

HAR ER RAI 9.4-1 Attachment A

Alternative Site Selection Process

Introduction

As a nuclear power plant applicant, Progress Energy Carolinas, Inc. (PEC) is required to obtain site permits and approval for construction and operation from the U.S. Nuclear Regulatory Commission (NRC). Prior to preparing the NRC application, PEC was required to select a suitable site location that incorporated the range of specific plant design parameters to be certified by the NRC. PEC chose the Harris Nuclear Site as the preferred site from a selection of alternatives that were identified as a result of a site selection process performed based, in part, on the Electric Power Research Institute (EPRI) Siting Guide, ESRP 9.3, and Regulatory Guide 4.7, Rev. 2.

The EPRI Siting Guide, as adopted for the Progress Energy siting study, provides four steps in the site selection process whereby the **“regions of interest”** are initially subjected to exclusionary considerations to develop a list of **“candidate areas.”** The candidate areas are further reduced using more refined discretionary criteria. The resulting **“potential sites”** are further analyzed against avoidance considerations reducing to a small number of **“candidate sites.”** A suitability evaluation of specific criteria then determines the highest ranked **“alternative sites”** best suited for a nuclear plant. These sites are finally subjected to business strategy considerations to determine the **“preferred site.”**

Potential site locations included greenfield sites, previously considered nuclear facility locations, and existing nuclear plant sites. They were subjected to exclusionary and avoidance criteria such as identification of inadequate water supply, adverse environmental impacts, insufficient land area, or unavailable transmission. The potential site locations were thereby reduced to four “alternative sites” and subjected to a detailed suitability evaluation. These locations included one greenfield site previously considered for a merchant fossil plant (Marion site), and three locations with existing operating nuclear plants (Brunswick Steam Electric Plant, Shearon Harris Nuclear Plant, and H. B. Robinson Nuclear Plant).

Executive Summary

The economically and environmentally preferable alternative for the PEC COL is co-location with an existing nuclear facility owned by PEC. As summarized in PEC’s site selection report and summarized in the Combined License Application (COLA) Environmental Report, the process to select the proposed site considered PEC’s business objectives and addressed the elements described in NUREG-1555, Section 9.3, “Site Selection Process,” and the EPRI Siting Guide. PEC located and evaluated both greenfield sites and locations with operating nuclear plants. Sites previously considered for a nuclear facility and fossil facilities were also included. Sites outside the ROI were considered only in specific instances. For

example, the Savannah River site (which is outside the PEC service territory and the ROI) was considered as a potential site because the site aggressively pursued a new nuclear plant with PEC, Duke, and SCANA. Based on this review and consideration of PEC's business objectives, Harris was selected as the proposed site.

To determine alternate sites for the Environmental Report analysis, consistent with NRC guidance, PEC included the other two sites it owns in the Region of Interest with nuclear power plants; Robinson and Brunswick. A greenfield site is unlikely to be environmentally preferable to co-location. To validate this conclusion, PEC selected a greenfield site (Marion Site) that was one of the most appropriate for location of a nuclear power plant for further analysis to compare with the proposed site.

The four candidate sites, Harris and the three alternate sites, are among the best sites that could reasonably be found for the siting of a nuclear power station. The selected candidate sites chosen had the least environmental impacts while satisfying the requirements of an AP1000 nuclear plant site. The three nuclear sites are owned by PEC (with ready access to the site and other information), are located within the Region of Interest, and are within the applicant's candidate areas. Finally, all candidate sites are expected to be licensable (that is, able to obtain applicable NRC licenses and state and local permits).

The comparison of alternate sites to the proposed sites concluded that none of the sites was environmentally preferred to Harris. This analysis also confirmed, based on review of the representative greenfield site (Marion), that no greenfield sites would be expected to be environmentally preferable to Harris.

Key Assumptions

Certain key assumptions and criteria were used as "bounding conditions" to aid in the site selection process. The key assumptions are as follows:

- The location must be compatible with system operation and transmission delivery capabilities.
- The expected licensing path and regulatory outlook for the identified proposed site must reduce PEC's schedule and financial risk for establishing additional nuclear baseload generation.
- The cost of the proposed nuclear generation as affected by the location must be reasonable and fair, and methods to ensure greater certainty of the cost and schedule during the licensing, design engineering, and construction phases of the proposed project must be included.
- The selection and evaluation process included a generic "greenfield" site, existing nuclear power station locations in the ROI, other power generating stations (coal, hydroelectric), and other previously developed sites (brownfield sites).
- The sites were evaluated based on the assumption that an AP1000-designed nuclear station will be built and operated. This assumption provides a realistic, consistent basis

for evaluating site conditions against site requirements for a nuclear power station design.

The following sections provide an overview of the site selection process. The objectives of the site selection process were to: (1) position the proposed nuclear power station within a defined ROI at a geographic location that was determined based on the outcome of the site selection process; (2) support the company's business objectives; (3) satisfy applicable NRC site suitability requirements; and (4) comply with NEPA requirements regarding the consideration of alternative sites.

Federal Law, Regulation, and Guidance

In order to select the best location for the proposed nuclear power station, PEC conducted a site selection process, as required by the National Environmental Policy Act of 1969 (NEPA) and Code of Federal Regulations (CFR), Title 10, Part 51.45 (10 CFR 51.45). The site selection process considered relevant federal, state, local, and other requirements, as well as business, engineering, and socioeconomic factors, which demonstrated that the selected site met these requirements.

The following general guidelines were used to develop and document the site selection process. Any deviations from the regulatory guidelines are noted in the text below.

- NRC guidance: NUREG-1555, Environmental Standard Review Plan (ESRP), Section 9.3: Site Selection Process (NRC, 2007). This document formed the basis of the site selection process.
- Regulatory Guide 4.2, Rev. 2, "Preparation of Environmental Reports for Nuclear Power Stations" (NRC, 1976). This guide was used in comparing the alternative sites to the proposed site. According to the guide, a cost-effectiveness analysis of realistic alternatives in terms of both economic and environmental costs can be conducted, if needed, to show why the proposed site is preferred over the alternative sites. In order to determine a suitable site, expected environmental impacts are appraised for each site. Quantifying impacts, while desirable, may not be possible for most factors because of a lack of adequate data. Under such circumstances, qualitative and general comparative statements supported by documentation may be used. The guide suggests various criteria that may be used for comparing the alternatives and the proposed nuclear power station, including the following:
 - Engineering and environmental factors: meteorology; geology; seismology; hydrology; population density in site environments; access to road, rail, and water transportation; fuel supply and waste disposal routes; cooling water supply; water quality; sensitivity of aquatic and terrestrial habitats affected; commitment of resources; and dedicated areas
 - Transmission hookup factors: access to transmission system in place, problems of routing new transmission lines, problems of transmission reliability, and minimization of transmission losses

- Construction factors: access for equipment and materials; housing for construction workers
 - Land use factors: land use types, including compatibility with zoning or use changes
 - Cost factors: construction costs, including transmission, fuel (annual), and operating and maintenance (annual) costs
 - Operating factors: load-following capability
 - Alternative site cost factors: land and water rights; base station facilities; main condenser cooling system; main condenser cooling intake structures and discharge system; transmission and substation facilities; access roads and railroads; and site preparation including technical investigations
- Regulatory Guide 4.7, Rev. 2, “General Site Suitability for Nuclear Power Stations” (NRC, 1998). This guide discusses the major site characteristics related to public health and safety and environmental issues that the NRC staff considers in determining the suitability of candidate sites for nuclear power stations. The safety issues that the NRC considers in its evaluation include geologic/seismic, hydrologic, and meteorological characteristics of proposed sites; exclusion areas and low population zones; population considerations as they relate to protecting the general public from the potential hazards of serious accidents; potential effects on a station from accidents associated with nearby industrial, transportation, and military facilities; emergency planning; and security plans. The environmental issues that the NRC considers in its evaluation include potential impacts on ecological systems, water use, land use, the atmosphere, aesthetics, and socioeconomics (social, cultural, and economic features, including environmental justice).
 - 10 CFR 100, “Reactor Site Criteria,” (NRC, 1996). This document requires that criteria, such as population density, use of site environments (including proximity to man-made hazards), and physical characteristics of the site be used as exclusionary criteria at a higher level to determine the acceptability of a site for a nuclear power reactor.
 - Electric Power Research Institute (EPRI), *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application*, Final Report (EPRI, 2002). The siting guide serves as a roadmap and tool and provides the methodology and framework for developing a detailed and specific process to meet the needs of early site permit (ESP) applicants for site selection. The siting guide is the industry standard for site selection and ESP preparation, and it is also appropriate to use with the COLAs. The siting guide describes a four-step site selection process involving sequential application of exclusionary, avoidance, and suitability criteria, as well as incorporation of preferences (or weighting factors) that are applied to the suitability criteria. Steps 1 and 2 of the siting process are areal in nature; screening of a relatively large region of interest (ROI) is performed to identify a number of discrete “site-sized” parcels for evaluation as a potential nuclear power station site. These steps are accomplished using mappable information. Steps 3 and 4 compare individual sites based on their relative suitability.

This portion of the process begins with the use of mapped and other published information and concludes with detailed information collected through onsite investigations, as necessary. Step 4 culminates in selecting a proposed site.

Region of Interest

The first step in the site selection process was to define and identify the ROI. As defined in ESRP 9.3 (NRC, 2007), the ROI is the geographic area within which sites suitable for the size and type of nuclear power generating facility proposed by the applicant are evaluated. The basis for an ROI can be the state in which the proposed site is located or the relevant service area for the proposed facility. PEC's service territory is the relevant service area that will be served by the Shearon Harris Nuclear Power Plant Units 2 and 3 (HAR). Therefore, the ROI used in the HAR COLA for the proposed Environmental Report (ER) has been defined as PEC's service territory in both North Carolina and South Carolina.

PEC's service territory consists of an area approximately 34,000 square miles (mi.²) (88,060 square kilometers [km²]) and includes northeastern South Carolina, portions of the coastal plain, a lower piedmont section, and a portion of western North Carolina as depicted on Figure 1.

The ROI encompasses the major towns/cities of Asheville, Durham, Cary, Raleigh, Greenville, Jacksonville, Fayetteville, and Wilmington in North Carolina, as well as Florence, Georgetown, Myrtle Beach, and Sumter in South Carolina. Water bodies within the ROI that are available as a source of cooling water for the proposed nuclear station include the Cape Fear River, Haw River, Pee Dee River, Tar River, Neuse River, Santee River, Wateree River, and the Atlantic Ocean. Major highways within the ROI include Interstate 20 (I-20), I-40, I-85, I-95, and I-240. Railroads that operate within the ROI include Amtrak, CSX Transportation, Inc. (CSXT), and the Norfolk Southern Railway. Major airports within the ROI include Raleigh-Durham International Airport, Wilmington International Airport, and Myrtle Beach International Airport. Major land use designations can be found throughout the ROI and include residential, rural, agricultural, industrial, commercial, public facilities, parks, open space, preserves, reserves, natural areas, transportation, communications, utilities, government special designation, and education. Topographic features in the ROI range from flat floodplains along the rivers and coastal plains along the bays to steep hills, deep ravines, and mountain ranges.

Identification of Candidate Areas

Candidate areas refer to one or more areas within the ROI that remain after unsuitable areas have been removed. Thus, the next step in the site selection process was to identify suitable candidate areas by screening the ROI using exclusionary criteria. ROI screening was done at a high level with the purpose of identifying areas within the ROI that would not be suitable for the siting of a nuclear power station. The criteria used in the ROI screening process included (a) proximity to population centers, (b) transmission lines, and (c) cooling water sources. No ratings by criteria were used to screen for the candidate areas—areas

either passed or failed the exclusionary criteria. The criteria used in the identification of the candidate areas are consistent with those identified in ESRP 9.3 (NRC, 2007) and the EPRI siting guide (EPRI, 2002). **Figure 1 identifies the criteria used to screen the ROI (some of the identified excluded areas overlap).**

More specifically, exclusionary criteria used to screen the ROI to identify candidate areas include:

- Proximity to major population centers (that is, not located in an area with greater than or equal to 300 persons per square mile [ppsm] or 300 persons per 2.6 km²).
- Proximity of adequate transmission lines (that is, within 30 miles [mi.] or 48.3 kilometers (km) of 345-kilovolt [kV] or 500-kV transmission lines). The 345-kV or 500-kV transmission lines are needed for the standard grid connection design. Areas with proximity to 230-kV lines that could potentially be upgraded were also considered.
- Lack of a suitable cooling water source (that is, within 15 mi [24.1 km] of an adequate cooling water source).
- Dedicated land (that is, not located within national, state parks, historic sites, or tribal lands).

Proximity to Population Centers

The exclusionary criterion pertaining to population density used in this siting evaluation is more specific and more conservative than what is required under Nuclear Regulatory Commission regulation 10 CFR § 100. The information presented in 10 CFR § 100 does not specify a permissible population density or total population within this zone because the situation may vary from case to case. NRC Regulatory Guide 4.7, Rev. 2 (NRC, 1998), however, contains the same information as presented in 10 CFR § 100, but adds the following specific criteria:

Preferably a reactor would be located so that, at the time of initial site approval and within about 5 years thereafter, the population density, including weighted transient population, averaged over any radial distance out to 20 miles (cumulative population at a distance divided by the circular area at that distance), does not exceed 500 persons per square mile [ppsm]. A reactor should not be located at a site whose population density is well in excess of the above value.

In addition, the EPRI siting guide contains the most conservative criterion with regard to population density and proximity to major population centers (that is, not located in an area with greater than or equal to 300 ppsm or 300 persons per 2.6 km²) (EPRI, 2002). This siting evaluation used the conservative population criterion (300 ppsm) as an exclusionary criterion in the identification of candidate areas to be in alignment with current industry objectives.

As stated above, the exclusionary criteria related to proximity to major population centers follows the EPRI Siting Guide recommendation of 300 ppsm.

Publicly held information on geographic information system (GIS) database websites were used to obtain the screening information. Information gathered from the initial screening was used to identify areas not affected by the exclusionary screening criteria. The GIS information was layered to produce a figure that represented the suitable candidate areas for the potential placement of a nuclear power facility (see Figure 2).

Identification of Potential Sites

The next step in the site selection process was to screen the candidate areas using refined discretionary criteria to identify potential geographic locations for the placement of the proposed nuclear power station. The screening process used to identify the potential sites considered discretionary criteria (that is, distance of a site from population centers, proximity of transmission lines, and proximity to suitable source of cooling water) similar to those used to identify the candidate areas. However, identifying potential sites required a more detailed review of available information (NRC, 2007). The goal of the screening process was to use a process that produced a list of the best potential sites located within the candidate areas. (NRC, 2007).

The economically and environmentally preferable alternative for the PEC COL is co-locating the new reactor with an existing nuclear power facility. Within the candidate area, PEC located and evaluated both greenfield sites and locations with operating nuclear plants. Sites previously considered for a nuclear facility were also included. Sites outside the ROI were considered only in specific instances. For example, the Savannah River site (which is outside the PEC service territory and the ROI) was considered as a potential site because the site aggressively pursued a new nuclear plant with PEC, Duke, and SCANA.

The following preference factors influenced the decision to review existing nuclear sites within the ROI:

- There are benefits offered by existing nuclear sites. For example, co-located sites offer existing infrastructure and support facilities.
- The environmental impacts of an existing plant are known and the impacts of a new facility should be comparable to those of the operating nuclear plant.
- Site physical criteria, primarily geological/seismic suitability, have been characterized at existing sites; these criteria are important in determining site suitability.
- Transmission is available and the existing sites have nearby markets.
- Existing nuclear plants have local support and the availability of experience personnel.

PEC conducted the screening of the potential sites as an iterative process by applying refined criteria – including (a) identification of water supply, (b) environmental impacts, (c) sufficient land area, and (d) sufficient transmission lines – until a limited number of potential sites were identified. By applying these discretionary criteria, potential sites were identified by availability of discrete parcels of land approximating the size needed for an AP1000 nuclear station plus additional land for the ancillary structures and areas such as

construction laydown area and parking area. The screening process also included consideration of existing site conditions, including whether the site was improved or potentially contained wetlands or floodplains. In addition, the potential sites needed to satisfy PEC's overall business objectives and offer the ability of constructing and operating future nuclear units to provide PEC customers with reliable, cost-effective electric service.¹

Compiling and screening the information resulted in the identification of the following 11 potential sites:

1. Harris nuclear site,
2. Brunswick nuclear site,
3. Robinson nuclear site,
4. Three greenfield sites in South Carolina, including Marion County, and
5. Five greenfield sites in North Carolina.

Candidate Sites

Candidate sites were identified in a two-step technical evaluation of the potential sites. The first step involved identifying criterion ratings for each site and developing composite site suitability ratings. The criteria used to evaluate the potential sites were selected to be appropriate to: (1) the ROI; (2) the status of the proposed applicant's nuclear power generating facility being a merchant nuclear power generating facility; and (3) the technology involved with constructing and operating the proposed AP1000 nuclear facility.

The sites were further evaluated and scored using the following discretionary criteria (as identified on Table 1):

- Seismic considerations: Sites needed to meet seismic requirements for existing and planned certified reactor designs.
- Available Land/Land Acquisition, of approximately 400 acres (ac.) (162 hectares [ha]): This is an exclusionary criterion based on the availability of the identified site and adjoining available area to support an AP1000 footprint approximately (240 ac. [97 ha]) plus approximately 180 ac. (73 ha) of additional land needed for ancillary structures, construction buildings, construction laydown areas, and parking areas rounded to 400 ac.
- Cooling Water: Sites needed to be in proximity to adequate cooling water source that contained sufficient quantity of water and the water was available.

¹ Information used in the screening and evaluation of the candidate areas was obtained from PEC personnel, GoogleEarth™ images, publicly held information on GIS database websites that generally included electric power-producing plants, topographic maps showing roads, urban areas, wetlands, parks, and other dedicated lands.

- Geotechnical Considerations: Sites needed to meet geologic requirements for existing and planned certified reactor designs.
- Environmental Considerations: proximity of a site to floodplains, proximity of a site to low population areas; and sites were evaluated based on the presence or absence of wetlands at or surrounding the site.
- Transmission: Sites were evaluated based on the need for transmission system upgrades.
- Power: Sites needed to have access to sufficient off-site power voltage to support a nuclear unit.
- An ownership criterion was based on the site's ownership status.

The second step of the potential site evaluation involved evaluating each potential site to determine if it was acceptable or should be excluded from further evaluation. Readily available reconnaissance-level information sources, which included publicly available data, information available from PEC files and personnel, and GoogleEarth™ images were used to evaluate the potential sites.

During the two step evaluation of the eleven potential sites to determine candidate sites, PEC determined that the advantages of co-locating the new facility with an existing nuclear power facility often outweighed the advantages of any other probably siting alternative. Some potential environmental and market advantages included:

- The total number of required generating sites is reduced.
- Construction of new transmission corridors may not be required due to potential use of existing corridors.
- No additional land acquisitions would be necessary, and PEC can readily obtain control of the property.
- The site has already gone through the alternatives review process mandated by NEPA, and was the subject of extensive environmental screening during the original selection process.
- The site development costs and environmental impact of any preconstruction activities are reduced.
- Construction, installation and operation and maintenance costs are reduced because of existing site infrastructure.

Existing facilities where PEC could obtain access and control were preferred over the other sites within the region of interest. Sites that were originally designed for more generation than actually constructed also received preference.

Based on the above two-step evaluation process and PEC's preference for co-location, of the eleven potential sites, PEC selected four candidate sites. The four candidate sites that

were carried forward for further analysis included three nuclear power generating stations and a greenfield site, as identified in Table 2.

Potential sites were excluded and not carried forward as candidate sites because of the following reasons: a South Carolina site was eliminated because seismic criteria could not be met; a North Carolina site was eliminated because the tract of land was not of suitable size; a North Carolina site was eliminated due to soil liquefaction issues; three sites located near the North and South Carolina border (on or near the Pee Dee River) were eliminated because a new cooling water reservoir would have been required, as well as significant transmission line upgrades; a South Carolina site was eliminated because it lies outside the PEC service territory and the ROI; and two sites in eastern North Carolina were eliminated because they are being actively considered for new fossil plants and the location lacked sufficient off-site power voltage to support a nuclear plant (Table 2).

The potential sites that PEC chose as candidate sites for further evaluation included:

- Harris nuclear site
- Brunswick nuclear site
- Robinson nuclear site
- Marion County greenfield site

No additional potential sites were selected as candidate sites, because according to NUREG-1555, ESRP, Section 9.3, three to five alternative sites in addition to the proposed site are considered to be an adequate number of candidate sites (NRC, 2007).

The four candidate sites were the best sites that could reasonably be found for the siting of a nuclear power station. The selected candidate sites chosen had the least environmental impacts while satisfying the requirements of an AP1000 nuclear plant site. The three nuclear sites are owned by PEC (with ready access to the site and other information), are located relatively near the Harris Nuclear Plant site, and are within the applicant's candidate areas. Finally, all candidate sites are expected to be licensable (that is, able to obtain applicable NRC licenses and state and local permits).

The scoring associated with the identification of candidate sites from the pool of potential sites did not indicate whether or not one site is environmentally preferable to the other. That determination was accomplished during the next phase of the site evaluation process (that is, evaluation of the candidate sites), when the alternative sites were compared with the proposed site.

Table 1**Evaluation of North and South Carolina Potential Sites**

	Exclusionary Criteria							
Site	Seismic	Land Acquisition	Cooling Water	Geotech	Environmental	Transmission	Power	Outcome
1 (NC)	A	A	A	A	A	A	A	Candidate site
2 (NC)	A	A	A	A	A	A	A	Candidate site
3 (SC)	A	A	A	A	A	A	A	Candidate site
4 (SC)	A	A	A	A	A	A	A	Candidate site
5 (SC)	X	A	A	A	A	A	A	Excluded
6 (NC)	A	X	X	A	A	A	A	Excluded
7 (NC)	A	A	X	X	X	A	A	Excluded
8 (NC/SC)	A	A	X	A	A	X	A	Excluded
9 (SC)	A	A	X	A	A	X	A	Excluded
10 (NC)	A	A	A	A	A	A	X	Excluded
11 (NC)	A	A	A	A	A	A	X	Excluded

Notes:

X = Excluded

A = Acceptable

NC = North Carolina

SC = South Carolina

Table 2 (Sheet 1 of 2)
North and South Carolina Potential Site Evaluation
and Identification of Candidate Sites

Site #	Site Description and Location	Evaluation	Status
<i>Carolinas locations identified as candidate sites for further consideration:</i>			
1	Harris Nuclear site	Existing nuclear power plant site; no issues to preclude consideration for COL site. This site was originally developed to accommodate much more electrical capacity and has much of the infrastructure to support units already in place.	Carried forward as candidate site.
2	Brunswick Nuclear site	Existing nuclear power plant site; no issues to preclude consideration for COL site.	Carried forward as candidate site.
3	Robinson Nuclear site	Existing nuclear power plant site; no issues to preclude consideration for COL site. This site is challenged from thermal limits on the lake, based on existing operating experience.	Carried forward as candidate site.
4	Marion County, SC Site	Site identified as being available for acquisition, with adequate land area and water supply from the Pee Dee River.	Carried forward as candidate site.
<i>Carolina Potential Sites eliminated from further consideration:</i>			
5	SC site	Site identified as being available for acquisition, with adequate land and water. Initial evaluation of the site indicated a high likelihood that it would not meet seismic requirements for existing and planned certified reactor designs.	Eliminated from further consideration.
6	NC site	Preliminary analysis indicates that there is no block of suitable land of sufficient size in a low population zone without wetlands. The area is also generally too flat for development of the large lake that would be required for a cooling water reservoir, and the site would require considerable expense to make it viable from an engineering perspective.	Eliminated from further consideration.

Table 2 (Sheet 2 of 2)**Carolinas Potential Site Evaluation and Identification of Candidate Sites**

Site #	Site Description and Location	Evaluation	Status
7	NC site	This site was previously considered by PEC for a potential nuclear plant. Soil liquefaction issues have been identified that could make the site unsuitable for a certified plant design, and cooling tower makeup water sources are not adequate. The site also appears to be environmentally sensitive.	Eliminated from further consideration.
8	Three sites near the NC/SC border	This site grouping was identified based on current ownership of the hydro plant and previous Progress Energy site selection studies. The site would require major transmission upgrades and a new cooling water reservoir would likely be needed to deal with periodic low river flows on the Pee Dee River at this location.	Eliminated from further consideration.
9	SC site	This site (which is outside the PEC service territory) was identified because the SRS has aggressively pursued a new nuclear plant on the reservation with PGN, Duke, and SCANA. The site is not close to the PEC service territory and therefore would have high transmission costs. In addition, SRS controls the on-site cooling water loop from which cooling water would be drawn; the need for operational water arrangements with SRS to obtain cooling water was not desirable.	Eliminated from further consideration.
10	NC site	The site is available, has been identified in previous PEC siting studies, and is actively being considered for a future approximately 800-MW fossil plant. This location also did not have sufficient off-site power voltage to support a nuclear unit.	Eliminated from further consideration.
11	NC site	The site is available, has been identified in previous PEC siting studies, and is actively being considered for a future approximately 800 MW fossil plant. This location also did not have sufficient off-site power voltage to support a nuclear unit.	Eliminated from further consideration.

Source: PEC, 2006

Evaluation of the Candidate Sites (Proposed Site and Alternative Sites)

This section discusses how PEC evaluated the candidate sites in order to determine the highest ranked alternative sites, i.e., how PEC selected the one proposed site and how PEC determined there was no obviously superior environmental alternative to the proposed site. The four candidate sites are evaluated against suitability criteria, resulting in a transition from the elimination approach to an evaluation approach of the candidate sites. The objective of evaluation against suitability criteria is to rank the small number of alternative sites for determination of the proposed site. PEC performed three evaluations for each site in order to determine the overall ranking of the candidate sites: (1) Technical Evaluation, (2) Strategic Considerations, and (3) a Transmission Study.

The suitability criteria for the technical evaluation were grouped into four categories listed below 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. The multiple features of the suitability criteria are combined into one composite value for each of the alternative sites.

- Health and Safety
- Environmental
- Land Use and Socioeconomics
- Engineering and Cost-related

The components of PEC's business strategic considerations include the following (PEC, 2006):

- Existing nuclear site advantages: Sharing of existing resources and facilities associated with security, maintenance, training, warehousing, and emergency planning.
- Proximity to load: Location to load center to ensure transmission delivery capabilities and system operations.
- NRC considerations: Preference of existing nuclear facility sites facilitating the COLA review process.
- Local and state government support: Incentives and support associated with infrastructure improvements, rate base impact, emergency planning and employment training.
- Business planning: The selected site must promote assurance of satisfying schedule and budget for COL approval.
- Public support: General public desire for safe and efficient nuclear power generation and avoidance of nonproductive intervention.
- Land utilization: Leverage of PEC land for potential applications of public benefit.

The Transmission Study provides input for each site regarding direct connection costs and system upgrade costs.

The results of the technical evaluation and verification process are summarized as follows and presented on Figure 3. The HAR site was considered the best with regard to technical evaluation criteria that address licensing and design technical requirements to construct and operate a new nuclear plant. The HAR site is superior to Robinson with regard to the lake cooling water and availability of PEC-owned property. While Brunswick had access to more than adequate river water for cooling, the transmission system upgrades required are significant. The Marion County site had the largest land area but also the largest percentage of wetland acreage and less than desirable geotechnical features. The HAR site has the least wetland acreage and the benefit of being a solid rock site, compared with deep soil of the alternative locations (PEC, 2006).

In regards to PEC's strategic considerations, the HAR site also ranks the highest. The NRC indicates a preference for existing nuclear plant sites based on licensing reviews and detailed site characterization already completed to support the existing nuclear plant, which places the Marion County site at a disadvantage. The existing nuclear plant locations further provide an advantage due to the ability to leverage existing site facilities and resources, such as warehousing, security, and operator training. The HAR site demonstrated an advantage over Brunswick and Robinson due to larger acreage of PEC-owned property and the clear ability to accommodate additional future generation capacity (PEC, 2006).

Transmission deliverability analysis has further concluded the HAR site is best suited to the existing transmission system requirements. The HAR site has minimal transmission impact costs for the installation of a nuclear unit. All other sites evaluated had considerable overloads identified with the addition of a nuclear unit (during various contingency scenarios), and required significant transmission system upgrades compared with the HAR site. Brunswick required the most extensive transmission system upgrades to remedy current overloads (PEC, 2006).

In summary, PEC chose HAR as the proposed site. The site selection process addresses the elements described in NUREG-1555, Section 9.3, "Site Selection Process," and the EPRI Siting Guide. The evaluation of the four candidate sites determined that all three of the nuclear sites were suitable for a new nuclear power plant; the Marion County site (greenfield site) ranked significantly lower than the existing sites as a result of high transmission costs and seismic, land acquisition, and wetlands issues. Of the existing nuclear sites, the HAR site rated highest, followed by Robinson and Brunswick. Robinson rated somewhat lower, primarily due to potential cooling water supply operational limitations and a lower rating in the geology/seismic category. Brunswick rated lower primarily due to transmission challenges and was slightly less favorable with respect to ecology and nearby hazardous land uses.

Once the candidate sites, including the proposed site, were identified, the next step was to screen and evaluate the sites in a two-part sequential test to determine whether any of the remaining three alternative sites were environmentally preferable, and thus potentially obviously superior, to the proposed site.

The first stage of the test determined whether there were environmentally preferred sites among the alternative sites. For this step, the alternative sites were those candidate sites that remained after the proposed site was selected (that is, candidate sites - proposed site = alternative sites). This identification matches the guidance provided in ESRP 9.3 (NRC, 2007).

If an alternative site was found to be environmentally preferable to the proposed site, then the second stage of the alternative site review process would have been implemented. If that stage had been needed, the economics, technology, and institutional factors among the environmentally preferred site(s) and the proposed site would have been considered to determine if any of the environmentally preferred sites were obviously superior to the proposed site. As indicated in ESRP 9.3 (NRC, 2007):

The criterion for making this determination is that one or more important aspects, either singly or in combination, of a reasonably available alternative site are obviously superior to the corresponding aspects of the applicant's proposed site, and the alternative site does not have offsetting deficiencies.

Because there was no alternative site that was environmentally preferable to the proposed site, then the proposed site prevailed and became the candidate site submitted to the NRC by the applicant as the proposed location for a nuclear power station (NRC, 2007).

The basic constraints and limitations of the site selection process are the currently implemented rules, regulations, and laws within the federal, state, and local agency levels. These provide a comprehensive basis and an objective rationale under which this selection process is performed. (NRC, 2007)

In the first stage of the screening and evaluation of the candidate sites, the standard was one of "reasonableness," considering whether the applicant has performed the following:

- Identified reasonable alternative sites
- Evaluated the likely environmental impacts of construction and operation at these sites
- Used a logical means of comparing sites that led to the applicant's selection of the proposed site

The evaluation of the candidate sites was done using readily available reconnaissance-level information per Regulatory Guide 4.2, Rev. 2 (NRC, 1976), which states:

The applicant is not expected to conduct detailed environmental studies at alternative sites; only preliminary reconnaissance-type investigations need be conducted.

The reconnaissance-level information sources included publicly available data, information available from PEC files and personnel, and GoogleEarth™ images in order to evaluate, score, and rank the candidate sites. Additional information and clarification of map and literature data were supplemented with site investigations as needed.

In order to begin the first stage, suitability criteria were identified to help facilitate the evaluation of the alternative sites. The criteria used in comparing the proposed site with the alternative sites to determine if there are environmentally preferred sites among the alternative sites were consistent with those presented in ESRP 9.3 (NRC, 2007) and include the following:

- Environmental
- Aesthetics
- Demography
- Ecology
- Geology, hydrology
- Socioeconomics
- Archaeological and historic preservation
- Environmental justice
- Transportation access
- Land use
- Water use
- Workforce availability, accessibility, and housing
- Access roads and railways
- Cooling system
- Intakes and discharges
- Transmission System

The suitability criteria were grouped into four categories: Health and Safety, Environmental, Land Use/Socioeconomics, and Engineering/Cost-related. Features in each category relevant to the specific aspects of facility development were weighted and scored to provide a relative comparison of the candidate sites (PEC, 2006).

Each site was assigned a rating of 1 to 5 (1 = least suitable, 5 = most suitable) for each of the evaluation criteria. Weight factors reflecting the relative importance of these criteria were synthesized from those developed for previous nuclear power plant siting studies. Weight factors used factors of 1 through 5, with 1 being least important and 5 being most important. Each criterion was assigned a weighted score by multiplying the primary weight and the score. Finally, the scores for each criterion were totaled into one composite value for each of the alternative sites, as depicted in Tables 3 and 4 (PEC, 2006).

A review of the scoring results indicated that none of the alternative sites were deemed to be environmentally preferable to the proposed HAR site. Therefore, the second step, that is, a determination of whether the environmentally preferable alternative site was obviously superior to the proposed site, was not required.

Table 3
Technical Evaluation of the Candidate Sites

Criteria		Weight Factor	Brunswick		Harris		Marion		Robinson	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score
	Geology/Seismology	3.77	3	11.31	4	15.08	2	7.54	2	7.54
	Cooling System Requirements	3.27	5	16.35	4	13.08	4	13.08	3	9.81
	Flooding	2.4	1	2.4	1	2.4	1	2.4	3	7.2
	Nearby Hazardous Land Uses	3.35	1	3.35	2	6.7	2	6.7	2	6.7
	Extreme Weather Conditions	2.36	1	2.36	3	7.08	3	7.08	3	7.08
	Accident Effect Related	4.09	3	12.27	3	12.27	4	16.36	4	16.36
	Surface Water – Radionuclide Pathway	2.5	5	12.5	4	10	4	10	4	10
	Groundwater Radionuclide Pathway	2.55	3	7.65	5	12.75	3.5*	8.925	3	7.65
	Air Radionuclide Pathway	2.5	5	12.5	5	12.5	5	12.5	5	12.5
	Air-Food Ingestion Pathway	2.5	5	12.5	4	10	3	7.5	2	5
	Surface Water-Food Radionuclide Pathway	2.41	5	12.05	3	7.23	5	12.05	5	12.05
	Transportation Safety	2.14	5	10.7	5	10.7	5	10.7	5	10.7
	Disruption of Important Species/Habitats	2.64	3	7.92	4	10.56	4	10.56	4	10.56

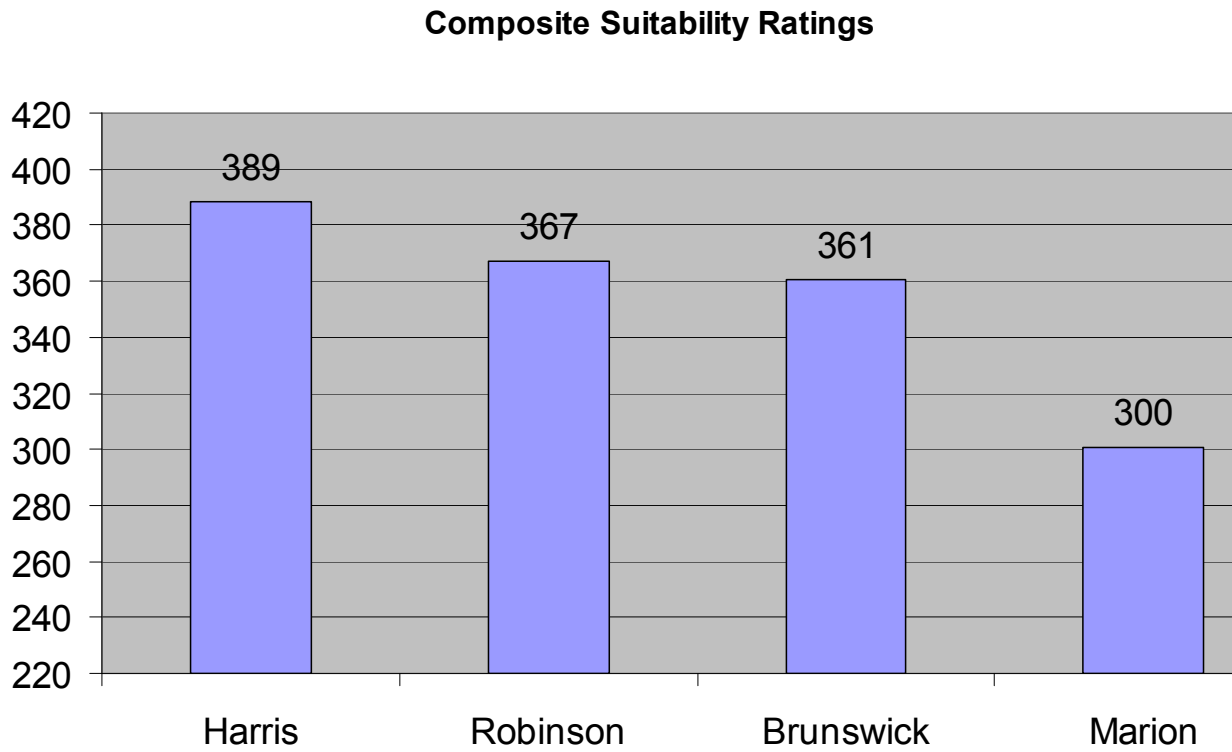
Criteria		Weight Factor	Brunswick		Harris		Marion		Robinson	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score
	Bottom Sediment Disruption Effects	2.14	4	8.56	4	8.56	2	4.28	2	4.28
	Disruption of Important Species/Habitats and Wetlands	3.18	3	9.54	4	12.72	2	6.36	4	12.72
	Dewatering Effects on Adjacent Wetlands	2.77	3	8.31	5	13.85	1	2.77	5	13.85
	Thermal Discharge Effects	3.64	4	14.56	4	14.56	4	14.56	3	10.92
	Entrainment/Impingement Effects	3.23	3	9.69	3	9.69	3	9.69	3	9.69
	Dredging/Disposal Effects	2.36	3	7.08	4	9.44	3	7.08	3	7.08
	Drift Effects on Surrounding Areas	2.36	3	7.08	4	9.44	4	9.44	4	9.44
	Socioeconomics – Construction – Related Effects	2	5	10	5	10	5	10	5	10
	Environmental Justice	1.95	5	9.75	5	9.75	5	9.75	5	9.75
	Land Use	3.8	5	19	5	19	2	7.6	5	19
	Water Supply	3.7	5	18.5	5	18.5	3	11.1	5	18.5
	Pumping Distance	3.05	5	15.25	5	15.25	3	9.15	5	15.25
	Flooding	2.9	1	2.9	1	2.9	1	2.9	3	8.7
	Civil Works	3.4	3	10.2	3	10.2	2	6.8	3	10.2
	Railroad Access	2.6	5	13	5	13	3	7.8	5	13
	Highway Access	2.8	5	14	5	14	3	8.4	5	14

Criteria		Weight Factor	Brunswick		Harris		Marion		Robinson	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score
	Barge Access	2.85	5	14.25	1	2.85	1	2.85	1	2.85
	Transmission Access	4.8	1	4.8	5	24	2	9.6	3	14.4
	Topography	2.55	4	10.2	4	10.2	4	10.2	4	10.2
	Land Rights	2.75	5	13.75	5	13.75	3	8.25	5	13.75
	Labor Rates	3.3	5	16.5	5	16.5	5	16.5	5	16.5
	Composite Site Rating		361		389		300		367	

Source: PEC, 2006

Table 4

Composite Suitability Ratings for the Technical Evaluation of the Candidate Sites



Source: PEC, 2006

Results of the Evaluation of the Candidate Sites

Based on these rating results and other applicable considerations related to PEC's business plans, the HAR site was selected as the proposed site for the PEC COL and there is no alternate site that is environmentally preferable to the proposed site.

References

Electric Power Research Institute (EPRI). 2002. *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application*, Final Report. March 2002.

Progress Energy Carolina, Inc. (PEC). 2006. Progress Energy Carolinas, Inc., "Progress Energy: New Nuclear Baseload Generation Addition, Evaluation of Carolina Sites," January 2006 (Proprietary Reference).

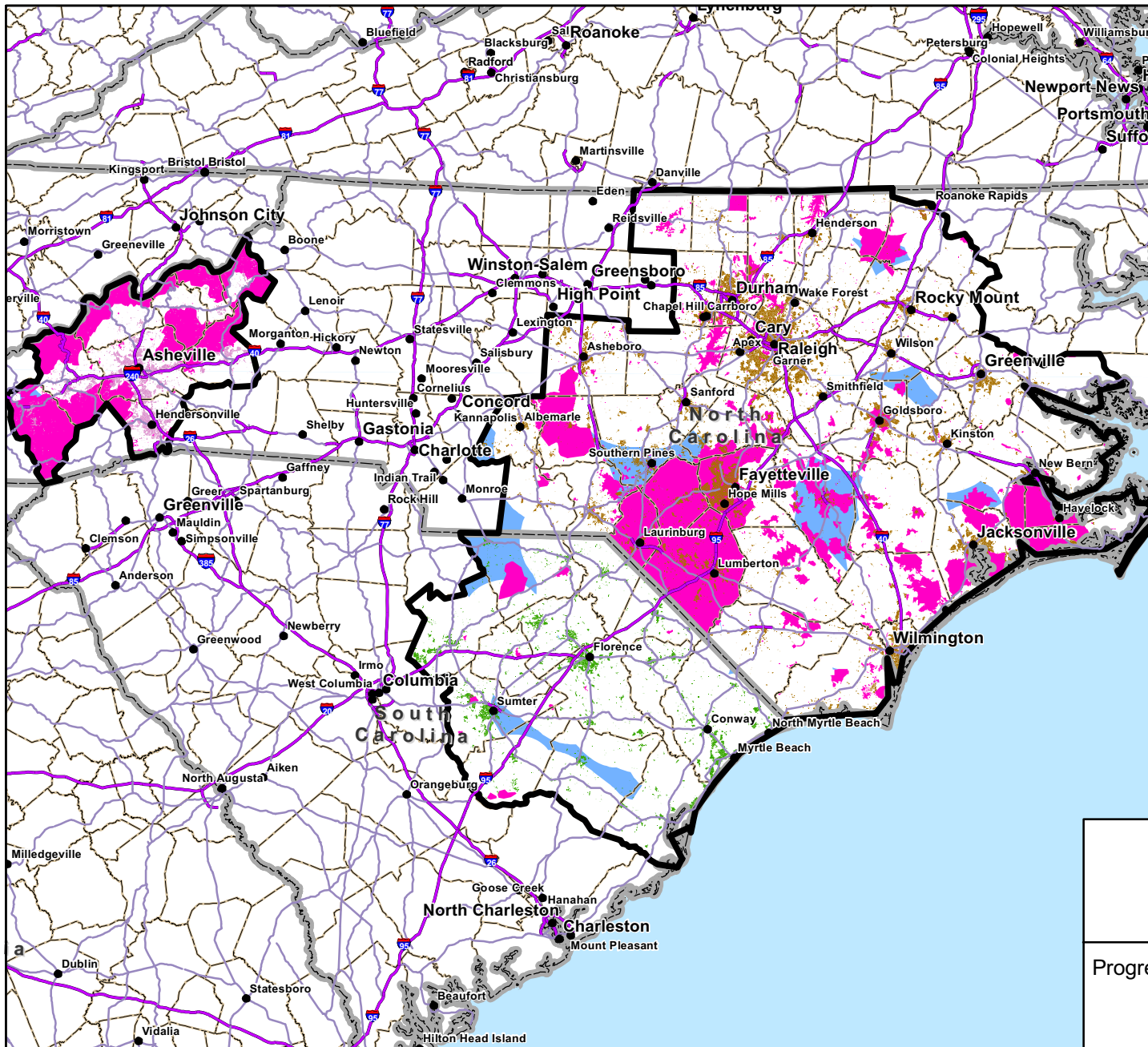
U.S. Nuclear Regulatory Commission (NRC). 2007. NUREG-1555, "Environmental Standard Review Plan, Section 9.3: Site Selection Process," July.

U.S. Nuclear Regulatory Commission (NRC). 1998. Regulatory Guide 4.7, Rev. 2, "General Site Suitability for Nuclear Power Stations."

U.S. Nuclear Regulatory Commission (NRC). 1998. Title 10, Part 50, "Domestic Licensing of Production and Utilization Facilities."

U.S. Nuclear Regulatory Commission (NRC). 1996. Title 10, Part 100, "Reactor Site Criteria."

U.S. Nuclear Regulatory Commission (NRC). 1976. Regulatory Guide 4.2, Rev. 2, "Preparation of Environmental Reports for Nuclear Power Stations."



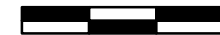
Legend

- Region of Interest
- Population Center
- Eastern North Carolina
- Western North Carolina
- South Carolina
- Dedicated Land
- Waterway Exclusion Area

Sources

Source: POWERmap:
www.powermap.platts.com 2009
 Platts, A Division of
 The McGraw-Hill Companies

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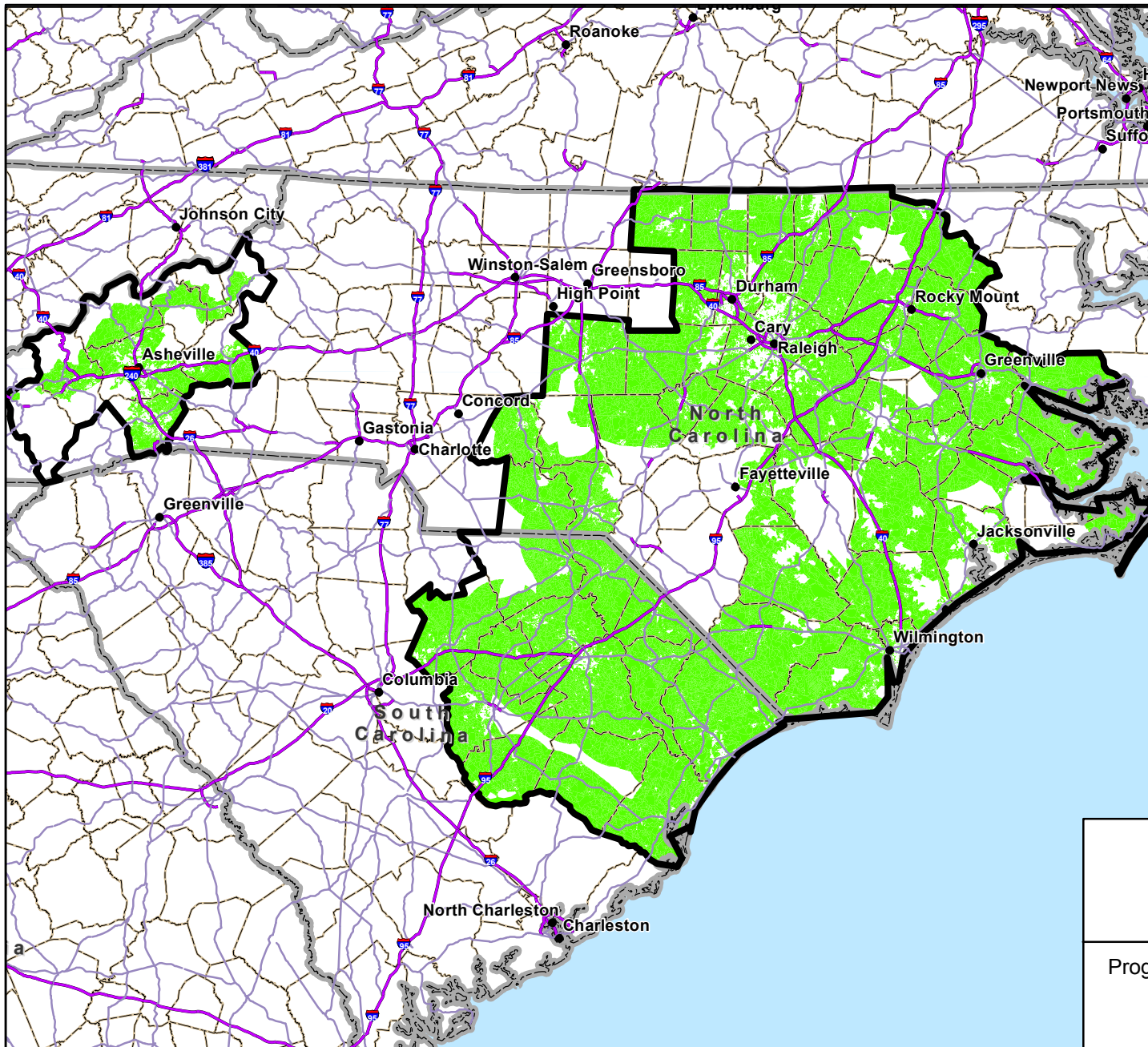
Miles

Progress Energy Carolinas
**Shearon Harris Nuclear Plant
 Units 2 and 3**

New Hill, North Carolina

Progress Energy Carolinas Exclusionary Areas

Attachment 9.4-1A, Figure 1



Legend

- Region of Interest
- Candidate Area

Sources

Source: POWERmap:
www.powermap.platts.com 2009
 Platts, A Division of
 The McGraw-Hill Companies

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Kilometers

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Miles

Progress Energy Carolinas

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 Units 2 and 3**

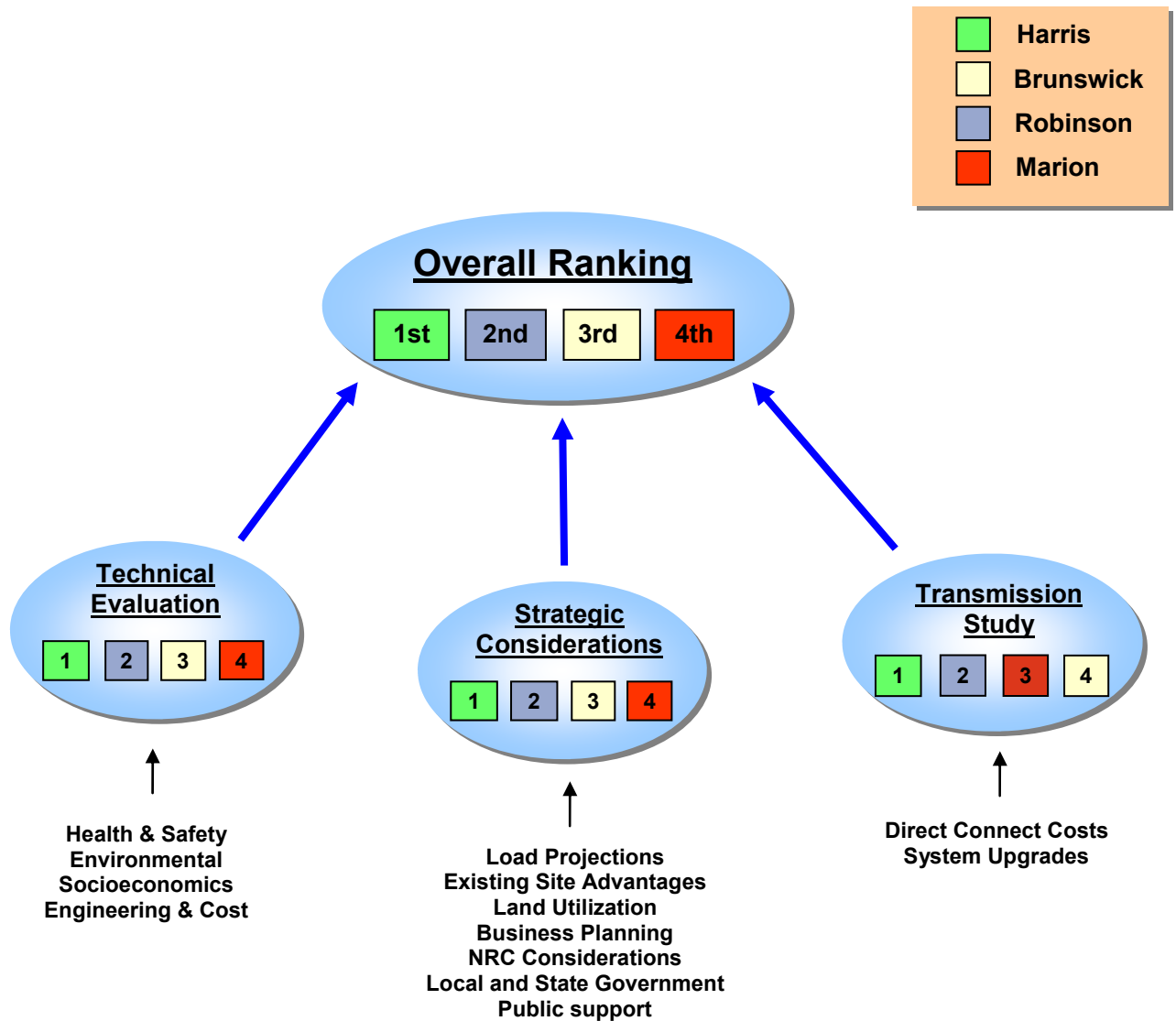
New Hill, North Carolina

Progress Energy Carolinas Candidate Areas

Attachment 9.4-1A, Figure 2

Figure 3

Overall Ranking of the Candidate Sites Based on the Results of the Technical Evaluation, Strategic Considerations, and Transmission Study



Source: PEC, 2006