route requiring the anticipated additional clearing of 200 or 300 feet, respectively, of forested habitat adjacent to the existing transmission line ROW.

Detailed assessments would be required to determine if these, or any previously undocumented RCW cavity trees, are located within 0.5 mile of the new transmission lines and whether adverse impacts would result from clearing for new ROWs.

On 20 January 2000, the NMFS-Southeast Region issued its most recent Biological Opinion regarding the operation of the cooling water intake system at the Brunswick plant based on the current water intake scenario. The 20 January 2000 Biological Opinion is valid for 20 years and resulted from a re-initiation of a prior consultation that was completed for the Brunswick plant on 30 April 1999. The Incidental Take Statement (ITS) of the April 1999 opinion anticipated that 50 loggerheads, 5 green, and 8 Kemp's ridley sea turtles would be incidentally taken, but released without harm on a biennial basis at the Brunswick plant. The April 1999 ITS also anticipated the incidental take by injury or mortality, on a biennial basis, of 1 hawksbill or leatherback, 6 loggerheads, 2 greens, and 2 Kemp's ridleys during Brunswick plant operations. Between 30 April 1999 and 14 September 1999, the Brunswick plant documented the mortality of 2 endangered Kemp's ridleys, thus meeting the level of anticipated incidental take (NMFS 2000). This action along with new information on how dead sea turtles were being washed into the intake canal from surrounding areas triggered the need for re-initiation of formal consultation. The April 2000 NMFS Biological Opinion suggests that it is NMFS's opinion that the operation of the water intake system at the Brunswick plant is not likely to jeopardize the continued existence of the loggerhead, leatherback, green, hawksbill, or Kemps ridley sea turtles. The conclusion was based on the proposed action's anticipated effects on each of these species being limited to the incidental take, through death or injury, of a small number of mostly immature sea turtles over the next 20 years. This Biological Opinion is also based on the current generating capacity and intake water flow at the Brunswick plant.

An increase in cooling water flow needed for any new reactors to provide additional generation has the potential to result in additional sea turtle takes due to the unavoidable changes in the water flow regimes and possibly the intake structure itself. Any deviation from the current generating capacity and water flows at the Brunswick site will require re-initiation of formal consultation with NMFS to evaluate the potential effect on sea turtles resulting from increased water flow into the intake canal. Likewise, if the currently authorized level of incidental take is exceeded, such incidental take represents new information requiring re-initiation of consultation and review of reasonable and prudent measures. Incidental take data provided by PEC documents that a total of 221 sea turtles (loggerhead, Kemp's and green) were entrapped between 1994 through 2008 under the current generating capacity (PEC 2009b). This resulted in 31 mortalities.

NMFS also commented in the April 2000 Biological Opinion that the likelihood for shortnose sturgeon to be adversely affected by the proposed action (intake water canal) is low enough to be considered discountable. Therefore, NMFS has determined that it is unlikely that a shortnose sturgeon would be adversely affected by the operation of the Brunswick plant. As with the sea turtles, a new opinion on the potential effect on the shortnose sturgeon will be necessary if the intake water flow increases as a direct result of an increase to generating capacity at the Brunswick plant.

Harris

There are no USFWS designated critical habitats associated with the Harris site (COLA ER 5.6.2). Federally protected species listed for Wake and Chatham Counties include the following: bald eagle, RCW, dwarf wedgemussel (*Alasmidonta heterodon*), Michaux's sumac (*Rhus michauxii*), Cape Fear shiner (*Notropis mekistocholas*), and harperella (*Ptilimnium nodosum*). The Cape Fear shiner likely does not occur in the vicinity of the proposed water intake structure, given the limited distribution of the species and the lack of habitat at the proposed structure location. The Cape Fear shiner is not known to exist in the portion of the Cape Fear River from Buckhorn Dam to Lock and Dam 3, and is thought to be extirpated in this area. The dwarf wedgemussel is not known to occur in the Cape Fear basin, and it is likely that this mussel would not occur in this area. The intake in the Cape Fear River should not adversely affect the Cape Fear shiner or dwarf wedgemussel due to the lack of suitable habitat in the area of the proposed structure. There are known occurrences of bald eagles from Harris Lake and Jordan Lake, as well as nesting bald eagles along the Cape Fear River near the Agape Lutheran Camp (5-6 miles downstream). NCWRC indicates that the new shoreline of Harris Lake will move within the secondary management zone of a bald eagle nest near Avent Ferry Road. These eagles, including breeding pairs, likely use Harris and Jordan Lakes as a food source. The proposed action should not adversely affect bald eagles other than temporarily removing potential perching locations along Harris Lake in the zone between the existing and proposed pool elevations. Trees that can be utilized for perching will remain intact at and above the 240 foot NGVD29 contour. PEC has procedures in place if threatened or endangered species are discovered on a site or on a transmission line corridor (COLA ER 9.3.2.2.1.4).

The proposed upgrades and expansions of certain transmission lines have the potential to affect threatened or endangered species though habitat conversion or loss. RCWs are known to occur in mature longleaf pine forests crossed by the Harris-Fayetteville transmission corridor (COLA ER 5.6.1.1); NCNHP data show that eight RCW clusters have been documented within 1.0 mile of the transmission line on Fort Bragg. The RCW population on Fort Bragg is one of twelve primary core populations listed in the RCW Recovery Plan (USFWS 2003) as critical for the survival and recovery of the species. Any activities involving the removal of pines for new ROW on Fort Bragg will require surveys for this species as well as a foraging habitat assessment to ensure that no birds or cavity trees are impacted and that foraging habitat is not adversely impacted. NCNHP data also document three RCW records in Wake County within 1.0 mile of the transmission lines; however, two of these occurrences were reported as destroyed and the other as historic (last seen more than 20 years ago). The new Harris transmission lines each are anticipated to require clearing of 100 feet of new ROW adjacent to existing transmission line ROWs. None of the new Harris transmission lines share a common route for all or part of their routes as do those projected for three of the new Brunswick lines that would be required.

NCNHP data documents two other federally endangered species in or within 500 feet of the new potential transmission line corridors. Two records, one historic (Neuse River),

for dwarf wedgemussel are documented in NCNHP data within streams crossed by a new transmission line. Avoiding in-stream work and minimizing clearing of streambank vegetation would minimize potential impacts to this species. Adverse impacts would not be expected for the other species, rough-leaved loosestrife, for similar reasons identified for the Brunswick site.

Michaux's sumac is also known to occur in disturbed areas along existing ROWs elsewhere in the area, however ROW expansion should not negatively impact this species as said expansion will open up more potential habitat for Michaux's sumac in certain areas. A research plot containing Michaux's sumac is adjacent to PEC property within the Harris Research Tract. This research area will not be impacted by any activities associated with the HAR project.

Summary

Table 8. Threatened and Endangered Species Documented Occurrences (NCDENR 2008).

Potential Impact Source	Site	
	Brunswick	Harris
400-Acre Power Block	None	None
Water Supply Canal (Brunswick), Water Supply Intake and Reservoir (Harris)	Loggerhead, Kemp's Ridley, and Green Sea Turtles (31 mortalities resulting from 221 entrapments between 1994 – 2008)	None
Transmission Line Upgrades[1]	Red-cockaded Woodpecker (46), Shortnose Sturgeon (1), Manatee (1), Rough-leaved Loosestrife (8), Cooley's Meadowrue (3), Golden Sedge (2)	Red-cockaded Woodpecker (11), Dwarf Wedgemussel (2), Rough-leaved Loosestrife (2)

[1] RCW element occurrences within 1.0 mile; all others within 500 feet.

The Brunswick site has the potential for greater adverse impact to federally threatened and endangered species than the Harris site due to potential increase in incidental take of three species of sea turtle within the intake canal, and greater potential adverse impact to RCWs along the new transmission lines (Table 8). With proper best management practices and protection during construction, no adverse impacts to the plants or other aquatic animals within the transmission line upgrade areas are expected.

5. Biological availability of possible contaminants in dredge or fill material

Brunswick

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

Harris

Onsite material from grading of HAR-3 may be used as a source for fill material. Per the 404(b)(1) guidelines, the fill will be free of petroleum products and hazardous substances as well as free from chemical, biological, and other pollutants. The Harris site provides more opportunity for use of fill from onsite sources than does the Brunswick site.

C. Human Use Characteristics and Impacts

1. Existing and potential water supplies; water conservation

Brunswick

The Brunswick site only uses one on-site water supply well at the biology lab; all other potable water for the facility is supplied by Brunswick County. According to the ER, the Brunswick site uses 1 percent of the treated water production capacity of Brunswick County and two percent of actual production. Uses of potable water provided by the Brunswick County water system to the Brunswick site do not stress system's capacity to supply water to residents and businesses (Brunswick ER 4.15). The businesses and residents in the vicinity of the Brunswick site use either water from wells or municipal water. In the vicinity of the site, shallow wells in the surficial aquifer are adequate for small potable water supplies, but for larger water yields the Castle Hayne Aquifer is the most important aquifer. The Castle Hayne Aquifer provides water to the Sunny Point Military Ocean Terminal and to the municipalities of Long Beach and Southport. Residents of New Hanover County get their drinking water primarily from water wells with the exception of the City of Wilmington that gets its water from the lower Cape Fear River. Wells in New Hanover County used for domestic purposes are in the surficial sand aquifer and for larger yields, are located in the Castle Hayne (Brunswick ER 2.3).

Due to the salinity of the water in the Cape Fear River downstream of the Brunswick site, there are no withdrawals of water from this area as a water supply. No adverse environmental consequences are anticipated for this alternative.

Harris

Groundwater will not be used for the facility operation. The subsurface geology consists of Triassic aged sedimentary rocks with well yields of between 10 and 25 gallons per minute. Use of groundwater in the vicinity of the site is restricted as PEC owns most properties within a 2-mile radius. A well survey performed by PEC indicated that the closest water supply well to the HAR site is located 1.2 miles to the north-northwest. The private wells identified were noted as being 75 to 360 feet deep and cased in the bedrock aquifer. Only two communities within 5 miles of the Harris Site use groundwater as a source of drinking water (New Hill and Fuquay-Varina). The Fuquay-Varina community is located in Wake County and is located in the Carolina Slate Belt (COLA ER 2.3.2.2).

Potable water for the Harris site comes from and will come from the reservoir. No adverse environmental consequences are anticipated for this alternative.

2. Recreational or commercial fisheries

Brunswick

The Cape Fear River, up to Highway 421, is considered Essential Fish Habitat by the NMFS for egg, larval, and/or juvenile life stages of the following species: red drum, bluefish, summer flounder, gag grouper, gray snapper, cobia, king mackerel, Spanish mackerel, black sea bass, spiny dogfish, brown shrimp, pink shrimp, white shrimp, plus

twelve different shark species (NMFS 2009). The Magnuson-Stevens Fishery Conservation and Management Act is the primary law governing marine fisheries management in United States federal waters. The Act was first enacted in 1976 and amended in 1996. The 1996 amendments focused on rebuilding depleted fisheries, protecting essential fish habitat, and reducing bycatch. The increased volume of cooling water necessary to operate the new reactors at the Brunswick site could result in increased rates of entrainment and impingement, which could have the potential to affect commercial and recreational fisheries stocks.

Harris
No adverse environmental consequences are anticipated for this alternative. Recreational fishing opportunities should be enhanced with the larger impoundment. There is no known commercial fishing industry on Harris Lake.

3. Other water related recreation

Brunswick
There is no public access for the intake canal for the Brunswick site. No adverse environmental consequences are anticipated for this alternative.

Harris
Displacement of public boat ramps and public access areas will result from expansion of Harris Lake. Replacement ramps and access areas at higher elevations will be built.

4. Aesthetics of the aquatic ecosystem

Brunswick
No adverse environmental consequences are anticipated for this alternative. Because the new reactors would be placed near the existing units with substantial buffer of land controlled by PEC, no changes in existing aesthetics of nearby aquatic ecosystems would be expected.

Harris
No adverse environmental consequences are anticipated for this alternative. The HNP uses vegetation as a visual screen or buffer from surrounding land uses so construction and operational activities will not be visible to area residences. Because the HAR sites will be screened by the existing HNP from the main portion of the reservoir, individuals pursuing water-based activities on Harris Reservoir will have minimal exposure to construction activities (COLA ER 10.3.1.10.2). There will be temporary impacts to aesthetic views along the lake perimeter during site clearing that will be undertaken prior to raising the water level.

5. Parks, national and historic monuments, national seashores, wild and scenic rivers, wilderness areas, research sites, etc.

Brunswick
No parks, national and historic monuments, national seashores, wild and scenic rivers, wilderness areas, or research sites are present on the Brunswick site. No adverse environmental consequences are anticipated.

Harris
The Harris Lake County Park would be impacted by construction at the Harris site, specifically by the raising of the pool level of Harris Lake (COLA ER 4.1.1.2.1.3, 4.4.2.6). These impacts would include the flooding of approximately 279 acres within the current park boundaries as well as the displacement of other amenities. However, PEC is committed to relocating the park services affected by the increased water level. Numerous additional facilities are located within a 50-mile radius of the Harris site that would offset temporary displacements during construction.

6. Traffic/transportation patterns

Brunswick
The proposed Brunswick site is located near the City of Southport and the site is accessed by local roads. State Highways 87, 133, and 211 provide access to the area, and feed into U.S. Highway 17 (COLA ER 9.3.2.2.2.7). Temporary access road and additional plant roads have not been fully assessed, but are expected to be similar in nature to those required at the Harris site.

On-site railroad access is already provided in the immediate vicinity of the proposed site, but an additional 0.1 mile of rail would be needed to connect to the existing rail line (COLA ER 9.3.2.2.2.7).

No significant adverse environmental consequences are anticipated.

Harris
Roads and highways in the vicinity will not be adversely impacted by operation of the new facility; because most of the operational workers are expected to already live within a 50-mile radius of the plant site, traffic would be divided over the two primary access routes, U.S. Highway 1, and Old U.S. Highway 1, as well as supported by the proposed Western Wake Parkway when this controlled access parkway is completed (COLA ER 5.8.2.8).

A new interchange on U.S. Highway 1 and Shearon Harris Road may be required to support construction and operation of the HAR; additional plant roads will be constructed prior to HAR construction (HAR 5.1.1.1.2). PEC has initiated discussion with NCDOT regarding county and state roadway impacts due to increased lake levels in the Harris Reservoir required for operations of the HAR. The rise in reservoir elevation will require enhancements to existing roads affected by the increased lake level; in-use

roadways, along with associated infrastructure, will be reconstructed in their current locations to accommodate the rise in the reservoir's elevation (COLA ER 5.1.1.2.2.4).

On-site railroad access is already provided in the immediate vicinity of the proposed site, but an additional 0.2 mile of rail would be needed to connect to the existing rail line (COLA ER 9.3.2.2.1.7).

No significant adverse environmental consequences are anticipated.

7. Energy consumption or generation

Brunswick
The addition of two Westinghouse AP1000 units will provide an electrical output of at least 2000 megawatt electric (MWe) (COLA ER 1.1.3). Four new 230-kV transmission lines would be required for the addition of a single advanced reactor at the Brunswick site; these transmission lines are identified as the new Brunswick to Cumberland 230-kV, new Brunswick to Clinton 230-kV, new Brunswick to Jacksonville 230-kV, and new Brunswick to Wommack 230-kV lines (PEC 2006). Routing studies have not been completed, but routes are expected to be adjacent to or within existing ROWs where possible. The total length for four new transmission lines is approximately 360 miles. Potential impacts to natural resources are described in appropriate sections of this document.

Harris
The addition of two Westinghouse AP1000 units will provide an electrical output of at least 2000 megawatt electric (MWe) (COLA ER 1.1.3). Seven 230-kV transmission lines currently connect the existing Harris Nuclear Plant (HNP) to the PEC electric grid system, with an eighth line planned for 2011. These transmission lines will also connect HAR-2 through the HNP common expanded switchyard to the PEC electric grid. HAR-2 will connect to the PEC grid utilizing existing towers, lines, and ROWs that currently support HNP operations (COLA ER 3.7.1.1). Three new 230-kV transmission lines will connect the HAR-3 switchyard to the PEC electric grid. The proposed routing of the three new transmission lines for HAR-3 is being evaluated to be adjacent to or within the existing ROWs. These three transmission lines will be connected to the existing Fort Bragg Woodruff Street Substation, Erwin Substation, and Wake Substation. The total length of the three new transmission lines is approximately 103 miles. Potential impacts to natural resources are described in appropriate sections of this document.

8. Navigation

Brunswick
Although the Cape Fear River adjacent to the Brunswick site constitutes navigable waters, the intake canal is restricted with no public access. No adverse impacts to navigation are anticipated for this alternative.

Harris
The Cape Fear River at this stretch and Buckhorn Creek are not currently used as navigable waters. Expanding the reservoir will increase the surface area available for recreational watercraft. No adverse impacts to navigation are anticipated for for this alternative.

9. Safety

Brunswick
The NRC performs safety evaluations of operating and prospective nuclear sites. Safety related to seismic activity is considered to be a low level of concern at the Brunswick Site. Five low magnitude earthquakes were recorded for the period from 1860 to the present, but there was no significant damage noted (FSAR 2.5.2.1). No adverse environmental consequences are anticipated for this alternative.

Harris
The NRC performs safety evaluations of operating and prospective nuclear sites. The COL Application document noted that review of geological, seismological, geophysical, and geotechnical data for the Harris Site did not identify anything that would preclude the safe operation of the proposed facilities (COLA ER 2.5.0.1.2). No adverse environmental consequences are anticipated for this alternative.

10. Air quality

Brunswick
The Brunswick site would use saltwater for cooling which would result in cooling water salt drift (COLA ER 10.4.1.3). Since the construction of the facility would constitute a major modification under Environmental Protection Agency (EPA) guidelines and could result in a significant increase in particulate emissions due to salt drift, the facility may be required to obtain a Prevention of Significant Deterioration (PSD) air quality permit (40 CFR § 52.21).

A small increase in air emissions may occur during construction of the proposed Brunswick site. During construction activities at the Brunswick site, controls will be implemented to mitigate potential air emissions from construction sources. The small increase in emissions during construction is not expected to pose a significant adverse environmental consequence for the site and will comply with the State Implementation Plan.

Harris
The Harris site uses fresh water from Harris Lake for use in cooling. The use of fresh water for cooling would not be expected to cause a significant increase in particulate emissions and may indicate that a PSD air quality permit would not be required for the Harris site. The Harris site would be required to comply with an emissions permit (COL Application 9.3.2.2.1.2). The construction of the proposed facility is not expected to pose a significant environmental consequence for the facility or surrounding area.

A small increase in air emissions may occur during timber removal, and HAR site preparation activities required for the Harris Reservoir perimeter, transmission corridors, pipeline corridor, and/or installation of the intake structure and pumphouse. During construction activities at the HAR site, controls will be implemented to mitigate potential air emissions from construction sources (COLA ER 10.3.1.4). The small increase in emissions during construction is not expected to pose a significant adverse environmental consequence for the site and will comply with the State Implementation Plan.

11. Noise

Brunswick
There were no significant noise concerns noted in the ER or FSAR for the Brunswick Site. Temporary increases in noise levels are expected during construction. Noise levels will be controlled by following Occupational Safety and Health Administration (OSHA) regulations, Federal noise pollution control regulations and applicable local noise ordinances. The construction of the facility is not expected to pose a significant adverse environmental consequence related to noise.

Harris
Temporary increases in noise levels are expected during construction of HAR-2 and HAR-3. The temporary noise increases can be expected due to clearing of trees prior to raising the reservoir level, during grading, and the actual construction of the HAR-2 and HAR-3 facilities. Noise levels will be controlled by following Occupational Safety and Health Administration (OSHA) regulations, Federal noise pollution control regulations and applicable local noise ordinances. The construction of the facility is not expected to pose a significant adverse environmental consequence related to noise.

12. Historic properties

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

Brunswick
No coordination has occurred to date with the North Carolina SHPO regarding potential expansion of the Brunswick site. However, when the existing site was permitted, coordination with the North Carolina Department of Arts, Culture, and History and the NRC occurred, which resulted in a conclusion that the construction of the original Brunswick site would not impact National Register properties (Brunswick ER 2.11, 4.19).

Additionally, no archaeological survey has been conducted of the approximately 400-acre area at the Brunswick site. However, the uplands within this area have been previously

disturbed during construction of the current nuclear facility, including construction that began, but was ceased, on cooling towers that were determined to not be necessary to the operation of the facility (Personal communication, Linda Hickok, 4 May 2009). As such, this area has a low potential to contain intact archaeological sites eligible for listing in the National Register. It would be expected, but cannot be stated, that the NC SHPO would recommend no archaeological survey for the Brunswick site based on previous disturbance.

No properties listed in or eligible for listing in the National Register are located on the proposed construction areas at the Brunswick site. While there are properties listed in the National Register, eligible for listing in the National Register, or potentially eligible for listing in the National Register within a 10-mile radius of the site, none of these properties would be directly or indirectly impacted (Brunswick ER 2.11, 4.19; NC SHPO, Records on file).

Harris
No adverse environmental consequences are anticipated. Coordination with the North Carolina SHPO pursuant to Section 106 of the NHPA has been conducted by PEC for the HAR site (COLA ER 2.5.3.2, 4.1.3). This coordination resulted in the recommendation by the NC SHPO for an archaeological survey of the APE, defined as the approximately 400-acre proposed HAR site as well as the proposed reservoir expansion area and the associated water make-up line. These surveys were conducted in 2007-2009 (Espenshade 2007; Espenshade et al. 2007; Personal communication, Linda Hickok, 23 April 2009). None of these archaeological surveys encountered any archaeological sites that could be considered eligible for listing in the National Register. A management summary for the Phase I archaeological survey of the proposed reservoir expansion area has been submitted to the SHPO.

No properties listed in or eligible for listing in the National Register are located at the HAR site. While there are properties listed in the National Register, eligible for listing in the National Register, or potentially eligible for listing in the National Register within a 10-mile radius of the site, none of these properties will be directly or indirectly impacted by construction activities or newly constructed structures (COLA ER 2.5.3.1). No impacts to historic properties are anticipated for the site.

13. Land use classification

Brunswick
The Brunswick site is on land already owned by PEC and is already zoned for uses compatible with the development of new units (COLA ER 9.3.2.2.2.1). No adverse environmental consequences are anticipated.

Harris
The HAR site is on land that is already owned by PEC and is already zoned for uses that are compatible with the development of new reactor units (COLA ER 9.3.2.2.1.1). No adverse environmental consequences are anticipated.

14. Economics

With the PEC service area, the Annual Peak demand increased by 24.6 percent and the Annual Load increased by 18.1 percent from 1997-2006, indicative of the growing need for electrical power with the PEC service area. On average within that 10 year time span, the need for power within the PEC service area increased by nearly 900 megawatts every four years. From the year 2007-2008 to 2021-2022, PEC anticipates load to increase by 24.7 percent (PEC 2006). Construction at either site would help maintain an adequate supply to load ratio and reliable electrical service to commercial customers, which would help maintain and support growth of economic activity within the PEC service area.

Brunswick
No adverse environmental consequences are anticipated. It is anticipated that construction of two units at the Brunswick site would create a maximum of 3,150 jobs in the construction sector over the 7 year construction period (COLA ER 4.4.2.1), as well as approximately 773 jobs to operate the new facilities (COLA ER 5.1.1.1.2). Given the anticipated 2010 population of the four-county region surrounding the site of 437,592 (PEC 2006, Attachment V Criterion P3), the effect on the local and regional economies from construction and post-construction employment at the site would be considered small.

Harris
No adverse environmental consequences are anticipated. Construction of two units at the Harris site would create a maximum of 3,150 jobs in the construction sector over the 7 year construction period (COLA ER 4.4.2.1), as well as approximately 773 jobs to operate the new facilities (COLA ER 5.1.1.1.2). Given the anticipated 2010 population of the five-county region surrounding the site of 1,532,854 (PEC 2006, Attachment V Criterion P3), the effect on the local and regional economies from construction and post-construction employment at the site would be considered small (COLA ER 4.4.2.1).

15. Property values

A study on the effect of nuclear facilities on the value of surrounding property found that the presence of a nearby nuclear facility did not negatively impact property values (Bezdek and Wendling 2006).

Brunswick
No adverse environmental consequences are anticipated. The Brunswick site is an existing nuclear power plant site; no negative impacts to adjacent property values are anticipated.

Harris
No adverse environmental consequences are anticipated. The Harris site is an existing nuclear power plant site; no negative impacts to adjacent property values are anticipated.

16. Regional growth

Brunswick
No adverse environmental consequences are anticipated. From 2000 to 2010, it is projected that the population of the four-county region consisting of Brunswick, Columbus, New Hanover, and Pender counties will grow by 32.9 percent to approximately 437,592 (PEC 2006, Attachment V Criterion P3, 1.2.1, 3.1). It is anticipated that the population in Brunswick County and surrounding areas will continue to grow at a similar rate. Construction at the site would not be a catalyst for significant in-migration to the region over and above that which is already anticipated, as the peak construction workforce is anticipated to be approximately 3,150 (COLA ER 4.4.2.1).

Harris
No adverse environmental consequences are anticipated. From 2000 to 2010, it is projected that the population of the five-county region consisting of Chatham, Durham, Harnett, Orange, and Wake counties will grow by 38.1 percent to approximately 1,532,854 (PEC 2006, Attachment V Criterion P3, 1.2.1, 3.1). It is anticipated that the population in Wake County and surrounding areas will continue to grow at a similar rate. Construction at either site will not be a catalyst for significant in-migration to the region over and above that which is already anticipated. Construction at the site would not be a catalyst for significant in-migration to the region over and above that which is already anticipated, as the peak construction workforce is anticipated to be approximately 3,150 (COLA ER 4.4.2.1).

17. Tax revenues

Post-construction property tax revenues in the counties in which the additional facilities would be placed would increase based on the increase in property value resulting from the construction of high value nuclear facilities. Also, increases in sales tax revenue would be expected from construction at either site resulting from the local purchase of construction materials or goods and services by temporary construction workers. As it is anticipated that most workers at the site would come from within North Carolina, it is anticipated that the effect to income tax revenues would be small (Brunswick ER 2.7, 4.17.2; COLA ER 4.4.2.2).

Brunswick
No adverse environmental consequences are anticipated.

Harris
No adverse environmental consequences are anticipated.

18. Employment

Construction of two units is anticipated to require a peak construction labor force of approximately 3,150 people (COLA ER 4.4.2.1). It is anticipated that 2,362, or 75 percent, of the estimated peak of 3,150 construction force would live in the region, with

the other 25 percent relocating to the region. It is anticipated that an additional 773 full-time or contract employees will be required for the operation of two additional reactors (COLA ER 5.1.1.1.2).

Brunswick
No adverse environmental consequences are anticipated. The construction employment would consist of approximately 15.1 percent of the four-county regional construction labor pool (Brunswick, Columbus, New Hanover, and Pender counties) for the Brunswick site, and 2.1 percent of the total regional labor pool, based on year 2000 numbers (PEC 2006, Attachment V Criterion 3.1). The region around the Brunswick site will be able to supply and/or absorb the necessary number of workers for construction and operation of the units.

Harris
No adverse environmental consequences are anticipated. The construction employment would consist of approximately 6.3 percent of the five-county regional construction labor pool (Chatham, Harnett, Durham, Orange, and Wake counties) for the Harris site, and 0.1 percent of the total regional labor pool, based on year 2000 numbers (PEC 2006, Attachment V Criterion 3.1). The region around the Harris site will be able to supply and/or absorb the necessary number of workers for construction and operation of the units.

19. Public facilities and services

Brunswick
The Brunswick site contains two existing nuclear power plants. Public services are expected to be adequate and expected to expand to meet the demands in a similar fashion as those already provided. Wastewater treatment at the Brunswick site is provided by a 0.055 MGD domestic wastewater treatment plant (Brunswick ER Appendix B). Other public facilities (parks, transportation, water supply) are addressed elsewhere in this document. No adverse environmental consequences are anticipated.

Harris
The Harris site contains an existing nuclear power plant. The projected capacity of the public services is adequate and expected to expand to meet the demands of a slight population growth in the area (COLA ER 2.5.2.7). Wastewater treatment at the Harris site is provided by the HNP wastewater treatment plant, which is located in the exclusion area boundary (COLA ER 2.5.2.7). Other public facilities (parks, transportation, water supply) are addressed elsewhere in this document. No adverse environmental consequences are anticipated.

20. Business activity

The anticipated maximum number of construction workers at either site is 3,150, and it is anticipated that most workers would come from the surrounding region (COLA ER 4.4.2.1). It is anticipated that 2,362, or 75 percent, of the estimated peak of 3,150

construction force would live in the region, with the other 25 percent relocating to the region. For either alternative, 773 full time employees would be needed for operation of the new plants (COLA ER 5.1.1.1.2). Increases in business sales could be expected from construction at either site resulting from the local purchase of construction materials or goods and services by temporary construction workers (Brunswick ER 2.7, 4.17.2; COLA ER 4.4.2.2).

Brunswick
No adverse environmental consequences are anticipated. Given that the anticipated 2010 population of the four-county region surrounding the site is 437,592 (PEC 2006, Attachment V Criterion P3), the effect on local and regional business activity from construction and post-construction employment at the site would be considered positive, but small.

Harris
No adverse environmental consequences are anticipated. Given that the anticipated 2010 population of the five-county region surrounding the site is 1,532,854 (PEC 2006, Attachment V Criterion P3), the effect on local and regional business activity from construction and post-construction employment at the site would be considered positive, but small (COLA ER 4.4.2.1).

21. Prime and unique farmland

Brunswick
The Brunswick site includes no prime farmland soils within the 400-acre power block, but a small amount of Baymeade fine sand (Loamy, siliceous, semiactive, thermic Arenic Hapludults, map symbol BaB) a soil considered a farmland of statewide importance. The transmission line upgrades will cross agricultural areas, some of which may contain prime or unique farmland. No adverse environmental consequences are anticipated for this alternative.

Harris
The Harris site includes former areas of prime farmland within the 400-acre power block. Creedmoor sandy loam, 2 – 6% slopes (Fine, mixed, semiactive, thermic Aquic Hapludults, map symbols CrB and CrB2) is the only prime farmland soil series mapped within the power block. However, the soils were mapped before the development of the site and it is doubtful they still exist without considerable alteration. The transmission line upgrades will cross agricultural areas, some of which may contain prime or unique farmland. No adverse environmental consequences are anticipated for this alternative.

22. Food and fiber production

Brunswick
The transmission line upgrades associated with the Brunswick site will cross agricultural lands that are used for crop production. However, the overall affects are expected to be small. No adverse environmental consequences are anticipated for this alternative.

Harris
The transmission line upgrades associated with the Harris site will cross agricultural lands that are used for crop production. However, the overall affects are expected to be small. No adverse environmental consequences are anticipated for this alternative.

23. Water quantity

Brunswick
The Brunswick Site is located 9,000 feet west of the Cape Fear River. The Cape Fear River has a daily freshwater discharge rate of between 8,100 and 10,000 cfs. The Brunswick Site is considered to have sufficient water quantity and impacts are expected to be small. The ER did not identify any significant issues with water quantity for the Brunswick Site.

Harris
The Harris Site will use surface water from Harris Lake for domestic, process and cooling tower makeup water. The normal water withdraw from Harris Lake is 93.74 cfs and the normal consumptive water use is 62.66 cfs. The normal water return rate after use in HAR-2 and HAR-3 is expected to be 31.09 cfs. Makeup water will be obtained from the Cape Fear River near the Buckhorn Dam to maintain the proposed operating water level of 240 feet NGVD29. According to the COLA ER document, the water supply was adequate to support plant operation, including the makeup water from the Cape Fear River even under severe drought conditions.

24. Mineral needs

Brunswick
No significant differences identified between the two alternatives since PEC owns all the properties and their mineral rights. No adverse environmental consequences were identified for this alternative.

Harris
No significant differences identified between the two alternatives since PEC owns all the properties and their mineral rights. There are no known mineral resources of economic significance on the HAR property. Oil and gas exploration of the Triassic Basin in the 1980s identified no oil or gas (COLA ER 2.5.0.1.2). No adverse environmental consequences were identified for this alternative.

25. Consideration of private property

Brunswick
No adverse environmental consequences are anticipated. All proposed construction or related impacts at the site will occur completely on property currently owned by PEC (PEC 2006, Attachment V Table 3-1, Criterion P10, 4.3.2).

Harris
No adverse environmental consequences are anticipated. All proposed construction or related impacts at the site will occur completely on property currently owned by PEC (PEC 2006, Attachment V Table 3-1, Criterion P10, 4.3.2).

26. Community cohesion

It has been determined that there are no significant health and safety impacts related to the construction of additional nuclear facilities at either site (PEC 2006, Attachment V 3.3). As all construction activities would take place on property owned by PEC, there would be no displacement of minority or low-income groups (PEC 2006, Attachment V Table 3-1, Criterion P10, 4.3.2). As the anticipated maximum number of construction workers at the site is 3,150, and as it is anticipated that most workers would come from the surrounding region, the effects on the social structure of the region from construction at either site would be small (COLA ER 4.4.2). As such, the effects of construction at the site on community cohesion would be no less than anticipated due to normal population growth.

Brunswick
No adverse environmental consequences are anticipated. In the year 2000, within a 50-mile radius of the Brunswick site, the low-income population was 48,233, or 14.6 percent of the total area population, while the minority population was 76,393, or 23.3 percent of the total area population. Of 257 United States Census block groups within a 50-mile radius of the Brunswick site, 3 exceeded the threshold for low-income populations, while 41 exceeded the threshold for aggregate minority populations. No minority or low-income populations are located in immediate vicinity of the Brunswick site (Brunswick ER 2.6.2).

Harris
No adverse environmental consequences are anticipated. In the year 2000, within a 50-mile radius of the Harris site, the low-income population was 113,905, or 10.3 percent of the total area population, while the minority population was 358,446, or 32.3 percent of the total area population. Of 1,144 United States Census block groups within a 50-mile radius of the Harris site, 58 exceeded the threshold for low-income populations, while 253 exceeded the threshold for aggregate minority populations. No minority or low-income populations are located in immediate vicinity of the Harris site (COLA ER 2.5.4).

27. Community growth and development

As the anticipated maximum number of construction workers at the site is 3,150, and as it is anticipated that most workers would come from the surrounding region, the effects on community growth and development from construction at the site would be small (COLA ER 4.4.2). For either alternative, 773 full time employees would be needed for operation of the new plants (COLA ER 5.1.1.1.2).

Brunswick
No adverse environmental consequences are anticipated. From 2000 to 2010, it is anticipated that the population of the four-county region consisting of Brunswick, Columbus, New Hanover, and Pender counties will grow by 32.9 percent to approximately 437,592 (PEC 2006, Attachment V Criterion P3, 1.2.1, 3.1).

Harris
No adverse environmental consequences are anticipated. From 2000 to 2010, it is anticipated that the population of the five-county region consisting of Chatham, Durham, Harnett, Orange, and Wake counties will grow by 38.1 percent to approximately 1,532,854 (PEC 2006, Attachment V Criterion P3, 1.2.1, 3.1).

28. Relocations (business, homes, etc.)

Brunswick
No adverse environmental consequences are anticipated. The Exclusion Area Boundary (EAB) for the Brunswick site would include only property currently owned by PEC (Brunswick ER 2.1; PEC 2006, Attachment V Table 3-1, Criterion P10, 4.3.2). No residential or commercial relocations would be necessary at the site.

Harris
No adverse environmental consequences are anticipated. The Exclusion Area Boundary (EAB) for the Harris site would be within the current EAB for the existing reactors (COLA ER 1.1.2, 3.1; PEC 2006, Attachment V Table 3-1, Criterion P10, 4.3.2). No residential or commercial relocations would be necessary at the site.

29. Recreation

Brunswick
No adverse environmental consequences are anticipated. The Brunswick site does not contain any recreational facilities that would be impacted by plant construction.

Harris
The Harris Lake County Park would be impacted by construction at the Harris site, specifically by the raising of the pool level of Harris Lake (COLA ER 4.1.1.2.1.3, 4.4.2.6). These impacts would include the flooding of approximately 279 acres within the current park boundaries, as well as the displacement of other amenities. However, PEC is committed to relocating the park facilities affected by the increased water level. Numerous additional facilities are located within a 50-mile radius of the Harris site that would offset temporary displacements during construction. The larger lake would offer more opportunities for water-based recreation, offsetting loss of terrestrial gamelands.

D. Summary

PEC has evaluated a number of alternatives for achieving new baseload generation that is reliable and proximate to PEC's major customer base. The no-action alternative would not meet the stated purpose and need and was eliminated from consideration. Non-nuclear alternative energy sources were evaluated and found to not meet the stated purpose and need and were eliminated from further consideration. PEC evaluated 11 sites for potential use for adding the nuclear baseload required to meet purpose and need; 7 of these sites were eliminated through exclusionary criteria during the siting study. Of the four carried forward for further consideration, the Harris site was selected as the applicant's preferred alternative based on results of PEC's technical evaluation, strategic considerations, and transmission study.

Review of potentially adverse impact on the aquatic ecosystem indicated that the Marion site and Robinson site both would result in substantially greater impacts to wetlands and streams compared to the preferred alternative, the Harris site, both for construction of drought mitigation reservoirs and for transmission line upgrades. Neither the Marion nor the Robinson site constitute an environmentally preferred alternative to the Harris site based on the greater environmental impacts to the aquatic ecosystem. The Marion and Robinson sites were dropped from further evaluation.

The Brunswick alternative would result in greater impact to wetlands through conversion of forested wetlands to herbaceous wetlands along the new transmission line upgrades than the Harris alternative would impact though inundation and conversion of wetland habitats to lake habitats through reservoir expansion and conversion of forested wetlands along the new transmission line upgrades. However, the Harris site would result in greater impacts to streams through inundation by the expanded reservoir and conversion of intermittent and perennial stream habitats to lake habitats. Because neither alternative provided a clearly preferable environmental alternative based on potential impacts to the aquatic ecosystem, the Brunswick site was carried forward for more detailed evaluation against the Harris site.

No other significant adverse environmental consequences were identified among the other public interest factors for either the Harris or Brunswick sites, other than for potential for impacting endangered and threatened species. The Brunswick alternative has greater potential adverse impacts to habitat for the federally endangered red-cockaded woodpecker along the new transmission line upgrades, and potential adverse impacts through increased incidental take of federally threatened and endangered sea turtles within the intake canal as flows are increased to provide water for the new units.

Based on the difference in types of aquatic ecosystem impacts and the difference in functions lost or gained, the Brunswick alternative does not constitute an alternative demonstrating less adverse impact on the aquatic ecosystem in comparison to the preferred alternative, the Harris site. Because the Harris site has the least overall impact on the aquatic environment and no other significant adverse environmental consequences, the Harris site is the least environmentally damaging preferred alternative.

V. SUMMARY OF SECONDARY AND CUMULATIVE IMPACTS

NEPA defines secondary impacts as those impacts caused by the proposed action or alternatives and are later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative impacts result from the incremental impact of the proposed action or alternatives when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (Duke University 2002).

Examples of secondary impacts include growth inducing effects or changes in land use patterns that themselves cause changes in air, water, or other natural systems. Construction of the HAR-2 and HAR-3 units at the Harris site is not expected to result in any significant growth inducing effects. Population growth is coming to this part of the state regardless of the proposed action at the Harris site. The land use at the Harris site is already conducive to construction of the new units. Necessary infrastructure such as roads, railways and line corridors are in place. PEC owns a vast amount of property surrounding the Harris site, much of which will remain undisturbed except for what is affected by the rise of the normal pool elevation of Harris Lake. The expansion of the transmission lines identified earlier in this document will convert existing land cover as a result of ROW clearing. Forested land will be converted to herbaceous or successional communities and forested wetlands will be converted to low-growing wetland habitats. PEC uses all applicable best management practices to protect sensitive areas, including wetlands and streams, when constructing or expanding ROWs.

Cumulative effects result from the spatial and temporal crowding of environmental perturbations. The effects of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the effect of the first perturbation (CEQ 1997). In the case of the preferred alternative, the increased capacity of Harris Lake to supply reliable cooling water during drought conditions will be the primary ecosystem perturbation resulting from the project. This assertion is based on the analysis of anticipated effects to the aquatic ecosystem associated with the HAR project that is contained herein. One effect that is reasonably foreseeable may result from the replacement of public access areas, including boat ramps, around Harris Lake that will be lost as a result of inundation. However, these areas will be constructed using applicable best management practices to prevent adversely affecting the water quality of Harris Lake.

Existing wetland habitat within and along the lakeshore fringe of Harris Lake will be lost to inundation. Natural establishment of wetlands may occur in the shallows and along the shoreline at the new lake elevation. In addition, stream habitats and associated wetlands will also be inundated; however it is not expected to have any detrimental effect on downstream water quality nor is there expected to be any additional impacts from reservoir expansion after this action is complete. PEC will be required to mitigate for unavoidable losses of wetland and streams. Fish habitat and surface area that is usable for aquatic recreation will actually be increased by the reservoir expansion. Land clearing associated with the reservoir expansion is not expected to result in any

detrimental habitat fragmentation. The structure of the human environment surrounding the Harris site is not expected to be negatively affected by the construction of the HAR project. There should be no changes in community dynamics or loss of neighborhoods or community character as a result of the HAR project.

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Enclosure 2

Description of How the Comments and Information Requests Made by the USACE to the NRC in USACE Letter dated June 19, 2009 Have Been Addressed

Description of How the Comments and Information Requests Made by the USACE to the NRC in USACE Letter dated June 19, 2009 Have Been Addressed

In a letter dated June 19, 2009, the USACE provided the U.S. Nuclear Regulatory Commission (NRC) with comments and requests for information regarding two documents. The first document entitled "HAR ER RAI USACE – 15 Attachment B – Need for Maximum Harris Reservoir Level" was originally provided in response to RAI USACE-15. That document has been superseded by a new document prepared by CH2M Hill; Tech Memo 107 entitled "Determination of Harris Reservoir Storage Requirements", which was submitted to the NRC in a letter dated September 14, 2009, serial number NPD-NRC-2009-205. The second document referred to in the USACE letter was prepared by Environmental Services, Inc., (ESI) and was entitled "Harris Advanced Reactor (HAR) Section 404(b)(1) Alternatives Analysis", dated May 14, 2009. The alternatives analysis document has been revised to provide additional information and is provided in Enclosure 1 of this letter. The USACE comments in their June 19, 2009 letter and a summary of how each comment has been addressed are discussed below. The comments have been numbered to facilitate review with the USACE comment noted in italics.

1. *The document uses the time period from 1985 through 1997 as the drought of record for Harris Reservoir due to historical inflows and meteorology. Within this time period, certain assumptions were made to determine the necessary withdrawals from the Cape Fear River to allow for continuous plant operations. One such assumption is that the minimum elevation of Harris Reservoir for continuous operation of 3 units would be 220 msl, and that lower levels would necessitate the shutting down of reactors. However, no safety or operational justification for this minimum level is offered.*

   Nuclear reactors are generally designed as baseload units, providing a steady, base level of electric power. Power output cannot easily be scaled down based on need or cooling water supply. Other electrical generation technologies such as natural gas fired power plants are used to provide peak load since they can be more readily scaled or shut down. In accordance with the Conceptual Design, the two proposed Harris AP-1000 units are designed to operate at a reservoir level of at least 220 feet. Tech Memo 107, clearly states that the design basis for the HAR is 220 feet.

   As discussed in Section 8 of the COLA Environmental Report (ER), the population growth and the need for power are expected to increase steadily in the future. This will require increased baseload capacity. Chapter 8 of the ER also shows the power demands are highest during the summer. For this reason, the maximum generation capacity is required during the summer which is also when the lowest flows in the Cape Fear River are seen. Raising the lake level to 240 feet allows for the generation of reliable electrical power while limiting water demands from the Cape Fear River during drought conditions. A detailed analysis of the water needs for Harris Reservoir including estimates of plant consumptive use, assumptions on maximum withdrawal amounts from the Cape Fear River based on future demands, and a minimum release from Harris Reservoir is provided in Tech Memo 107 provided in the supplemental response to RAI USACE-15.

2. *Additional information on the drought of record is also needed to clarify the study period. It is unclear if the drought of record used for this study also pertains to the Cape Fear River drainage basin.*

   The basis for the watershed flows in this analysis was the Middle Creek. The selection of Middle Creek to estimate inflow to Harris Reservoir was based on watershed size, the absence of an impoundment which would affect flow, and similarities in landuse. A comparison of annual instream flows for the Middle Creek and the Haw River above Jordan Lake show similarities in flow patterns for the period from 1974 – 2008. Flow patterns in the period from 1987 through 1995 show a similar response during wet and dry years.

   As described in Tech Memo 107, the entire period from 1939 through 2008 was used for the lake level analysis. Review of Cape Fear River flows show the lowest flows occurred immediately after the creation of Jordan Lake and during the 2001-2002 drought which were included in the lake level analysis. While extreme single-year drought events can impact short term streamflow levels, the period from 1987 through 1995 had below average flows on a more consistent basis. As a result, reservoir levels were drawn down more extensively than in the extreme single-year droughts seen in recent years.

3. *It is possible that there was ample water in the Cape Fear River [during the analysis period] for more than the assumed rate of makeup flow of 43 cfs, even if this included short periods where the river flow could have supported substantial makeup water for augmenting Harris Lake levels.*

   The original lake level analysis was based on the assumption of a constant withdrawal rate. The analysis included flows up to 20 percent of the 7Q10 (76.4 cubic feet per second [cfs]) but determined that a lower withdrawal rate of 43 cfs could maintain the lake level above the desired level of 220 feet. This analysis was revised to use a variable pumping rate of up to 134 cfs during periods of high flow. It was determined that use of a variable pumping rate as described in Tech Memo 107 would maintain the lake level above the 220 foot design basis under future demand conditions for all but one drought in the modeled analysis period.

4. *It is also understood that the Western Wake Regional Wastewater Facilities Environmental Impact Study is currently assessing the possibility of utilizing Harris Reservoir as a discharge point for treated effluent. The Harris study should recognize any nearby project that has the ability to alter assumptions and results.*

   Progress Energy is aware of the proposed Western Wake Regional Wastewater Facility (WRF) and has been providing the WRF Project Partners with monitoring data for their analyses. However, the WRF project is only a proposal and cannot be assumed to be constructed at this time.

   As noted in Tech Memo 107, the Western Wake Partners have proposed that the WRF discharge could be relocated from the Cape Fear River to Harris Lake to supplement the water supply. The WRF project is currently in the planning stages, and additional technical analyses and negotiations with stakeholders are ongoing. A supplement to the project's Environmental Impact Statement and a revised National Pollutant Discharge

Elimination System (NPDES) permit for the WRF would be required to allow a discharge to Harris Lake. In addition, regulations related to interbasin transfers may disallow a discharge from the WRF to Harris Reservoir. The timing constraints for the WRF project, plus the other factors outlined above, make this alternative not viable at this time. Even if this alternative were viable, the proposed WRF discharges would not provide sufficient supplemental water to maintain Harris Reservoir levels at the proposed 240-foot elevation. Some level of pumping from the Cape Fear River would still be required.

5. *Information on operational changes should be supplied which would detail the possibility of reducing power output during an extreme drought rather than relying on an elevated lake level at 240 feet msl.*

   As noted in the response to item 1, the Harris nuclear reactors are designed as baseload units and are not intended to be scaled down. In the event that reservoir levels fell below 220 feet, the HAR reactors would be shut down. A 240-foot operating elevation in Harris Reservoir is needed to meet the purpose and need of the project, providing continued reliable power generation from the three Shearon Harris units during all but the most extended drought situations.

6. *The second document entitled "Harris Advanced Reactor (HAR) Section 404(b)(1) Alternatives Analysis" (Alternatives Analysis), provides additional information on alternatives required for Department of the Army (DA) 404 permitting activities. These alternatives should include any which might be applicable to the project, including the No Action Alternative. Each viable alternative is compared against impacts to both the natural and human environment, as well as, its ability to meet the purpose and need of the project.*

   Informational comment, no action required. Applicable alternatives are described in Section III of the Alternatives Analysis document, and viable alternatives meeting purpose and need of the project are further evaluated in Section IV of the document provided in Enclosure 1.

7. *It appears that some items within the document are better described within the Combined License Application Environmental Report (COLA ER) released earlier in the scoping process. For example, the No Action Alternative is quickly dismissed in your alternatives document without fully considering all applicable actions including measures that do not require a DA permit such as conservation and purchasing power from other entities. The Alternatives Analysis study submitted in support of a 404 permit should be written as a stand-alone document with proper documentation of each alternative studied. By doing so, we can use this document during our review and identification of the Least Environmentally Damaging Practicable Alternative (LEDPA). Therefore, please expand the No Action analysis to properly encompass aspects of this alternative.*

   The No Action analysis has been expanded in Section III.B.1 of the revised Alternatives Analysis document to incorporate additional information from the COLA ER.

8. *As stated earlier, alternatives are initially compared against the purpose and need of the project to determine their overall viability. Those that meet purpose and need continue through an in-depth review process against other viable alternatives. We realize that as the proposal develops, slight modifications to the purpose and need statement may be necessary to reflect the current intention of the project. With this in mind, Corps Headquarters has suggested a modification to our original Purpose and Need Statement to include the word "nuclear", so that our review of alternatives is limited to those satisfying additional electrical power through the use of a nuclear facility. Therefore, the Corps sponsored Purpose and Need statement for this proposal is now "The development of new nuclear baseload generating capacity to supply electricity to PEC's service area, using advanced technology to produce reliable generation that is located proximate to its major customer base and that minimizes overall impacts to the environment". We understand that the Nuclear Regulatory Commission (NRC) may adopt a slightly different Purpose and Need statement which may allow for an assessment of other energy sources per their regulations. The Corps will accept the results of the NRC determination on the proper source of generation, and limit our study of alternatives accordingly. To clarify one other item, we have also determined that the use of the term "reliable generation" in the Purpose and Need statement can be used to justify generation during drought conditions as utilized in previous correspondence.*

   "Nuclear" has been added to project purpose and need in Section II of the Alternatives Analysis document. The requirement for reliable generation during drought conditions is considered in the sequenced search for less environmentally damaging alternatives (Section III.B.3) and in the evaluation of viable alternatives (Section IV.B.1).

9. *The COLA ER identifies 11 sites for consideration as possible locations for additional energy producing facilities. Seven of these 11 are dropped from further consideration due to factors such as soil liquefaction, seismic readings, inadequate water, etc. The remaining 4 sites are studied in detail.*

   Informational comment, no action required.

10. *During a meeting with PEC and the Nuclear Regulatory Commission (via telephone), we discussed the overall scope of the alternative analysis study. Most of the environmental impacts assessed to date for this project had been completed with GIS level data, some of which is not accurate enough for permit consideration. For example, wetland impacts were assessed using National Wetland Inventory (NWI) maps which are not always accurate.*

    Informational comment, no action required. Supplemental analysis undertaken to address comments on GIS data and NWI maps is summarized in the summary response to USACE comment 11 below.

11. *At this meeting we spoke about the possible inaccuracies with GIS review and stated that we may not be able to support an alternatives study reliant upon GIS data. In fact, we indicated that a complete GIS approach has not been conducted in the Wilmington*

District at the EIS level. Because of the questionable nature of this approach, we offered to review your draft study plan when it became available to fully consider your approach to the alternative sites. To date, a draft study plan has not been submitted to our office for consideration. Please continue to be aware that our assessment of alternatives must be commensurate with the level of impacts. Due to the large amount of possible impacts associated with this proposal, on-site checking of GIS data may be necessary at all viable alternatives in conjunction with the use of the North Carolina Wetlands Assessment Method dichotomous key for determining correct wetland types which will facilitate a more accurate representation of impacts. In addition, we strongly recommend that you coordinate with the Environmental Protection Agency (EPA) on a review of this document prior to the release of the Draft EIS due to EPA's Clean Water Act involvement and oversight.

A draft study plan was provided to the USACE on March 12, 2009 and discussed in a meeting with PEC and the USACE on March 13, 2009. Based on the magnitude of the areas covered by drought-mitigation reservoirs and/or transmission line upgrades required for the four alternatives carried forward for consideration, a GIS-based comparison of possible impacts was presented in the May 14, 2009 Alternatives Analysis document. A GIS-based assessment with no field verification is understood to have an undetermined margin of error, but with the assumption that comparable error would be present for all four alternatives. As such, the GIS-based assessment was believed to have value in approximating potential impacts to determine which alternative(s) would be expected to result in substantially greater impacts to wetlands and streams in comparison to the Harris alternative and could be eliminated from consideration as viable alternatives from an environmental impact standpoint.

In a meeting on July 8, 2009, PEC, NRC (via telephone), and the USACE discussed options for supplementing the GIS-based assessment. PEC proposed to refine the GIS-based assessment by incorporating LIDAR data, where available, and by undertaking limited field review. The GIS-based assessment has been updated to include results of incorporation of LIDAR data as well as limited field assessments. The wetland types utilized in the North Carolina Wetlands Assessment Method dichotomous key have been incorporated in the evaluation of alternatives in place of the National Wetlands Inventory wetland types. PEC has initiated coordination with the EPA.

12. *With respect to the 7 original sites identified as candidate areas but dropped early in the evaluation process, some of these sites appear to have been removed for logical reasons that may be supported by the Corps such as soil liquefaction and seismic activity. The others need further information to fully discount. For example, some are discounted due to the need for the construction of a dam on the Pee Dee River, or due to consideration of a possible fossil plant and insufficient off-site power voltage, or due to its location outside the PEC service territory. Since we are not sure about the feasibility of some of these factors (such as creating sufficient off-site power voltage, etc.), additional information and/or impact amounts are required to discount these areas from consideration during the 404 permitting process.*

In a meeting on July 8, 2009, PEC, NRC (via telephone), and the USACE, the USACE indicated that upon further consideration, the USACE will rely on NRC experts for determining which sites can safely support nuclear facilities. The USACE would then use these sites for analysis in the 404(b)(1) analysis. The four sites identified in the COLA ER as alternatives carried forward by NRC are those determined to be capable of supporting nuclear facilities following sequential application of exclusionary and avoidance criteria under EPRI siting guidance. This information is summarized in the revised Alternatives Analysis document in Section III.B.3.

13. *The remaining 4 sites were then reviewed in more detail to determine the best overall location for the facility. The facility footprint was determined in each of the 4 sites by utilizing a 400 acre project study area for the power block. It is unclear how 400 acres was chosen for this study. The COLA ER uses a 192 acre site for consideration of a nuclear power plant. Please explain the use of different size criteria. In addition, please clarify if minimization efforts were used to site the power block facilities within this area. Also consistent among each site is the lack of required impacts for total build-out of the project including roadways, all transmission corridors, etc. These totals are required for any viable alternative.*

The Alternatives Analysis document uses a 400-acre project study area for each of the four alternatives studied. The 400-acre project study area (power block) serves as a surrogate for onsite impacts that may result from build-out of the nuclear facility as well as attendant onsite infrastructure needs. The 400-acre project study area for each alternative originally used in the siting study was carried forward for this evaluation for consistency in determining potential impacts among the sites. The use of the 400-acre project study area and evaluation is summarized in Alternatives Analysis document Section I.D. The COLA ER utilizes more detailed information available for the Harris site for potential project impacts based on additional work undertaken for the preferred alternative. The COLA ER provides information on impacts resulting from construction of HAR 2 and HAR 3 within the 192-acre power block site, as well as appurtenant facilities.

Preliminary engineering plans are not available for alternatives for comparison to the Harris alternative, and the 400-acre project study area for each alternative is assumed to contain the approximate extent of impacts anticipated for total build-out of the project. For purposes of comparison in the Alternatives Analysis document, the 400-acre project study area for each of the other three alternatives is compared to the original 400-acre preliminary project study area identified in the siting study for the Harris alternative. Based on additional engineering studies conducted for the Harris site as the NRC's preferred alternative, the COLA ER presents the potential impacts for the Harris site by quantifying the impacts of the footprint for each of the various components of the facility, including the 192-acre power block area, blow-down pipe, and roadway improvements, as well as other components, which incorporated minimization efforts. This refined analysis of individual impacts is not used in the Alternatives Analysis document for comparison against the other alternatives since this level of detail is not available for all

sites. The 404 permit application will include the actual anticipated impacts associated with each component of the facility for the Harris site.

14. *One of the sites, the Marion alternative is a new-location facility near the Pee Dee River. Originally, it was carried forward because it contained all the aspects required for a nuclear power plant, including water. After further review, one of the concerns found with this site is the need for a new dam on the Pee Dee River. This criterion was already used for early dismissal of other sites, and was not found to inhibit the Marion site until drought safeguards were discussed which leads to questions on whether this alternative meets Purpose and Need of the proposal. However, no in-depth drought data is provided for our concurrence with the assessment of this site, nor are alternative drought remediation measures discussed. In addition, high wetland amounts were found by using Natural Resources Conservation Service data on hydric soils without any field confirmation to determine if the other two aspects of jurisdictional wetlands occur (hydrology and vegetation). If this is determined to be a viable alternative, accurate wetland and stream impacts will need to be quantified for the entire project. If it is determined that this alternative meets the Purpose and Need, complete information on the full range of impacts to the human and natural environment are needed for fair disclosure of all impacts.*

The need for a new dam on the Pee Dee River was used for early dismissal of one of the seven sites dropped from further consideration during the siting study due to EPRI criteria, which focus on technical elements needed to successfully site a nuclear plant per NRC requirements. The site dropped from consideration, located a considerable distance upstream of the Marion site, would have required a new cooling water reservoir to deal with periodic low river flows for operating under normal conditions. The Pee Dee River at the location of the Marion site was determined to provide adequate water supply for operating under normal conditions and was therefore carried forward for further consideration. The Marion site was subsequently evaluated against the "reliable generation" component of the Purpose and Need, which focused additional efforts on ensuring an adequate water supply exists or is provided for maintaining reliable generation during drought conditions. Drought remediation measures are considered vital for ensuring reliable generation when greater energy demands could conflict with restrictions on withdrawals to ensure minimum required flows are maintained in the river.

To evaluate the need for drought mitigation measures for the Marion site and the Robinson site, PEC developed the 7Q10s for gauges in the vicinity each site, specifically the Pee Dee River near Bennettsville, SC (02130561) and Black Creek near McBee, SC (02130900), respectively. Based on the period of record obtained, two different flow statistics for each year were evaluated: lowest consecutive 7-day low flow period each year; and average flow during the entire year. The results for the Pee Dee River near Bennettsville for a period of record from 1990-2009 are lowest flow period during 1999-2002 (with 2001 being the lowest overall year) and second lowest flow period during 2007-2008. These two drought periods correspond with similar low flow analysis on the Broad River and Catawba River in North and South Carolina. The results for Black Creek near McBee for a period of record from 1959-2009 are lowest flow period during

2001-2002 (with 2002 being lowest overall year), second lowest flow period during 2007-2008, and third lowest flow period during 1986. When available inflows from these two watercourses were considered and drought mitigation storage was estimated, these drought periods were included in the data set used for the calculation of available inflow. The estimate for drought mitigation storage at these two locations was not based solely on these drought periods. If the drought period inflows alone had been used for the estimates the reservoir sizes would likely be larger and impacts even greater than those resulting from use of the average inflow metric.

The Alternatives Analysis document has been revised to incorporate the results of supplemental evaluations conducted utilizing a wider spectrum of GIS data, including LIDAR data, combined with limited field assessments to refine the estimated possible wetland impacts for the alternative sites, including potential reservoir areas and transmission line upgrades. The revised information on the estimated potential wetland and stream impacts for the Marion alternative has been provided in Alternatives Analysis document Section III.B.3. Based on the refined GIS analysis with limited field evaluation, the Marion alternative would require substantially greater impacts to both wetlands and streams than the Harris alternative which eliminates the Marion site as a viable alternative.

15. *Another site, the Robinson Plant, is dismissed due to impacts from expanding Lake Robinson to supply adequate water to augment the thermal stress within the Lake during a drought. The Robinson Plant passed the initial screening criteria for adequate water supply, which appears to contradict this study. In addition, no alternatives for the thermal regulation of the lake were given within the document; therefore, it must be assumed that other possibilities exist, but were not studied. This information is needed for a fair comparison between alternatives. Wetland function impacts are discussed resulting from right-of-way creation, but these impacts are not quantified for comparison with the Harris alternative. If it is determined that this alternative is viable and meets the Purpose and Need, complete information on the full range of impacts to the human and natural environment would also be needed for fair disclosure. This would include impacts from all required project components at this site.*

The site selection process is summarized in Section III.B.3 of the document, and detailed in COLA ER Section 9.3.1. The COLA ER documents the steps taken to review potential sites after first considering exclusionary criteria, then by evaluating potential sites against avoidance considerations. The Robinson site passed the initial screening criterion for water supply, but was given a lower rating than the other three alternatives because the thermal stress issue was recognized and acknowledged some restrictions on operations had been required based on thermal effects. The Robinson site was subsequently evaluated against the "reliable generation" component of the Purpose and Need, which focused additional efforts on ensuring an adequate water supply exists or is provided for maintaining reliable generation during drought conditions. Drought remediation measures are considered vital for ensuring reliable generation when greater energy demands could conflict with restrictions on withdrawals due to thermal stress issues. Raising the existing dam to provide additional storage capacity was determined to

be impractical due to topographic constraints whereby the existing nuclear facility and homes surrounding the lake would be flooded at the point where the lake elevation is increased to provide approximately 3% of the needed additional storage. The revised Alternatives Analysis document incorporates subsequent evaluation for a dam farther upstream that would create a new reservoir without flooding the existing nuclear facility or homes around the existing lake. Alternatives for thermal regulation are provided in COLA ER Section 9.4.1. The closed-cycle cooling water system was determined to be the preferred alternative and the proposed facility at Robinson site would include cooling towers that will reduce the amount of cooling water withdrawal required for plant operation (COLA ER 9.3.2.2.3.5). The NRC has concluded that the potential heat shock impacts from operation of the plant's cooling water discharge system on the aquatic environment are small (COLA ER 9.3.2.2.3.3).

The Alternatives Analysis document has been revised to incorporate the results of supplemental evaluations conducted utilizing a wider spectrum of GIS data, including LIDAR data, combined with limited field assessments to refine the estimated possible wetland impacts for the alternative sites, including potential reservoir areas and transmission line upgrades. The revised information on the estimated potential wetland and stream impacts for the Robinson alternative has been provided in Alternatives Analysis document Section III.B.3. Based on the refined GIS analysis with limited field evaluation, the Robinson alternative would require substantially greater impacts to both wetlands and streams than the Harris alternative which eliminates the Robinson site as a viable alternative.

16. *The Brunswick site is the third site studied, and has sufficient water cooling capacity for this proposal. However, it was determined that 1,115 acres would be functionally impacted from conversion of forested wetlands to emergent during the right-of-way. It appears that the NWI dataset was used for this determination. As indicated before, we have accuracy concerns with the use of this dataset; therefore, if access is possible, field checking and/or verification will need to take place to validate these amounts and reduce the overall inaccuracies inherent with this approach. Also absent in the report is the width of the line used to determine these impacts, as well as, any avoidance and/or minimization measures in line routes used to reduce impact amounts. It is also questionable if all impacts have been accounted for from complete construction at this site including roadways, blow-down lines, etc.*

The Alternatives Analysis document has been revised to incorporate the results of supplemental evaluations conducted utilizing a wider spectrum of GIS data, including LIDAR data, combined with limited field assessments to refine the estimated possible wetland impacts for the alternative sites, including potential reservoir areas and transmission line upgrades. The revised information on the estimated potential wetland and stream impacts for the Brunswick alternative has been provided in Alternatives Analysis document Section III.B.3.

The width of additional right-of-way clearing used to determine potential impacts from transmission line upgrades has been clarified in Alternatives Analysis document Section

I.D. Avoidance and minimization measures in line routes are summarized in Section III.B.3 of the document. During transmission line design, PEC will employ measures to minimize impacts by avoiding siting of structures within wetlands, surface waters, and floodplains to the greatest degree practicable. The response to USACE comment 13 above summarizes how the facility build-out components were evaluated for comparison purposes.

17. *Please be aware that comparing functional impacts between alternatives could become problematic. For example, Harris proposes to functionally impact between 25 – 50 miles of streams by altering them to a lentic system, which would not result in a functioning stream. However, the Brunswick site would functionally change over 1,000 acres of forested wetland to emergent/herbaceous wetlands, all of which would still reflect a functioning wetland. Therefore it is questionable which functional impact would be considered least damaging between projects.*

    Informational comment, no action required. However, the proposed functional changes to streams by the reservoir expansion are not expected to be as significant as the functional changes that resulted from constructing and filling the present reservoir. The present reservoir appears to have inundated most perennial and many intermittent stream connections that may have linked the remaining tributaries. Biological connectivity between adjacent streams has been reduced for fauna other than those species able to tolerate wide aquatic habitat conditions including stream and lake habitats. Likewise, impacts to physical stream functions from reservoir expansion would not be expected to be as significant as changes resulting from the original reservoir construction. No changes to stream function would be expected to the stream segments above the influence of the new reservoir pool. Considerations for functional changes resulting from conversion of forested wetlands to herbaceous wetlands in the expanded, maintained right-of-way for transmission line upgrades include potential decrease in surface water storage from removal of woody vegetation and decrease in microtopography, decrease in aerial primary productivity, decrease in species diversity, and change in composition of wildlife species utilizing the habitat.

18. *Cost associated with the construction of the transmission line is listed as a factor with the Brunswick site, due to $300 million required for the complete installation of those lines. However, it remains to be determined if the Brunswick expansion is, or is not cost effective. If so, total costs including complete build-out and mitigation for both projects must be listed for a fair comparison between sites.*

    Costs were evaluated in the COLA ER for the alternative sites. Discussion of costs has been removed from the Alternatives Analysis document.

19. *In addition, entrainment and impingement are also listed as concerns with the Brunswick plant with regards to aquatic organisms including endangered and threatened species. However, no information from the National Marine Fisheries Service or the U.S. Fish and Wildlife Service are included to support this statement. Similar information is also lacking regarding possible impacts to protected species in and around the transmission*

lines. In addition, little information is presented on methods to prevent these situations or to minimize the results. In-depth consultations with the agencies listed above are required before federally protected species can be used to eliminate a viable alternative.

Alternatives Analysis document Section IV.B.4 has been revised to incorporate information from the NMFS-issued Biological Opinion regarding the operation of the cooling water intake system at the Brunswick plant. This Biological Opinion, issued on January 20, 2000, covers the current water intake scenario for the Brunswick plant for a 20-year period. An increase in cooling water flow needed for any new reactors has the potential to result in additional takings of sea turtles due to the unavoidable changes in the water flow regimes and possibly the intake structure itself. Any deviation from the current generating capacity and water flows at the Brunswick site will require re-initiation of formal consultation with NMFS to evaluate the potential effect on sea turtles resulting from increased water flow into the intake canal. Likewise, if the currently authorized level of incidental take is exceeded, such incidental take represents new information requiring re-initiation of consultation and review of reasonable and prudent measures.

No consultations with NMFS or USFWS have been undertaken for the alternatives analysis. Data on endangered and threatened species potentially affected by the alternative sites, drought-mitigation reservoirs, and transmission line upgrades are presented for informational and comparative purposes for the alternatives analysis. Consultations will be undertaken with NMFS and/or USFWS as appropriate for the preferred alternative as part of the permit process.

20. *Jurisdictional verification of aquatic features by the Corps has been started on the Harris site, but not completed. Even so, impacts from field work were used for the Harris site and then compared against GIS level impacts at other sites. This is not an equitable comparison due to the inherent error associated with GIS work. Field checking of GIS data on other sites may be needed to reduce this error and provide for a fair comparison. Furthermore, two of these sites (Marion County and Robinson) are located outside the Corps Wilmington District boundaries. We are currently coordinating with the Corps Charleston District for previous information on these two sites and will continue this coordination if field visits are warranted. Also, please be aware that we have not concurred with the statement that fringe and emergent wetlands will be naturally created to offset impacts to similar features due to concerns with the timing of wetland formation and estimations of actual amounts. Finally, we will continue to work with you and the NRC to fully assess secondary and cumulative effects of the project and document this within the EIS document.*

Completion of the jurisdictional verification of the Harris reservoir expansion delineation is being coordinated by PEC with the USACE, and the finalized jurisdictional verification will be utilized to determine impacts for submittal of the 404 permit application.

Alternatives Analysis document section I.D. has been revised to clarify that the wetlands and streams information used in the alternatives analysis for the four sites utilizes data collected using the same methodology for all four sites. Alternatives Analysis document sections III.B.3.d, III.B.4, and other sections referencing the Harris site have all been revised to present wetland and stream data obtained using the same methodology utilized for the other three sites.

The statement concerning fringe and emergent wetland offsets has been modified in Alternatives Analysis document Section IV.B.1. Fringe and emergent wetland mitigation will be evaluated in more detail as part of PEC's project mitigation plan.