Surry Power Station Units 1 and 2
Application for Subsequent License Renewal
Appendix E
Applicant's Environmental Report - Operating License Renewal Stage
October 2018

Intentionally Blank

List of Tables

List of Figures

List of Attachments

Abbreviations, Acronyms, and Symbols

$	dollar(s) (U.S.)
§	Section
°F	degrees Fahrenheit
µm	micrometer
A-R	agricultural-rural residence (zoning district)
AADT	average annual daily traffic
AAF	Felker Army Airfield
ALARA	as low as reasonably achievable
ALWR	advanced light water reactor
amsl	above mean sea level
APE	area of potential effect
AQCR	air quality control region
ATWS	anticipated transient without scram
BDB	beyond design basis
BEA	Bureau of Economic Analysis
BGEPA	Bald and Golden Eagle Protection Act
BLS	Bureau of Labor Statistics
BMP	best management practice
BOD	biological oxygen demand
Btu	British thermal unit
CAA	Clean Air Act
CBF	Chesapeake Bay Foundation
CCB	Center for Conservation Biology
CCRM	Center for Coastal Resources Management
CCS	carbon capture and sequestration
CDF	core damage frequency
CDP	census-designated place

CFR	Code of Federal Regulations
cfs	cubic feet per second
CILLRWC	Central Interstate Low-Level Radioactive Waste Commission
cm/sec	centimeters per second
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalent
COLA	combined license application
COV	Code of Virginia
CPDC	Crater Planning District Commission
CPI	consumer price index
CPP	Clean Power Plan
CRDP	cultural resources description process
CRI	Cultural Resources, Inc., now Stantec
CSA	Confederate States of America
CWA	Clean Water Act (Federal Water Pollution Control Act)
CWF	Colonial Williamsburg Foundation)
CZMA	Coastal Zone Management Act
DCH	designated critical habitat
DDT	dichlorodiphenyltrichloroethane
DECON	dismantling and decontamination, one of three NRC decommissioning strategies
DMMA	dredge material management area
DNH	Division of Natural Heritage
DOE	U.S. Department of Energy
Dominion	Virginia Electric and Power Company or Dominion Energy Virginia
Dominion Energy Virginia	Virginia Electric and Power Company
DOT	U.S. Department of Transportation

DSM	demand-side management
E	east
EAB	exclusion area boundary
EDG	emergency diesel generator
EFH	essential fish habitat
EIA	Energy Information Administration
ENE	east-northeast
ENTOMB	permanent entombment on site, one of three NRC decommissioning strategies
EP	emergency plan
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	environmental report
ERC	Energy Recovery Council
ERFDAS	emergency response facility data acquisition system
ESA	Endangered Species Act
ESE	east-southeast
ESH	Eastern State Hospital
ESP	early site permit
ESRI	Environmental Systems Research Institute
EV	Encyclopedia Virginia
FEMA	Federal Emergency Management Agency
FES	final environmental statement
FPPA	Farmland Protection Policy Act
fps	feet per second
FRI	Froehling & Robertson, Inc.
ft^3	cubic feet
FV	Fussell-Vesely (PRA importance measure)
FY	fiscal year

GDNR	Georgia Department of Natural Resources
GEIS	NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
GHG	greenhouse gas
GNCTS	Gravel Neck Combustion Turbines Station
GPI	Groundwater Protection Initiative
gpd	gallons per day
gpm	gallons per minute
gpy	gallons per year
HABS	Historic American Buildings Survey
HAER	Historic American Engineering Record
HAP	hazardous air pollutant
HAPC	habitat areas of particular concern
HDR	HDR Engineering, Inc.
HEPA	high-efficiency particulate absorption
HIC	high integrity container
HRSD	Hampton Roads Sanitation District
HUC	hydrologic unit code
HUD	U.S. Department of Housing and Urban Development
I-64	Interstate 64
I-95	Interstate 95
IGCC	integrated gasification combined cycle
IM	impingement mortality
IPA	integrated plant assessment
IPEEE	individual plant examination of external events
IRP	integrated resource plan
ISFSI	independent spent fuel storage installation
ISLOCA	interfacing systems loss-of-coolant accident
IWC	Isle of Wight County

IWCM	Isle of Wight County Museum
JRA	James River Association
kV	kilovolt
kWh/m2/day	kilowatt hour per square meter per day
LBGI	Louis Berger Group, Inc.
LHSI	low head safety injection
LLRW	low-level radioactive waste
LOS	level of service
LRA	license renewal application
mA	milliamperes
MAAP4	Modular Accident Analysis Program, Version 4
MACCS2	MELCOR Accident Consequences Code System
MACTEC	MACTEC Engineering and Consulting, Inc.
Mb	body-wave magnitude (earthquakes)
MB	maximum benefit
MBTA	Migratory Bird Treaty Act
mg	million gallons
mg/L	milligram per liter
MGD	million gallons per day
mgy	million gallons of water per year
MRLC	Multi-Resolution Land Characteristics Consortium
MM	modified Mercalli intensity (seismic intensity scale)
MMBtu	million British thermal units
MOAB	motor-operated air breaker
mph	miles per hour
mrad	milliradiation absorbed dose
mrem	millirem
MRLC	Multi-Resolution Land Characteristics Consortium
msl	mean sea level

MSLB	main steam line break
mSv	millisievert
MSW	municipal solid waste
MW	megawatt
MWd/MTU	megawatt days per metric ton uranium
MWe	megawatts electric
MWt	Megawatts thermal
N	north
NA	not available /not applicable
NAAQS	National Ambient Air Quality Standards
NAPS	North Anna Power Station
NAVD88	North American Vertical Datum 1988
NAVSEA	Naval Sea Systems Command
NCBM	North Carolina Office of State Budget and Management
NCSL	National Conference of State Legislatures
NCDC	National Climatic Data Center
NCEI	National Centers for Environmental Information
NCES	National Center for Education Statistics
NE	northeast
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NETL	National Energy Technology Laboratory
NGCC	natural gas combined-cycle
NHPA	National Historic Preservation Act
NiCAD	nickel-cadmium battery
NMFS	National Marine Fisheries Service
NN	Newport News
NNEDA	NNEDA (Newport News Economic Development Authorities

NNE	north-northeast
NNS	Newport News Shipbuilding
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NUG	non-utility generation
NW	northwest
NWF	National Wildlife Federation
NWI	National Wetlands Inventory
NWS	National Weather Service
NYDEC	New York Department of Conservation
NYNHP	New York Natural Heritage Program
OL	operating license
OALARM	offsite alarm time
ORV	off-road vehicle
OSHA	Occupational Safety and Health Administration
Pb	lead
PBAPS	Peach Bottom Atomic Power Station
PBDEs	polybrominated diphenyl ethers
pc/h	passenger cars per hour
PCB	polychlorinated biphenyl
pCi/l	picoCuries per liter
PDELAY	plume release time
PILOT	payment in lieu of taxes

$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter
PM	particulate matter
ppm	parts per million
ppt	parts per thousand
PRA	probabilistic risk assessment
PSD	prevention of significant deterioration
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PV	photovoltaic
PV	Preservation Virginia
PWR	pressurized water reactor
RCRA	Resource Conservation and Recovery Act
RCS	reactor coolant system
RDC	Riverside Diagnostic Center
RDH	Riverside Doctors' Hospital
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
RM	river mile
RO	reverse osmosis
ROW	right-of-way
RRMC	Riverside Regional Medical Center
RWST	refueling water storage tank
S	south
SAFSTOR	safe storage, one of three NRC decommissioning strategies
SAMA	severe accident mitigation alternative
SBO	station blackout
SC	Surry County
SCS	Stantec Consulting Services, Inc.

SDTSA	state-designated American Indian statistical areas
SCVA	Surry County Virginia
SCVT	Surry County Virginia Tourism
SE	southeast
SGTR	steam generator tube rupture
SHPO	state historic preservation office (or officer)
SLR	subsequent license renewal
SLRA	subsequent license renewal application
SMC	Surry Medical Center
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SMR	small modular reactor
SO_2	sulfur dioxide
SO_x	sulfur oxides
SPCC	spill prevention, control and countermeasure
SPS	Surry Power Station
SR	State Route
SSA	sole source aquifer
SSC	systems, structures, and components
SSE	south-southeast
SSW	south-southwest
STC	source term category
SU	standard units
SW	southwest
SW	service water
SWCGP	stormwater construction general permit
SWPE	Sea World Parks and Entertainment
SWPPP	stormwater pollution prevention plan
TEA	Themed Entertainment Association

TEDE	total effective dose equivalent
TRB	Transportation Research Board
TSS	total suspended solids
TVA	Tennessee Valley Authority
TWH	terrawatt hours
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USC&GS	U. S. Coast and Geodetic Survey
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of Interior
USDOT	U.S. Department of Transportation
USFA	U.S. Fire Administration
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USTA	U.S. Travel Association
UVA	University of Virginia
VAC	Virginia Administrative Code
VaFWIS	Virginia Fish and Wildlife Information Service
VB	Virginia Business.com
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Fisheries
VDH	Virginia Department of Health
VDHR	Virginia Department of Historic Resources
VDOT	Virginia Department of Transportation
VHHA	Virginia Hospital & Healthcare Association

VIMS	Virginia Institute of Marine Sciences
VISC	Virginia Invasive Species Council
VMRC	Virginia Marine Resources Commission
VNC	Visit North Carolina
VOC	volatile organic compound
VPDES	Virginia Pollutant Discharge Elimination System
VSCC	Virginia State Corporation Commission
VTA	Virginia Tourism Authority
W	west
WAP	wildlife action plan
WFO	weather forecast office
WM	William & Mary
WMA	wildlife management area
WNS	white-nose syndrome
WNW	west-northwest
WSW	west-southwest

Intentionally Blank

E1.0 INTRODUCTION

E1.1 PURPOSE OF AND NEED FOR ACTION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. Virginia Electric and Power Company (Dominion Energy Virginia or Dominion) owns and operates Surry Power Station (SPS) Units 1 and 2 pursuant to NRC operating licenses (OLs) DPR-32 and DPR-37, respectively. Based on a license renewal application (LRA) submitted in 2001, the NRC issued renewed OLs in March 2003, providing authorization to operate for an additional 20 years beyond the original 40-year licensed operating term. The renewed Unit 1 OL shall expire on May 25, 2032, and the renewed Unit 2 OL shall expire on January 29, 2033. SPS is located on the James River in Surry, Virginia

Dominion Energy Virginia has prepared this environmental report (ER) in conjunction with its application to the NRC for a subsequent renewal of the SPS OLs, as provided by the following NRC regulations and guidance:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application—Environmental Information [10 CFR 54.23]
- Title 10, Energy, CFR, Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)]
- NUREG-1555, Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal

The NRC has defined the purpose and need for the proposed action—renewal of the OLs for nuclear power plants such as SPS—as follows (NRC. 2013a):

> The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decision-makers, such as State, utility, and, where authorized, Federal agencies (other than the NRC). Unless there are findings in the safety review required by the Atomic Energy Act or the NEPA environmental review that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of whether a particular nuclear power plant should continue to operate.

The renewed OLs would allow an additional 20 years of operation for the SPS units beyond their current licensed operating terms. The subsequent renewed license for SPS Unit 1 would expire on May 25, 2052, and the subsequent renewed license for SPS Unit 2 would expire on January 29, 2053.

Dominion has prepared Table E1.1-1 to verify compliance with regulatory requirements. Table E1.1-1 indicates the sections in the SPS subsequent license renewal (SLR) ER that respond to each requirement of 10 CFR 51.53(c) and 10 CFR 51.45.

Table E1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements

Description	Requirement	ER Section(s)
Environmental Report—General Requirements [10 CFR 51.45]		
Description of the proposed action	10 CFR 51.45(b)	E2.1
Statement of the purposes of the proposed action	10 CFR 51.45(b)	E1.0
Description of the environment affected	10 CFR 51.45(b)	E3.0
Impact of the proposed action on the environment	10 CFR 51.45(b)(1)	E4.0
Adverse environmental effects which cannot be avoided should the proposal be implemented	10 CFR 51.45(b)(2)	E6.3
Alternatives to the proposed action	10 CFR 51.45(b)(3)	E2.6, E7.0, and E8.0
Relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity	10 CFR 51.45(b)(4)	E6.5
Irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented	10 CFR 51.45(b)(5)	E6.4
Analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects	10 CFR 51.45(c)	E2.6, E4.0, E7.0, and E8.0
Federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and description of the status of compliance with these requirements	10 CFR 51.45(d)	E9.0

Table E1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements

Description	Requirement	ER Section(s)
Status of compliance with applicable environmental quality standards and requirements which have been imposed by federal, state, regional, and local agencies having responsibility for environmental protection, including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements	10 CFR 51.45(d)	E9.0
Alternatives in the report including a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements	10 CFR 51.45(d)	E9.7
Information submitted pursuant to 10 CFR 51.45(b) through (d) and not confined to information supporting the proposed action but also including adverse information	10 CFR 51.45(e)	E4.0 and E6.3
Description of the proposed action including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with §54.21. The report must describe in detail the affected environment around the plant, the modifications directly affecting the environment or any plant effluents, and any planned refurbishment activities	10 CFR 51.53(c)(2)	E2.1, E2.3, E2.4, E3.0, and E4.0
Analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for applicable Category 2 issues, as discussed below	10 CFR 51.53(c)(3)(ii)	E2.3 and E4.0
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	E4.5.1
Groundwater Resources		
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	E4.5.2

Table E1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements

Description	Requirement	ER Section(s)
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute [gpm])	10 CFR 51.53(c)(3)(ii)(C)	E4.5.3
Groundwater quality degradation (plants with cooling ponds at inland sites)	10 CFR 51.53(c)(3)(ii)(D)	E4.5.4
Radionuclides released to groundwater	10 CFR 51.53(c)(3)(ii)(P)	E4.5.5
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	10 CFR 51.53(c)(3)(ii)(B)	E4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	10 CFR 51.53(c)(3)(ii)(B)	E4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	E4.6.3
Terrestrial Resources		
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	E4.6.4
Effects on terrestrial resources (non-cooling system impacts)	10 CFR 51.53(c)(3)(ii)(E)	E4.6.5
Special Status Species and Habitats		
Threatened, endangered, and protected species, and essential fish habitat	10 CFR 51.53(c)(3)(ii)(E)	E4.6.6
Historic and Cultural Resources		
Historic and cultural resources	10 CFR 51.53(c)(3)(ii)(K)	E4.7
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals, or cooling towers that discharge to a river)	10 CFR 51.53(c)(3)(ii)(G)	E4.9.1

Table E1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements

Description	Requirement	ER Section(s)
Electric shock hazards	10 CFR 51.53(c)(3)(ii)(H)	E4.9.2
Environmental Justice		
Minority and low-income populations	10 CFR 51.53(c)(3)(ii)(N)	E3.11.2 and E4.10.1
Cumulative Impacts		
Cumulative Impacts	10 CFR 51.53(c)(3)(ii)(O)	E4.12
Severe Accident Mitigation Alternatives		
Severe accidents	10 CFR 51.53(c)(3)(ii)(L)	E4.15
All Plants		
Consideration of alternatives for reducing adverse impacts for all Category 2 license renewal issues	10 CFR 51.53(c)(3)(iii)	E4.0 and E6.2
New and significant information regarding the environmental impacts of license renewal of which the applicant is aware	10 CFR 51.53(c)(3)(iv)	E4.0 and E5.0

E1.2 ENVIRONMENTAL REPORT SCOPE AND METHODOLOGY

NRC regulations for domestic licensing of nuclear power plants require reviews of environmental impacts from renewing an OL. NRC regulation 10 CFR 51.53(c) requires an applicant for license renewal to submit with its application a separate document (Appendix E of the application) entitled "Applicant's Environmental Report—Operating License Renewal Stage." In determining what information to include in the SPS SLR applicant's ER, Dominion has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), Revision 1 (NRC. 2013a), and referenced information specific to transportation (NRC. 1999)
- NRC supplemental information in the *Federal Register* notice for the 2013 final rule updating 10 CFR 51 (78 FR 37282)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC. 1996a)
- Regulatory Guide 4.2, Supplement 1, Revision 1, *Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications* (NRC. 2013b)

The NRC included in 10 CFR 51 the list of 78 National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants that were identified in the 2013 GEIS (Appendix B to Subpart A of 10 CFR 51, Table B-1). Attachment A lists the 78 issues from 10 CFR 51, Subpart A, Appendix B, Table B-1 and identifies the section in this ER in which Dominion addresses each applicable issue.

E1.3 SURRY POWER STATION LICENSEE AND OWNERSHIP

Dominion Energy Virginia, incorporated in Virginia in 1909 as a Virginia public service corporation, is a wholly owned subsidiary of Dominion Energy, Inc., and a regulated public utility that generates, transmits, and distributes electricity for sale in Virginia and North Carolina. In Virginia, the company conducts business under the name "Dominion Energy Virginia" and primarily serves retail customers. In North Carolina, it conducts business under the name "Dominion Energy North Carolina" and serves retail customers located in the northeastern section of the state, excluding certain municipalities. In addition, Dominion Energy Virginia sells electricity at wholesale prices to rural electric cooperatives, municipalities, and into wholesale electricity markets. All of Dominion Energy Virginia's stock is owned by Dominion Energy, Inc. Dominion Energy Virginia is subject to regulation by various federal, state, and local governmental agencies. SPS Units 1 and 2 are owned and operated by Dominion Energy Virginia, the current SPS licensee and applicant for subsequent license renewal.

Intentionally Blank

E2.0 PROPOSED ACTION AND DESCRIPTION OF ALTERNATIVES

E2.1 THE PROPOSED ACTION

In accordance with 10 CFR 51.53(c)(2) a license renewal applicant's ER must contain a description of the proposed action. The proposed action is to renew for a second time, and for an additional 20-year period, the OLs for SPS Units 1 and 2, which would preserve the option for Dominion Energy Virginia to continue operating SPS and provide reliable baseload power for the proposed SLR operating term. For SPS Unit 1, the proposed action would extend the OL from May 25, 2032, to May 25, 2052. For SPS Unit 2, the proposed action would extend the OL from January 29, 2033, to January 29, 2053.

Dominion Energy Virginia does not anticipate any license renewal-related refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process. The relationship of refurbishment to subsequent license renewal is described in Section E2.3.

Changes to surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) would be implemented as a result of the 10 CFR 54 aging management review for SPS. Potential SMITTR activities are described in Section E2.4. No plant upgrades to support extended operations that could directly affect the environment or plant effluents are planned to occur during this period of extended operation.

E2.2 GENERAL PLANT INFORMATION

A license renewal applicant's ER must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures. This report must describe in detail the affected environment around the plant and the modifications directly affecting the environment or any plant effluents. [10 CFR 51.53(c)(2)]

The principal structures at SPS are the reactor containments, auxiliary building, fuel building, turbine building, radwaste facility, condensate polishing building, service building, and administration building, which includes the main control area. Main structures outside the power block are the low-level radwaste (LLRW) building, independent spent fuel storage installation (ISFSI), steam generator storage facility, beyond design basis (BDB) storage building, sewage treatment plant, firing range, general training center, warehouses, 230-kilovolt (kV) and 500-kV switchyards, meteorological towers, intake canal, and intake and discharge structures. Figure E3.1-1 illustrates these plant structures and the exclusion area boundary (EAB), which is the same as the SPS property boundary, or site boundary. As presented in Section E3.1.2, with the exception of public access to Hog Island on State Route (SR) 650, Dominion has the authority to control activities within the EAB, including exclusion and removal of personnel and property.

E2.2.1 REACTOR AND CONTAINMENT SYSTEMS

E2.2.1.1 Reactor System

As shown in Figure E3.1-1, SPS is a two-unit (Units 1 and 2) plant. Each unit includes a pressurized water reactor (PWR) nuclear steam supply system and turbine generator furnished by Westinghouse Electric Corporation. The main turbines were furnished by Alstom under a design change (Dominion. 2010a). The balance of each unit was designed by Dominion with the assistance of its agent, Stone & Webster Engineering Corporation. (SPS. 2016a, Section 1.1)

Units 1 and 2 achieved commercial operation in December 1972 and May 1973, respectively. Each reactor unit was designed for a warranted power output of 2,441 megawatts thermal (MWt), with an equivalent warranted gross electrical output of 822.6 megawatts electric (MWe). In 1995, both units were uprated to the design values corresponding to a core power output of 2,546 MWt and expected gross electrical output of 855.4 MWe. In 2010, both units were uprated to a core power output of 2,587 MWt (corresponding to a nuclear steam supply system power rating of 2,599 MWt). (SPS. 2016a, Section 1.1)

The nominal core power rating for each unit is 2,587 MWt. All steam and power conversion equipment, including the turbine generator, has been designed on the basis of this higher thermal output and has the capability to generate a maximum calculated gross output of 885 MWe per unit. The engineered safeguards systems and the containment are designed and evaluated for operation at this higher power level, which is used in the analysis of all postulated incidents that have offsite consequences. (SPS. 2016a, Section 1.1) Plant operations consume a portion of the gross output, with the remainder provided to the service area electrical grid (i.e., net generating capacity). SPS's net generating capacity that Dominion plans on for meeting electrical demand of its service area is 1,676 MWe (Dominion. 2018) (see Section E2.6).

The reactor coolant system is arranged as three closed reactor coolant loops connected in parallel to the reactor vessel, each containing a reactor coolant pump, isolation and bypass valves, piping, and a steam generator. An electrically heated pressurizer is connected to one of the loops. (SPS. 2016a, Section 1.2.3)

Each reactor core includes uranium dioxide pellets as fuel, enclosed in zirconium alloy tubes with welded end plugs. The tubes are supported in assemblies by structures of grids, and there are suitable end pieces for the support of the assembled rods and restraint of abnormal axial movement. The mechanical control rod assemblies consist of clusters of stainless steel-clad absorber rods guided by tubes located within the fuel assembly. The core consists of 157 of these fuel assemblies loaded in varying enrichments. (SPS. 2016a, Section 1.2.3) Core average initial fuel enrichment does not exceed 5%, because for the purpose of transportation impacts analysis and the determination that impacts reported in Table S-4 [10 CFR 51.52] would apply to and be

bounding for accidents that may occur during extended license terms, the GEIS assumes fuel would be enriched at 5% or less, and burnup would not exceed 62,000 MWd/MTU.

The fuel assemblies are designed to perform satisfactorily throughout their required lifetime. The loads, stresses, and strains resulting from the combined effects of flow-induced vibrations, earthquakes, reactor pressure, fission gas pressure, fuel growth, thermal strain, and differential expansion during both steady-state and transient reactor operating conditions have been considered in the design of the fuel rods and fuel assembly. The assembly is also structurally designed to withstand handling and shipping loads prior to irradiation, and to maintain sufficient integrity at the completion of design burnup to permit safe removal from the core, handling, shipment, and fuel reprocessing. (SPS. 2016a, Section 3.2.3.4.2)

The reactor is controlled by a coordinated combination of chemical shim and mechanical control rod assemblies. The control of both the reactor and turbine generator for each unit is accomplished from the control room and is supervised by licensed operators. (SPS. 2016a, Section 1.2.4)

Dominion refuels each SPS nuclear unit on a staggered 18-month schedule, which means at least one refueling every year and two refuelings every third year (SPS. 2001, Section 3.4). With the 18-month cycles currently in effect and planned, typical batch average burn-ups of about 45,000 to 50,000 megawatt days per metric ton of uranium (MWd/MTU) can be achieved. Beginning with SPS-improved fuel assemblies with ZIRLO cladding, and continuing with the 15 x 15 upgrade assemblies with optimized ZIRLO cladding, the lead rod average burnup limit is 62,000 MWd/MTU. The optimized ZIRLO cladding was approved by the NRC for use at SPS as part of the 15 x 15 upgrade fuel design. (SPS. 2016a, Section 3.5.2.6.1)

A low-leakage type of fuel management, which places burned fuel assemblies on the core periphery and intermingles the fresh fuel assemblies with previously burned assemblies in the core's interior regions, is employed (SPS. 2016a, Section 1.2.3).

E2.2.1.2 Containment System

The containment systems for the two units are similar and completely independent (SPS. 2016a, Section 5). Each reactor containment is a steel-lined, reinforced concrete, 135-foot diameter cylinder with a hemispherical dome and a flat, reinforced concrete foundation mat. Each containment structure is designed to withstand an internal pressure of 45 pounds per square inch gauge (psig) above atmospheric pressure. (NRC. 2002a, Section 2.1.2) Air pressure inside the containment structure is maintained between 10.3 and 11.3 pounds per square inch absolute (psia) atmospheric pressure based on service water temperature for accident analysis.

The containment structure encloses the entire reactor coolant system (SPS. 2016a, Section 1.4.10). The containment system, together with the engineered safeguards, is designed to

limit radiation doses under conditions resulting from a design-basis accident to less than or equal to the limits specified in 10 CFR 50.67 at the site boundary and beyond (SPS. 2016a, Section 5.1).

The containment structure is designed to sustain a design-basis accident of a double-ended shear of the reactor coolant piping. Engineered safeguards are designed to limit peak containment pressure to 60 psia, return containment to sub-atmospheric in one hour, and provide long-term cooling of the reactor core. The containment and its associated engineered safeguards exceed the required functional capability of protecting the public from the consequences of gross equipment failures, because they provide for a rapid termination of the effects of the event. (SPS. 2016a, Section 1.4.10)

The containment isolation features, such as penetrations, access hatches, and isolation valves, have been designed so that double barriers or seals exist between the interior of the containment and the environment. Hence, there are no direct leakage paths between the containment and the environment. (SPS. 2016a, Section 5.4)

E2.2.2 MAINTENANCE, INSPECTION, AND REFUELING ACTIVITIES

Various programs and activities at the site maintain, inspect, test, and monitor the performance of plant equipment. These programs and activities include, but are not limited to, those implemented to achieve the following:

- Meet the requirements of 10 CFR 50, Appendix B (Quality Assurance), Appendix R (Fire Protection), and Appendices G and H (Reactor Vessel Materials);
- Meet the requirements of 10 CFR 50.55a, Codes and Standards, which invokes the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, "In-service Inspection and Testing Requirements";
- Meet the requirements of 10 CFR 50.65, the maintenance rule; and
- Maintain water chemistry in accordance with Electric Power Research Institute (EPRI) guidelines.

Additional programs include those implemented to meet technical specification surveillance requirements; those implemented in response to NRC generic communications; and various periodic maintenance, testing, and inspection procedures necessary to manage the effects of aging on structures and components. Certain program activities are performed during the operation of the units, while others are performed during scheduled refueling outages.

E2.2.3 COOLING AND AUXILIARY WATER SYSTEMS

SPS uses a once-through cooling system to remove waste heat from the reactor steam electric system and plant auxiliary (service water) systems (Figure E2.2-1) (SPS. 2001, Section 3.1.2.1). The circulating water and service water systems are required for cold shutdown in order to supply

cooling to certain safe shutdown components such as the component cooling water heat exchangers, and control and relay room air conditioning units (SPS. 2016a, Section 9.10.3.4). Each SPS unit has its own residual heat removal system, but the component cooling water system and the service water system are shared by both units (SPS. 2001, Section 3.1.2.1).

To prevent the direct recirculation of the heated circulating water discharge, the system is designed to take water from the James River on the east end of the site and to discharge to the James River on the west end of the site. The shoreline distance between the low-level intake and discharge points is about 5.7 miles, and the overland distance across the peninsula is about 1.9 miles. (SPS. 2016a, Section 10.3.4.1) As shown in Figure E3.1-1, the low-level intake structure is on the river, while the high-level intake structures are at the units.

Cooling water is withdrawn from the James River through a channel dredged in the riverbed between the main river channel and the eastern shore of Gravel Neck Peninsula, a distance of approximately 5,700 feet. Dominion has typically dredged this channel every 3-4 years to maintain a depth of approximately 13 feet (Section E2.2.7.2). The bottom width of the channel is approximately 150 feet, with a bank slope ratio of 3:1 (horizontal:vertical). These dimensions allow the channel to be used for shipping materials and equipment to a permanent dock located just north of the low-level intake structure. (SPS. 2001, Section 3.1.2.1)

Each unit requires 840,000 gallons per minute (gpm) of river water to supply condensing and service water needs. To provide operational flexibility, system reliability, and station economy, the water requirement for each unit is supplied by four circulating water pumps, rated at 220,000 gpm each. These pumps discharge to the common high-level intake canal that conveys the circulating water to the station power generation area. (SPS. 2016a, Section 10.3.4.1)

The common high-level intake canal is lined with concrete to prevent erosion. Water levels in the canal vary between 20 and 23 feet above mean sea level (AMSL), depending on the tidal stage in the James River. At a minimum water level (20 feet AMSL), the canal contains approximately 45,000,000 gallons of cooling water. (SPS. 2001, Section 3.1.2.1)

A reinforced concrete high-level intake structure is provided in the high-level intake canal at each power station unit. Each structure contains four bays, and each bay contains a trash rack, a traveling screen, and an inlet to a condenser intake line. (SPS. 2016a, Section 10.3.4.2) The cooling water is gravity fed from a high-level intake bay through an 8-foot diameter pipe to the turbine steam condensers. Service water for auxiliary cooling systems is diverted and withdrawn from the system before the circulating water enters the condensers. Steel plates can be placed on the stop log supports to permit dewatering of individual bays of the structure. Screenwash water is supplied by two pumps, each rated at 850 gpm. (SPS. 2016a, Section 10.3.4.2)

After passing through the condensers, the cooling water empties into a 12.5 x 12.5-foot square discharge tunnel and subsequently flows into a common circulating water discharge canal that

conveys the effluent from both units (including the service water discharge) to the James River (SPS. 2001, Section 3.1.2.1). The discharge canal is excavated in earth and designed to carry the flow of the two units with a velocity of about 2.2 feet per second (fps) at the elevation of mean low water. The canal slope is stable under the design-basis earthquake condition. The discharge canal extends about 1,200 feet into the James River. (SPS. 2016a, Section 10.3.4.2) The discharge canal is provided with rock groins along each side to control sedimentation and to maintain exit velocities of the circulating water to achieve desired dilution effects of the heated effluent (SPS. 2016a, Section 10.3.4.1).

Coarse trash is removed from the circulating water by trash racks at the low-level intake structure, and finer trash is removed at the low-level intake and at the entry bay and station ends of the intake canal by two sets of traveling water screens (SPS. 2016a, Section 10.3.4.1). The low-level intake structure is equipped with a specially designed Ristroph traveling screen system that was installed in May 1974, approximately two years after Unit 1 came online. Each of the eight low-level bays is equipped with a Ristroph screen that consists of 47 panels, each 15 feet wide by 2 feet high, with a screen mesh size of 0.375 inches. Unlike other traveling screens, which rotate every 12 to 24 hours (or when a pressure differential develops), the Ristroph units rotate continuously at a speed of 5-10 feet per minute. This greatly reduces fish mortality because impinged fish are quickly removed from the screens and returned to the James River. Because the system employs low-pressure spray to gently remove fish from the screens, injuries to fish (such as descaling) are also greatly reduced. Fish washed from the screens are returned (via an underwater pipe) to the James River. (SPS. 2001, Section 3.1.2.1). Schematic drawings of the low-level intake structure and traveling screens are shown in Figures E2.2-2 and E2.2-3.

Dominion maintains as necessary the low-level intake structure, traveling screens, and fish flume. Prior to initial license renewal, Dominion replaced the carbon steel screen structures and hardware with stainless steel and lightweight fiberglass baskets. Dominion removes each screen structure for periodic maintenance. Based on SPS operations and maintenance of the low-level intake structure and associated equipment, the Virginia Institute of Marine Sciences (VIMS) considers that the performance of these structures is better than it was during the original Clean Water Act (CWA) 316(b) demonstration. (SPS. 2001, Section 3.1.2.1)

Each condenser was originally equipped with an Amertap condenser cleaning system that circulated sponge rubber balls through the condenser tubes to prevent accumulation of deposits (such as biofouling organisms). In the 1980s, use of the Amertap system at SPS was discontinued in favor of chemical controls. At present, oxidizing biocides (sodium hypochlorite and sodium bromide) are used to control fouling of cooling system components such as condenser tubes. Although instantaneous maximum total residual chlorine concentrations of up to 1.0 milligram per liter are permissible under Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0004090 (Attachment B), the permit requires SPS to achieve a non-detectable concentration in

the final effluent. When chlorine is detected in an effluent sample, the injection of sodium hypochlorite is discontinued and the concentration in the system normally returns to a non-detectable level in a very short time (less than an hour). SPS has been in compliance with the permitted effluent limitations from 2012-2016. (SPS. 2001, Section 3.1.2.1)

E2.2.3.1 Component Cooling Water System

The component cooling water system is an intermediate cooling system that transfers heat from heat exchangers containing reactor coolant or other radioactive liquids to the service water system. Operation of the component cooling water system is required for the removal of decay heat to attain and maintain long-term safe shutdown, for example, in the event of a hurricane. (SPS. 2016a, Section 9.4.1.1) A schematic of the SPS component cooling water system is shown in Figure E2.2-4.

E2.2.3.2 Thermal Effluent Dispersion

At full power, SPS discharges 11.9 x 10^9 British thermal units (Btu) per hour into the James River estuary by way of cooling water discharged into Cobham Bay. Dissipation of the thermal plume produced by the warmed water discharge is dependent upon prevailing estuarine and meteorological conditions. The various flow regimes of the estuary, their associated densities and temperatures, wind velocities, ambient air temperatures, and relative humidities affect the size, shape, and rate of dissipation of the plume. (SPS. 2001, Section 3.1.2.1)

The VDPES permit (Attachment B) limits waste heat rejected to the James River from SPS to 12.6 x 10^9 Btu per hour, but does not require the reporting of discharge temperatures. Over the seven-year period (1969-1975), Dominion carried out extensive pre-and post-operational studies on thermal effects of SPS on the James River. These studies included computer modeling; field investigations of water quality and aquatic biota; field measurements of water temperatures upstream and downstream of SPS; and continuous electronic monitoring of water temperatures in the SPS intake and discharge canals. The results were compiled and summarized in a successful CWA Section 316(a) demonstration which showed that temperatures higher than 90 degrees Fahrenheit (°F) at the SPS outfall normally occur only in the months of June, July, August, and September when river water temperature is highest. (SPS. 2001, Section 3.1.2.1)

The highest surface temperature recorded in the SPS discharge canal in a comprehensive five-year study (two years pre-operational and three years post-operational) under a variety of operational conditions was 99.9°F on August 21, 1975. Even in this extreme case, all excess temperatures decreased rapidly as distance from the outfall increased, and temperatures at distances of 3,000 feet or more were rarely greater than 5°F above ambient temperatures in the river. (SPS. 2001, Section 3.1.2.1)

During a period of high ambient water temperatures (August 6 to September 10, 1975) when SPS was running at 90% or greater capacity, discharge temperatures ranged from 92.8°F to 99.9°F. These temperatures are believed to be typical of those observed in the discharge canal in late summer when both SPS units are operating at or near full power. (SPS. 2001, Section 3.1.2.1) There are no changes since the 2010 uprate.

Temperatures immediately outside the discharge canal in the James River are lower, with the effluent losing 1-2°F with every 1,000 feet from the mouth of the discharge canal (SPS. 2001, Section 3.1.2.1). There are no changes since the 2010 uprate.

E2.2.3.3 Domestic Water Supply System

A 4,000-gallon hydropneumatic tank, located in the fire-pump house, is provided for the domestic water supply system (from onsite wells). Pressure in the hydropneumatic tank is maintained at 40-60 psig by a pressure system consisting of a pressure-level regulator, air compressor, and related controls and accessories. Hypochlorinator equipment provides a means of chlorinating the domestic water supply. Piping from the hydropneumatic tank supplies cold water to safety showers, drinking water coolers, hot water storage tanks, and domestic cold water throughout the station. (SPS. 2016a, Section 9.11.2)

E2.2.3.4 Makeup Water System

The makeup water system consists of equipment to produce high-purity water by demineralizing well water for makeup to the various station systems. The flash evaporation system is no longer used to treat water, even though the equipment remains installed in the plant. (SPS. 2016a, Section 9.11.3) Reverse osmosis is also used to purify well water for makeup to the various station systems.

Well water is stored in the fire protection and domestic storage tank. The condensate polishing system removes any impurities using demineralizers and provides supplementary chemical treatment of condensate for feedwater conditioning. High-purity water is pumped to the primary water storage tanks for reactor plant makeup, and to the condensate storage tank for secondary plant makeup. (SPS. 2016a, Section 9.11.3)

E2.2.3.5 Fire Protection System

In addition to its primary function, the fire protection system also provides alternate sources of makeup water to certain other plant systems as follows:

- Auxiliary Feedwater System: This interconnection can be used for the fire protection system to provide an emergency water supply to the suction of the Unit 1 and Unit 2 auxiliary feedwater pumps (SPS. 2016a, Section 9.10.1).
- Spent Fuel Pool: A normally covered outlet above the spent fuel pool is supplied from the fire protection system for emergency makeup water to the pool. Teeing into this fire protection makeup line inside the fuel building is a line that is accessible external to the fuel building, which can be used to enable supply by an external makeup source. (SPS. 2016a, Section 9.10.1)

Water for firefighting is obtained from two 300,000-gallon water storage tanks, each with 250,000 gallons reserved exclusively for the fire protection system and 50,000 gallons in the upper portion of the tanks available for domestic water use. Each tank has a separate line to the suction header of the fire pumps located in the adjacent fire-pump house. The lines from the tanks to the suction header are equipped with isolation valves that can be closed to prevent both tanks from draining in the event of a leak. The tanks are supplied from two wells. (SPS. 2016a, Section 9.10.2.2.1)

Backup water for fire protection can be obtained in an emergency from the two 300,000-gallon condensate storage tanks or by taking suction from the intake canal and discharging into the fire loop through a hydrant (SPS. 2016a, Section 9.10.2.2.1).

The underground yard main system encircling the plant is supplied by two 12-inch lines from the fire-pump house, and is provided with isolation valves at the juncture, enabling either or both fire pumps to discharge into either line supplying the yard main loop. All yard fire hydrants, automatic suppression systems, and interior fire hose lines are supplied from the fire main yard loop. Post-indicator sectional valves are provided on the loop to permit the isolation of sections of the loop without interrupting service to the entire loop. (SPS. 2016a, Section 9.10.2.2.3)

E2.2.4 METEOROLOGICAL MONITORING PROGRAM

There are two meteorological towers at SPS. Meteorological tower locations are illustrated in Figure E3.1-1. The primary meteorological tower monitors wind direction and wind speed at two levels of the tower, ambient air temperature at two levels of the tower, differential air temperature between tower levels, horizontal wind direction fluctuation at both tower levels, dew point temperature at the lower tower level, and rainfall at the base of the tower. The backup meteorological tower monitors wind direction, wind speed, temperature, and horizontal wind direction fluctuation, all at only one level. (SPS. 2016a, Section E2.2.1.2)

The nearest structures to the primary tower are 500 feet north-northwest, while the nearest structures to the backup tower are 150 feet northwest. At the primary site, the nearest continuous tree line is approximately 50 feet south of the tower. Tree heights are 40-50 feet. At the backup tower, the nearest tree line, with trees 10-15 feet high, is located approximately 50 feet south-southwest of the tower. (SPS. 2016a, Section 2.2.1.2)

The primary tower is a guyed, triaxial, open-latticed structure. On May 21, 2012, the primary tower wind and temperature instrument elevations were surveyed. Table E2.2-1 provides the survey and pre-survey instrument heights (above ground level). The backup tower is a freestanding, triaxial, open-latticed structure. The instrumentation on the backup tower is located at 30.3 feet above ground level. (SPS. 2016a, Section 2.2.1.2)

On the primary tower, the wind speed, wind direction, and sigma-theta sensors are mounted on booms longer than 1.5 times the tower face width. On the backup tower, the sensors are post-mounted on top of the tower. The wind sensors are positioned such that the towers do not influence the prevailing south-southwest wind flow detected by the sensors. Temperature, differential temperature, and dew point temperature sensors are housed in motor-aspirated shields to insulate them from tower, solar, and terrestrial thermal radiation sources. (SPS. 2016a, Section 2.2.1.2)

Meteorological monitoring instrumentation is calibrated not less than semi-annually. Inspection, service, and maintenance are performed as required to ensure adequate data recovery. Redundant recording systems are incorporated into the program to minimize data loss due to recorder failure. (SPS. 2016a, Section 2.2.1.2) Based on five years of meteorological data from 2012-2016, the recovery rate at the SPS site has been greater than 90%.

Data from the site's primary and backup meteorological towers are transmitted to the control room and collected by the emergency response facility data acquisition system (ERFDAS). Temperature, differential temperature, wind speed, and wind direction from both the lower and upper primary tower level sensors are displayed on recorders in the control room, as are wind speed, wind direction, and sigma-theta from the backup tower (SPS. 2016a, Section E2.2.1.2). These parameters have been placed in the ERFDAS database, thus making site meteorological field data available for display in the technical support center, the local emergency operations facility, and the corporate emergency response center. Certain information is also hardwired for display on the control room meteorological panels.

A shelter is located at the base of each tower. The shelters have thermostatically controlled heat and air conditioning to maintain an interior temperature within a range appropriate for proper equipment operation. The enclosures are located to minimize any micrometeorological effects on the tower instrumentation. (SPS. 2016a, Section E2.2.1.2) Inside the shelters, the signals are

routed to the appropriate signal-conditioning equipment which go first to digital data recorders and second to an interface with the intelligent remote multiplexer system (SPS. 2016a, Section 2.2.1.2).

Microprocessor-based data acquisition systems are the primary method of data collection for offsite historical files. Backup collection consists of several remote data acquisition systems. In addition to being transmitted in real time to the control room recorders and to the ERFDAS, the data from the primary data collection system are telemetered daily to a computer in the corporate office, transferred to a network drive, and combined with the historical data. Professional meteorologists then review the data for representativeness and reasonability. (SPS. 2016a, Section 2.2.1.2)

The meteorological instrumentation and data recording described above were upgraded to be consistent with Regulatory Guide 1.23, Onsite Meteorological Programs, Proposed Revision 1, and Regulatory Guide 1.97, Revision 3, Instrumentation for Light-water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, May 1983. The meteorological sites and towers are consistent with NRC Regulatory Guide 1.23, Proposed Revision 1. (SPS. 2016a, Section 2.2.1.2)

Regional and site meteorology and air quality are presented in detail in Section E3.3.

E2.2.5 POWER TRANSMISSION SYSTEM

E2.2.5.1 In-Scope Transmission Lines

Based on NRC Regulatory Guide 4.2, Supplement 1 (NRC. 2013b, Section 2.2), transmission lines subject to evaluation of environmental impacts for license renewal are those that connect the nuclear power plant to the switchyard where electricity is fed into the regional power distribution system, and power lines that feed the plant from the grid during outages.

All in-scope transmission lines are located completely within the SPS EAB as shown in Figure E2.2-5. Additionally, Dominion has completed environmental permitting for an upgrade of electrical transmission capabilities for customers located in the southeastern Virginia peninsula region. The Surry-Skiffes Creek portion of the improvements includes the installation of a new 500-kV transmission line from the Skiffes Creek switching station in James City County, Virginia, to the Surry switching station located in the SPS 500-kV switchyard. The entire length of the project is approximately eight miles total, with 1.5 miles of the line located on Dominion property at SPS, 4.1 miles of overhead line crossing the James River, and 2.3 miles of the line located on land in southern James City County. (Dominion. 2016a) The Surry-Skiffes Creek line for electrical transmission is a separate project and is therefore not included in the scope of this analysis.

Electrical energy generated by Unit 1 at 22 kV is raised to 230 kV by the main transformer and delivered to the 230-kV switchyard. Electrical energy generated by Unit 2 at 22 kV is raised to 500 kV by the main transformer and delivered to the 500-kV switchyard by way of a motor-operated

air breaker (MOAB) and isolation breakers. The MOAB is located between the Unit 2 main transformer and the generator isolation breakers, and permits the isolation breakers to be closed when Unit 2 is off line. Reclosing the isolation breakers while Unit 2 is off line is important for ensuring proper voltage levels are maintained off site, which contributes to grid stability. The MOAB is manually operated from the switchyard and is not designed to be operated under load. Control interlocks prevent the MOAB from being operated unless the isolation breakers are open. (SPS. 2016a, Section 8.3)

For each unit, the main generator feeds electrical power at 22 kV through an isolated-phase bus to the main step-up single-phase transformers and the unit station service transformers located adjacent to the turbine building. The primary side of each 22/4.16-kV station service transformer is connected to the unit isolated-phase bus at a point between the generator terminals and the low-voltage connection of the main step-up transformers. There are three station service transformers per unit. They supply three independent 4,160-V auxiliary buses and are designed to limit the short-circuit fault duty on any one bus to within the interrupting capability of the 250-megavolt amperes air circuit breakers. (SPS. 2016a, Section 8.3)

During start-up and emergencies, reserve station service power for the auxiliaries of either unit is normally supplied from the switchyard transformers No. 1 (a 500/36.5-kV transformer connected to the 500-kV bus); No. 2 (a 230/36.5-kV transformer connected to the 230-kV bus #4); or No. 4 (a 230/36.5-kV transformer connected to the 230-kV bus #3). The 500-kV and 230-kV systems are independent and provide alternative sources of reserve power that can be expanded for future units and lines as required. Each switchyard transformer is capable of providing power to an emergency bus on each unit. The transmission system can handle the full output of both units at SPS upon the loss of any two transmission circuits connected to the SPS substation. (SPS. 2016a, Section 8.3)

The 34.5-kV overhead and underground distribution lines that feed Units 1 and 2 from the 34.5 kV switchyard during unit outages are shown in Figure E3.1-1.

E2.2.5.2 Vegetation Management Practices

The in-scope transmission lines are completely within the SPS EAB as shown in Figure E2.2-5. The transmission lines cross the SPS industrial area, where vegetation is sparse. Except in unusual circumstances, transmission corridors where out-of-scope transmission lines are located are maintained on a three-year cycle. Mechanical mowing and selective herbicide application are the predominant methods for corridor maintenance. (SPS. 2001, Section 2.4)

E2.2.5.3 Avian Protection

Threatened and endangered species potentially occurring near SPS, or within counties located within a six-mile radius of SPS, are described in Section 3.7. As addressed in Dominion's migratory bird protection guidance document (Dominion. 2009a), avian monitoring is established and

conducted on a project-by-project basis. Dominion cooperates with both the U.S. Fish and Wildlife Service (USFWS) and state agencies during various project activities to properly evaluate potential impacts to migratory birds and to establish acceptable avian monitoring protocols. Additionally, Dominion requires the following protective measures to be implemented within critical bald eagle habitat areas:

- Installation of new and/or replacement utility poles in critical habitat areas should be built to "raptor safe" standards.
- Distribution lines located in these areas may be required to be equipped with raptor-proof design standards. These new design standards incorporate the use of protective spacing, 10-foot cross-arms, perch deterrents, and shielding and materials requirements to minimize the risk of electrocutions. (Dominion. 2009a)

E2.2.5.4 Public

All in-scope transmission lines are located completely within Dominion-owned property. The public does not have access to this area, and therefore, no induced shock hazards would exist for the public. (See Figure E2.2-5.)

E2.2.5.5 Plant Workers

NUREG-1437 suggests that occupational safety and health hazard issues are generic to all types of electricity generating stations, including nuclear power plants, and are of small significance if the workers adhere to safety standards and use protective equipment (NRC. 2013a, Section 3.9.5.1).

Dominion maintains the safety-specific policies for all work conducted at electrical transmission locations requiring personal protective equipment, such as working around energized equipment. Dominion's Electric Transmission Accident Prevention Manual provides a comprehensive description of the company's electrical transmission safety guidance and associated forms. (Dominion. 2010b)

E2.2.6 RADIOACTIVE WASTE MANAGEMENT SYSTEM

Dominion uses liquid, gaseous, and solid radioactive waste management systems to collect and process the liquid, gaseous, and solid wastes that may be byproducts of the SPS operations. These systems process radioactive liquid, gaseous, and solid effluents to maintain releases to the environment within regulatory limits. The SPS waste disposal system meets the design objectives of 10 CFR 50, Appendix I, and controls the processing, disposal, and release of radioactive liquid, gaseous, and solid wastes. (NRC. 2002a, Section 2.1.4)

Dominion's waste management policy is to maintain radioactive waste effluent from SPS at the lowest practical level. In keeping with this policy, the radioactive waste disposal system is designed,

to the extent possible in accordance with maintenance practices, to maintain releases of radioactive material and radiation exposures to unrestricted areas as far below the limits of 10 CFR 20 as is practicable. Normally, no radioactive waste stream will be discharged from the station without having first been processed through the waste disposal system. (SPS. 2016a, Section 11.2.1)

Nonfuel solid waste results from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid waste also consists of reactor components, equipment, and tools removed from service, as well as contaminated protective clothing, paper, rags, and other trash generated from plant design modifications and operations, and routine maintenance activities. Solid waste is shipped to a waste processor for volume reduction before disposal at a licensed burial site. Spent resins and filters are stored or packaged for shipment to a licensed offsite processing or disposal facility. (NRC. 2002a, Section 2.1.4)

Fuel rods that have exhausted a certain percentage of their fuel and are removed from the reactor core for disposal are called spent fuel. Spent fuel is stored onsite in the spent fuel pool in the fuel handling building or in containers located in the SPS ISFSI. Since 1986, spent fuel has been stored in the SPS ISFSI under a site-specific or general license, as necessary. (NRC. 2002a, Section 2.1.4)

Currently, the SPS ISFSI includes three separate spent fuel storage pads, and Dominion is in the process of adding a fourth pad to the site to accommodate additional storage. Installation of the fourth pad within the current ISFSI area is scheduled to be completed by the end of 2020. The addition of a fifth spent fuel storage pad to the current SPS ISFSI area to further increase storage capacity is under consideration, but plans are in the conceptual stage and no installation schedule has been established.

The waste disposal system used for processing liquid, gaseous, and solid wastes is common to Units 1 and 2, with the exception of the primary drain transfer tanks and the gaseous drain system in each reactor containment (NRC. 2002a, Section 2.1.4).

E2.2.6.1 Liquid Waste Disposal Systems

The liquid waste disposal system for Units 1 and 2 is shared, except for the primary drain transfer tanks and the gaseous drain system in each containment. Two systems currently exist for treating liquid waste. These are the boron recovery system and the liquid waste disposal system. The boron recovery system treats effluents collected in the primary drain tank from the vents and drains system, as well as letdown from the primary coolant that is diverted from the chemical and volume control system. The liquid waste disposal system treats the liquid waste originating from containment, auxiliary building, fuel building, safeguards, radwaste facility and decontamination building sumps, and from laboratory drains. (SPS. 2016a, Section 11.2.3) Dominion does not anticipate any increase in liquid waste releases during the proposed SLR operating term. As

explained below, systems and processes are designed and are in place to control and monitor pathways and releases.

E2.2.6.1.1 Boron Recovery System

The boron recovery system is a common system serving both units. The system degasifies and stores borated radioactive water let down by the chemical and volume control system to be processed as liquid waste for disposal. The boron recovery system is designed for liquid samples to be taken as appropriate for processing. A review of the effects of the power uprate to a core power of 2,546 MWt was conducted and the boron recovery system was found to be adequate. (SPS. 2016a, Section 9.2)

The system is capable of removing gases from both units simultaneously at the maximum letdown flow rate (SPS. 2016a, Section 9.2.1).

The primary drain tank, gas stripper, gas stripper overhead condenser, primary drain tank vent chiller condenser, overhead gas compressors, and gas stripper surge tank in the boron recovery system are designed as Class I components. All liquid lines, equipment, and accessories containing concentrated boric acid (6% by weight or greater boric acid) are electrically heat-traced with dual circuits to prevent crystallization of boric acid. (SPS. 2016a, Section 9.2.1)

Reactor coolant letdown, with entrained hydrogen and fission gases, enters the boron recovery system via the vent and drain system. This liquid is pumped under automatic level control from the primary drain tank to the gas stripper, stripped of dissolved gases, and, if necessary, passed through ion exchangers for the removal of soluble fission and corrosion products. After subsequent filtration to remove additional particulate materials, the liquid is held up in the three boron recovery tanks for processing by the liquid waste system. Non-condensable gases removed in the gas stripper are taken off the gas stripper overhead condenser and discharged into the gas stripper surge tank by the overhead gas compressors. The surge tank discharges to the gaseous waste disposal system. The capability exists to discharge to the volume control tank to return the hydrogen and radioactive gases to the reactor coolant system. The surge tank contains sufficient gas to provide a cover gas for the gas stripper to prevent drawing in air, which could form a combustible mixture when the stripper is shut down. (SPS. 2016a, Section 9.2.2)

E2.2.6.1.2 Liquid Waste Disposal System

Liquid waste originating from the containment, auxiliary building, fuel building, safeguards, component cooling water heat exchanger and decontamination sumps, and from the laboratory drains at both SPS units are collected in either the low-level waste drain tank or the high-level waste drain tank depending on the valve lineup in the primary vent and drain system. Liquid waste is then processed through the radwaste facility's evaporator system or in the radwaste facility's liquid waste reverse osmosis and demineralizer system. (SPS. 2016a, Section 11.2.3)

The radwaste facility's liquid waste reverse osmosis and demineralizer system is designed to remove radioactivity and dissolved solids from the liquid waste process prior to collection in the liquid waste monitor tanks where liquids are sampled and discharged or reused (SPS. 2016a, Section 11.2.3.1.8). Liquid waste originating in the radwaste facility itself is collected in sumps and pumped directly to the radwaste facility's liquid waste collection tanks or through filters to the laundry drain monitor tanks (SPS. 2016a, Section 11.2.3).

Potentially radioactive liquid waste originating from the laundry and personnel decontamination showers and sinks are collected in the contaminated waste drain tanks located in auxiliary building. From the contaminated drain tanks, liquid waste flows through the laundry drain filter in the radwaste facility. Filtered waste is collected in one of two laundry waste monitor tanks where liquids are sampled and released to the discharge canal via the radwaste facility liquid effluent release line or mixed with other station liquid waste. (SPS. 2016a, Section 2.1.4.1)

E2.2.6.1.3 Processing Steam Generator Blowdown System

During start-up and power operations, blowdown is either released to the discharge canal or returned to the condenser hotwell. During outages, the steam generators may be gravity drained through the blowdown lines to a waste neutralization sump located in the condensate polishing building. Water in the waste neutralization sump can be treated, recirculated, sampled, and discharged to a settling pond or the circulating water discharge. During discharge, the water may be directed through a filter or the filter can be bypassed. (SPS. 2016a, Section 11.2.3.2.1)

E2.2.6.2 Gaseous Waste Disposal System

All normally radioactive waste gases from the gaseous waste disposal system, the gas stripper in the boron recovery system, the vent and drain system, various pressure relief valves, and the containment vacuum system are regulated before discharge by the process vent subsystem (SPS. 2016a, Section 11.2.2). Waste gases, primarily hydrogen, nitrogen, and minor amounts of fission product gases, such as xenon and krypton, are removed from reactor coolant letdown by the stripper in the boron recovery system. The stripped gases are processed in the gaseous waste disposal system. (SPS. 2016a, Section 11.2.5)

These gases are allowed to decay in one of two double-walled waste gas decay tanks (NRC. 2002a, Section 2.1.4.2). When released, effluent from these tanks is mixed with a combination of dilution air, effluent from the containment vacuum system, and the aerated vents from the vent and drain system. The combined gaseous waste is filtered through charcoal and high-efficiency particulate air (HEPA) filters before being released to the atmosphere. The process vent blowers maintain a small vacuum in the charcoal filters to prevent out-leakage from the filter assembly. The decay tank contents are sampled before any release to the process vent. (SPS. 2016a, Section 11.2.5)

Dominion does not anticipate any increase in gaseous waste releases beyond normal operations during the proposed SLR operating term. Systems and processes are designed and are in place to control and monitor pathways and releases.

E2.2.6.2.1 Process Vent Subsystem

Gaseous waste enters the process vent subsystem from the gaseous waste disposal system, the stripper in the boron recovery system, the vent and drain system, various pressure relief valves, and the containment vacuum system (SPS. 2016a, Section 11.2.5.1).

Overpressure relief protection is provided at the waste gas decay tanks. The protective devices consist of bellows-sealed pressure relief valves followed by rupture disk assemblies. The use of bellow seals and rupture disks precludes the leakage of the waste gas to the environment during normal operation of the gaseous waste disposal system. The piping downstream of the protective devices relieves to the process vent through the radiation monitor station. (SPS. 2016a, Section 11.2.5.1)

Potentially high-activity waste gases are regulated by the process vent subsystem of the gaseous waste disposal system and released to the environment through the process vent located on top of the Unit 1 containment structure (NRC. 2002a, Section 2.1.4.2). Radioactive waste discharges from these subsystems are monitored by particulate and gas monitors that are part of the process radiation monitoring system (SPS. 2016a, Section 11.2.5).

Effluent from the waste gas decay tanks is mixed with dilution air, effluent from the containment vacuum system, and the aerated vents from the vent and drain system. The combined gaseous waste is filtered through charcoal before being released to the atmosphere. The process vent blowers maintain a small vacuum in the charcoal filters to prevent out-leakage from the filter assembly. The decay tank contents are sampled before any release to the process vent. (SPS. 2016a, Section 11.2.5.1)

The entire discharge stream of radioactive letdown gas and dilution air is monitored for flow rate, pressure, temperature, and particulate and gaseous activity before release through the process vents. The total flow is regulated by a flow control valve on the process vent blower. The ratio of dilution air to waste gas letdown flow is such that the mixed streams never enter the flammability region of the air-steam-hydrogen phase diagram. (SPS. 2016a, Section 11.2.5.1)

The process vent monitors are set such that the effluent activity release rate results in concentrations less than those limits provided in the revision of 10 CFR 20 to which the plant was originally licensed. In the event that the activity of the effluent stream exceeds the setting of the monitors, the process vent control station automatically terminates the release of waste effluents from the waste gas decay tanks and isolates the containment vacuum system from the process vent subsystem. The monitor also activates an alarm in the control room before valve closure if the

activity approaches a preset value. Subsequent restart of the system is manual, in accordance with SPS procedures. The discharge of gases from the waste gas decay tanks is initiated and controlled separately. (SPS. 2016a, Section 11.2.5.1)

The gaseous waste disposal system is designed to provide adequate radioactive decay storage time for the waste gases and to provide long-term holdup of these gases when high-flow letdown is required (SPS. 2016a, Section 11.2.5.1).

E2.2.6.2.2 Ventilation Vent Subsystem

The ventilation vent subsystem is considered a portion of the gaseous waste disposal system only for purposes of radiological surveillance, and it is designed on this basis. Because it handles air streams of very low activity levels and the gases to be handled are predominantly of nonradioactive origin, this subsystem has been considered an auxiliary system. (SPS. 2016a, Section 11.2.5.2)

Potentially low-activity waste gases are regulated by either the ventilation vent or the radwaste facility vent subsystem of the gaseous waste disposal system (NRC. 2002a, Section 2.1.4.2).

Gaseous waste from the ventilation vent subsystem is released to the environment through either the ventilation vent on the top of the service building or the ventilation vent on the roof of the auxiliary building. Gases from laboratories, a counting room, and the decontamination area located in the service building are exhausted through the ventilation vent on the top of the service building. Air from common areas of the auxiliary building, fuel building, decontamination building, and safeguards area are exhausted through the ventilation vent on the roof of the auxiliary building. Individual exhaust paths feeding into these vents are filtered or have the capability to be filtered (e.g., the fuel building exhaust will be diverted through a charcoal filter during refueling). Both ventilation vents are continuously monitored for radioactivity. (NRC. 2002a, Section 2.1.4.2)

Gaseous waste from the radwaste facility vent subsystem is released to the environment through the radwaste facility stack. Waste gases from the radwaste facility's tank, vent system, process equipment vents, and general area are exhausted through the radwaste facility stack. Gaseous waste streams are filtered through either HEPA filters or a combination of HEPA filters and charcoal filters. The radwaste facility stack is continuously monitored for radioactivity. (NRC. 2002a, Section 2.1.4.2)

The major components of the gaseous waste disposal system are listed below:

- Catalytic Recombiner (installed but not usable) (SPS. 2016a, Section 11.2.5.3.1)
- Waste Gas Surge Tank (SPS. 2016a, Section 11.2.5.3.2)
- Waste Gas Compressor (SPS. 2016a, Section 11.2.5.3.3)
- Waste Gas Decay Tank (SPS. 2016a, Section 11.2.5.3.4)
- Process Vent Blowers (SPS. 2016a, Section 11.2.5.3.5)
- Charcoal Filters (SPS. 2016a, Section 11.2.5.3.6)
- Post-Accident Radiation Waste Connection (SPS. 2016a, Section 11.2.5.3.7)

E2.2.6.3 Solid Waste Disposal System

Solid waste from SPS consists of concentrated liquid sludge, spent resin, spent filter cartridges, solid non-compactible and compactible trash, and miscellaneous materials from station and radwaste facility operation and maintenance. Concentrated liquid sludge is segregated by type, flushed to storage tanks, slurried into an appropriate container, and stored onsite prior to shipment offsite for disposal. Spent resin from the plant's ion exchangers located in the auxiliary building is collected in tanks and then transferred to a high integrity container (HIC) for shipment to a burial site. Spent filter cartridges are placed in prefabricated metal containers and placed in an appropriately shielded location prior to shipment. Solid non-compactible and compactible trash is placed in appropriate containers and shipped to an offsite facility for compacting. A storage area in the radwaste facility serves as a staging area for waste ready for shipment to offsite processing and disposal facilities. (NRC. 2002a, Section 2.1.4.3)

The solid waste disposal system provides logging, packaging, and storage facilities for scheduled shipment offsite and ultimate disposal of radioactive waste material. Materials handled as solid waste include concentrated liquid sludge, water, spent resin, spent filter cartridges, solid non-compactible and compactible trash, and other miscellaneous materials resulting from station and radwaste facility operation and maintenance. (SPS. 2016a, Section 11.2.4)

Dominion does not anticipate any increase in solid waste releases beyond normal operations during the proposed SLR operating term. Systems and processes are designed and are in place to control and monitor pathways and releases.

E2.2.6.3.1 Expended Filter Cartridge Handling Operations

Radioactive liquid service filters are removed from the system when the pressure drop across the filters becomes excessive or when the radiation level exceeds a predetermined maximum. The filter housing is surveyed prior to any opening or removal. In accordance with as low as reasonably achievable (ALARA) principles, the filter cover is remotely opened and removed by personnel using

appropriate tools and protected by a filter removal shield, when required. A lead cask is placed over the filter housing and the filter is moved upward into the lead cask. A drip pan is then secured to the bottom of the cask and the entire assembly is transported to the SPS onsite radwaste facility. The filter is placed in an approved container. The filter and container remain in the radwaste facility until shipment to the burial site. (SPS. 2016a, Section 11.2.4.1.1)

E2.2.6.3.2 Spent Resin Handling Operations

A spent resin catch tank and spent resin blend tank are provided to receive spent resin from the station's ion exchangers located in the auxiliary building. A transfer pump is associated with each tank. Spent resin is transferred from the blend tank to a HIC for shipment to a burial facility. A shipping container may be sent to the radwaste facility for staging prior to shipment off site. (SPS. 2016a, Section 11.2.4.1.2)

Primary plant resins are directed to the spent resin catch tank. Resins from the catch tank are slurried to the blend tank to produce a mixture of resin which may be shipped in an HIC. As an option, resin from the spent resin catch tank can be sluiced to a mobile resin transfer vessel for shielded transport to the radwaste facility. Subsequent to the processing operations, the lines are flushed with primary grade water. (SPS. 2016a, Section 11.2.4.1.2)

Spent low-activity resins from the condensate polishing system are typically dewatered to acceptable strong, tight containers and sent offsite for disposal. If the activity in these resins becomes high enough that the disposal site would not accept them in drums, the resins would be slurried to HICs and then dewatered prior to shipment to an offsite radwaste burial site. (SPS. 2016a, Section 11.2.4.1.2)

E2.2.6.3.3 Evaporator Concentrate Operations

Solids concentrated in the evaporator are discharged to the evaporator bottoms tank. The concentrates and sludges in the bottoms tank may be pumped to the waste batch tanks through heat traced lines where the concentrate waste is pretreated for processing by the solidification system. To preclude plugging of the concentrates transfer piping, redundant heat tracing circuits are installed. Clean, hot water flushing connections are included to clean each line following concentrates transfer. (SPS. 2016a, Section 11.2.4.1.3)

E2.2.6.3.4 Solidification Operations

Solidification operations are installed, but no longer used at SPS (SPS. 2016a, Section 11.2.4.1.4).

E2.2.6.3.5 Ultimate Disposal Operations

All packages containing radioactive non-fissionable material and the procedures used to prepare these for offsite shipment are in accordance with U.S. Department of Transportation (DOT) regulations. The radwaste facility, LLRW building, and sea van storage pad are facilities used for the storage of radioactive material. All waste material is transferred to a licensed disposal or processing contractor, or to a common carrier for delivery to a licensed disposal or processing contractor. Radwaste shipments fall under the purview of Dominion's procedures and quality assurance program. (SPS. 2016a, Section 11.2.4.1.5)

E2.2.6.3.6 Low-Level Radioactive Waste

LLRW is classified as Class A, Class B, or Class C (minor volumes are classified as greater than Class C). Class A includes both dry active waste and processed waste (e.g., dewatered resins). Classes B and C normally include processed waste and irradiated hardware. SPS has a contract with Energy Solutions for processing and disposal of its low-level waste. Energy Solutions operates processing facilities in Erwin, Tennessee, Oak Ridge, Tennessee, and Barnwell, South Carolina, and a disposal facility for Class A waste in Clive, Utah (Energy Solutions. 2017). In 2016, low-level waste was shipped to the facilities in Erwin and Oak Ridge (SPS. 2017a). Dominion also has a contract with Waste Control Specialists in Andrews, Texas, for Class B and C wastes, should there be a need. Classes B and C wastes constitute a low percentage by volume of the total LLRW generated and can be stored onsite in a low-level waste storage facility. Currently, SPS has no greater-than-Class C waste stored onsite. Disposal of greater-than-Class C waste is the responsibility of the federal government.

E2.2.6.3.7 Low-Level Mixed Waste

If generated, low-level mixed waste would be managed and transported to an offsite facility licensed to accept and manage the waste in accordance with appropriate site and company procedures. There has been no mixed waste generated at SPS for more than six years, and therefore no exemption under 40 CFR 266, Subpart N would have been executed.

E2.2.7 NONRADIOACTIVE WASTE MANAGEMENT SYSTEM

The Resource Conservation and Recovery Act (RCRA) governs the disposal of solid waste. Solid and hazardous wastes in Virginia are regulated and administered by the Virginia Department of Environmental Quality (VDEQ), the Virginia Waste Management Board, and the U.S. Environmental Protection Agency (EPA). (VDEQ. 2016a)

SPS generates nonradioactive waste as a result of plant maintenance, cleaning, and operational processes that occur at the site. Table E2.2-2 provides the amount of nonradioactive hazardous and nonhazardous wastes generated at SPS from 2012-2016.

E2.2.7.1 Hazardous Waste

As hazardous wastes routinely make up only a small percentage of the total wastes generated, SPS is classified as a small quantity generator of hazardous waste. Hazardous waste at SPS consists of paint wastes, spent and off-specification (e.g., shelf-life expired) chemicals, gun cleaning rags with lead residue, and occasional project-specific wastes. Universal wastes generated typically consist of used oil, fluorescent lamps, batteries, mercury devices, and electronics (state-specific) (ENERCON. 2016).

Dominion's hazardous waste guidance provides stepwise guidance for handling, transportation, recordkeeping, management, and reporting of hazardous waste. SPS is not required to have a hazardous waste permit. The Virginia Waste Management Board promulgates waste management regulations, while the VDEQ's Waste Management Program regulates management of hazardous waste within the state. Virginia's hazardous waste regulations are codified at Title 9 of the Virginia Administrative Code (VAC), Chapters 20-60. Virginia has been authorized by EPA to implement its own state hazardous waste program in lieu of the federal program. (Dominion. 2015a)

Dominion voluntarily participates in EPA's WasteWise program as a partner. WasteWise is a voluntary program that encourages organizations to reduce waste and save environmental resources while reducing greenhouse gas emissions. By participating in this program, partners eliminate costly municipal solid waste and select industrial wastes (including hazardous waste), benefiting their bottom line and the environment. As a WasteWise partner, Dominion is committed to reducing the amount of waste generated, recycling its waste, and purchasing recycled products. (Dominion. 2015a)

Dominion maintains an electronic waste management database known as the Waste Disposal Management System. Within that database, Dominion tracks all waste disposal, including hazardous waste, and can check trends in disposal and recycling efforts. This enables Dominion to make informed decisions about more appropriate future disposal and recycling opportunities. (Dominion. 2015a)

For most hazardous waste records, the regulations require that records be retained for at least three years from the date the hazardous waste, for which the record pertains, is last shipped offsite. It is a Dominion best management practice (BMP) to maintain most records for a minimum of five years in accordance with the Dominion record retention schedule. (Dominion. 2015a)

E2.2.7.2 Nonhazardous Waste

Nonhazardous waste generally includes glycol and antifreeze (state-specific), used polishing resin, nonhazardous paint, coatings, sealants, lubricants, grease, two-part epoxies, and fire barrier foam. Recycled waste typically consists of scrap metal, batteries, and used oil. Municipal waste is disposed of at the local permitted solid waste management facility. (ENERCON. 2016)

Dominion's nonhazardous waste management guidance provides Dominion's operations with information on how to comply with solid waste management regulations and Dominion BMPs for nonhazardous waste and summarizes the regulatory provisions and BMPs applicable to Dominion facilities based on current understanding of applicable law, regulations, and Dominion's current business practices. (Dominion. 2013a)

Dredge material from the intake channel is stored in the onsite dredge material management pond (Figure E3.1-1). Dominion has dredged approximately 150,000 cubic yards from this channel every 3-4 years. During maintenance dredging within the existing intake channel on the James River (October 2016-January 2017), approximately 41,544 cubic yards were hydraulically dredged to a depth of 12 feet mean lower low water within a 2,000-foot long by 150-foot wide channel. The dredged material was placed at the existing onsite dredge material management pond at SPS.

As addressed in Dominion's nonhazardous waste management guidance, dredged material is considered nonhazardous waste (Dominion. 2013a). Dominion is developing an offsite dredge material management area (DMMA), to be located on Hog Island Road, approximately four miles south of SPS (Figure E2.2-6), and is planned to be utilized once the onsite dredge material management pond reaches capacity. The offsite DMMA is currently undergoing permitting and evaluation processes, and construction has not yet been completed. (Dominion. 2016c) The offsite DMMA is being developed to support current station operations and is not in scope for SLR.

E2.2.7.3 Waste Vendor Selection

Dominion maintains a list of waste vendors that are approved for use across the entire company. Dominion facilities should only use the hazardous and nonhazardous waste treatment, storage, and disposal facilities contained on the current approved waste disposal list managed by Dominion Energy Environment and Sustainability. (Dominion. 2017a)

Table E2.2-1 Meteorological Parameters Monitored at SPS

Level	Parameter	Pre-Survey Height (feet above ground level)	Survey Height (feet above ground level)
Upper	Wind	150.0	151.2
	Temperature	147.4	149.4
Lower	Temperature	31.5	35.4
	Wind	34.0	34.7
	Dew Point	31.5	N/S

(SPS. 2016a, Table 2.2-8)

N/S: Not surveyed.

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
2016		
Batteries, dry, sealed, universal waste batteries	5	pounds
Batteries, spent, for recycling	5,297	pounds
Misc. nickel-cadmium batteries (NiCADs)	27	pounds
NA 3077, hazardous waste solid (lead)	100	pounds
NA 3077, hazardous waste solid (mercury)	69	pounds
NA 3082, hazardous waste liquid (chromium)	25	pounds
NA 3082, hazardous waste liquid (dioxane methyl chloroform)	440	pounds
NA 3082, hazardous waste liquid (lead)	25	pounds
NA 3082, hazardous waste liquid (phenylmercuric neodecanoate mixture)	8	pounds
NA 3082, hazardous waste liquid (potassium chromate)	55	pounds
Non-hazardous material	3,080	pounds
Non-regulated material (non-RCRA, non-DOT regulated)	3,841	gallons
UN1008, waste boron trifluoride, poison inhalation hazard	45	pounds
UN1263, waste paint related material including paint thinning, drying, removing, or reducing compound	2,395	pounds
UN1479, waste oxidizing solid	57	pounds
UN1805, waste phosphoric acid solution	22	pounds
UN1824, waste sodium hydroxide solution	8	pounds
UN1950, aerosols, flammable (each not exceeding one liter)	463	pounds
UN1956, compressed gases (carbon monoxide, nitrogen)	34	pounds
UN1992, waste flammable liquids, toxic	25	pounds

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
UN1993, waste flammable liquids, (acetone, toluene)	68	pounds
UN 1993, waste flammable liquids, (methyl ethyl ketone, toluene)	189	pounds
UN2672, waste ammonia solution	5	pounds
UN2735, amines, liquid, corrosive	32	pounds
UN2790, waste acetic acid solution with more than 10% and less than 50% acid, by mass	5	pounds
UN2922, waste flammable liquids, toxic (mercuric potassium iodide, sodium hydroxide)	5	pounds
UN2924, waste flammable liquids, corrosive	14	pounds
UN3087, waste oxidizing solid, toxic	22	pounds
UN3175, waste solids containing flammable liquid (mineral spirits, turpentine)	414	pounds
UN3260, corrosive solid, acidic, inorganic (sulfuric acid)	441	pounds
UN3264, waste corrosive liquid, acidic, inorganic	5	pounds
UN3266, waste corrosive liquid, basic, inorganic	41	pounds
UN3267, waste corrosive liquid, basic, organic	236	pounds
UN3287, waste toxic liquid, inorganic	50	pounds
UN3480, lithium batteries including lithium ion polymer batteries and nine universal waste batteries	40	pounds
UN3506, mercury contained in manufactured articles, universal waste mercury thermostat	52	pounds
Universal waste, mercury-containing lamps	2,287	pounds
Used consumer electronics for recycle	73	pounds

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
2015		
Batteries, dry, sealed, universal waste batteries	8	pounds
Batteries, spent, for recycling	6,000	pounds
Misc. NiCADs	35	pounds
NA 3077, hazardous waste solid (lead)	90	pounds
NA 3077, hazardous waste solid (mercury)	46	pounds
NA 3082, hazardous waste liquid (lead, cadmium)	225	pounds
NA 3082, hazardous waste liquid (potassium chromate)	45	yards
NA 3082, hazardous waste liquid (1,2,2-trichlorotrifluoroethane)	14	gallons
Non-hazardous material	4,870	gallons
Non-regulated electrical equipment	55	gallons
Non-regulated liquid	400	pounds
Non-regulated material (non-RCRA, non-DOT regulated)	5,118	pounds
UN1066, nitrogen, compressed	10	gallons
UN1263, waste paint related material including paint thinning, drying, removing, or reducing compound	1,131	pounds
UN1325, waste flammable solids, organic	5	pounds
UN1748, waste calcium hypochlorite mixtures, dry with more than 39% available chlorine	100	pounds
UN1805, waste phosphoric acid solution	15	pounds
UN1824, waste sodium hydroxide solution	1,360	pounds
UN1950, aerosols, flammable (each not exceeding one liter)	218	gallons
UN1956, compressed gases (nitrogen, ethanol)	11	pounds

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
UN1993, waste flammable liquids, (methyl ethyl ketone, toluene)	200	pounds
UN1993, waste flammable liquids, (xylene, methyl ethyl ketone)	135	pounds
UN2079, waste diethylenetriamine	83	gallons
UN2672, waste ammonia solution	15	pounds
UN2790, waste acetic acid solution with more than 10% and less than 50% acid, by mass	5	yards
UN2810, waste toxic liquids, organic	55	pounds
UN2922, waste corrosive liquids, toxic (mercuric potassium iodide, sodium hydroxide)	27	gallons
UN3086, waste toxic solid, oxidizing (potassium dichromate)	5	pounds
UN3098, waste oxidizing liquid, corrosive	5	pounds
UN3108, waste organic peroxide Type E, solid dibenzoyl peroxide-52% as paste)	154	pounds
UN3175, waste solids containing flammable liquid (mineral spirits, turpentine)	891	pounds
UN3264, waste corrosive liquid, acidic, inorganic	22	pounds
UN3266, waste corrosive liquid, basic, inorganic	25	pounds
UN3287, waste toxic liquid, inorganic	165	pounds
UN3480, lithium batteries including lithium ion polymer batteries and universal waste batteries	10	pounds
UN3506, mercury contained in manufactured articles	41	pounds
Universal waste, mercury-containing lamps	2,657	pounds
Used oil	12,470	pounds
2014		
Batteries, dry, sealed, universal waste batteries	77	pounds

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
Batteries, spent, for recycling	3,200	pounds
Misc. NiCADs	21	pounds
NA 3077, hazardous waste solid (lead)	90	pounds
NA 3077, hazardous waste solid (mercury)	36	pounds
NA 3082, hazardous waste liquid (ammonium thiocyanate)	5	pounds
NA 3082, hazardous waste liquid (chromium)	76	pounds
NA 3082, hazardous waste liquid (mercury)	5	pounds
Non-hazardous material	1,670	pounds
Non-regulated material (non-RCRA, non-DOT regulated)	4,524	pounds
UN1263, waste paint related material including paint thinning, drying, removing, or reducing compound	1,602	pounds
UN1805, waste phosphoric acid solution	11	pounds
UN1950, aerosols, flammable (each not exceeding one liter)	115	pounds
UN2735, waste amines, liquid, corrosive	165	gallons
UN2810, waste toxic liquids, organic	11	gallons
UN2817, waste ammonium hydrogendifluoride solution	55	gallons
UN2922, waste corrosive liquids, toxic	12	pounds
UN2924, waste flammable liquids, corrosive	115	gallons
UN3086, waste toxic solid, oxidizing (potassium dichromate)	5	pounds
UN3139, waste oxidizing liquid	5	gallons
UN3175, waste solids containing flammable liquid (mineral spirits, turpentine)	475	pounds
UN3262, corrosive solid, basic, inorganic (sodium hydroxide)	95	pounds

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
UN3266, waste corrosive liquid, basic, inorganic	65	pounds
UN3480, lithium batteries including lithium ion polymer batteries and universal waste batteries	14	pounds
UN3506, mercury contained in manufactured articles	90	gallons
Universal waste lamps	19	pounds
Universal waste, mercury containing lamps	1,370	pounds
Used oil	2,366	gallons
2013		
Batteries, dry, sealed, universal waste batteries	43	pounds
Batteries, spent, for recycling	15,000	pounds
Misc. NiCADs	67	pounds
NA 3077, hazardous waste solid (lead)	148	pounds
NA 3077, hazardous waste solid (mercury)	140	pounds
NA 3077, hazardous waste solid (silver chloride)	4	pounds
NA 3082, hazardous waste liquid (chromium)	354	pounds
Non-hazardous material	5,045	pounds
Non-regulated electrical equipment	8	pounds
Non-regulated material (non-RCRA, non-DOT regulated)	4,119	pounds
UN1263, waste paint related material including paint thinning, drying, removing, or reducing compound	2,320	pounds
UN1328, waste hexamethylenetetramine	4	pounds
UN1950, waste aerosols, flammable (each not exceeding one liter)	295	pounds
UN1993, waste flammable liquids, (ethanol, methyl ethyl ketone)	238	pounds

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
UN1993, waste flammable liquids (isopropyl alcohol, methyl ethyl ketone)	65	pounds
UN1993, waste flammable liquids, (methyl ethyl ketone, toluene)	259	pounds
UN1993, waste flammable liquids, (gasoline, diesel fuel)	224	pounds
UN1993, waste flammable liquids (mineral spirits, petroleum distillates)	133	pounds
UN2031, Waste nitric acid other than red fuming with at least 65%, but not more than 70%, nitric acid	5	pounds
UN2800, batteries, wet, non-spillable	11	pounds
UN2809, mercury contained in manufactured articles	92	pounds
UN2922, waste corrosive liquids, toxic	19	pounds
UN3082, environmentally hazardous substances, liquid (ethoxylated alcohol)	12	pounds
UN3082, environmentally hazardous substances, liquid (trizinc BIS [orthophosphate])	240	pounds
UN3082, hazardous waste, liquid (lead)	235	pounds
UN3098, waste oxidizing liquid, corrosive	19	pounds
UN3108, waste organic peroxide Type E, solid dibenzoyl peroxide-52% as paste)	5	pounds
UN3175, waste solids containing flammable liquid (mineral spirits, turpentine)	1,154	pounds
UN3264, waste corrosive liquid, acidic, inorganic	3	pounds
UN3286, waste flammable liquid, toxic, corrosive	28	pounds
UN3432, polychlorinated biphenyls, solid	10	kilogram
UN3480, lithium batteries including lithium ion polymer batteries and universal waste batteries	81	pounds
UN3506, mercury contained in manufactured articles	171	pounds

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
Universal waste, mercury containing lamps	3,008	pounds
Used oil	6,346	gallons
2012		
Batteries, dry, sealed, universal waste batteries	6	pounds
NA 3077, hazardous waste solid (lead	53	pounds
NA 3077, hazardous waste solid (mercury)	51	pounds
NA 3082, hazardous waste liquid (FOO2, DOO8)	15	pounds
NA 3082, hazardous waste liquid (chromium)	520	pounds
NA 3082, hazardous waste liquid (dioxane, methyl chloroform)	400	pounds
Non-hazardous material	580	pounds
Non-regulated liquid	920	pounds
Non-regulated material (non-RCRA, non-DOT regulated)	4,129	pounds
Non-regulated DOT, non-regulated	875	pounds
UN1133, waste adhesives, containing a flammable liquid	225	pounds
UN1160, waste dimethylamine solution	21	pounds
UN1263, waste paint related material including paint thinning, drying, removing, or reducing compound	850	pounds
UN1791, waste hypochlorite solutions	5	pounds
UN1950, waste aerosols, flammable (each not exceeding one liter)	93	pounds
UN1993, waste flammable liquids, (acetone, hexane)	579	pounds
UN2014, waste hydrogen peroxide, aqueous solutions	5	pounds
UN2790, waste acetic acid solution not less than 50%, but not more than 80% acid, by mass	110	pounds

Table E2.2-2 SPS Nonradioactive Waste Generation, 2012–2016

Waste	Weight or Volume	Units
UN2796, waste sulfuric acid	12	pounds
UN2809, mercury contained in manufactured articles	38	pounds
UN2810, waste toxic liquids, organic	160	pounds
UN2922, waste corrosive liquids, toxic (sodium hydroxide, mercuric iodide)	5	pounds
UN3108, waste organic peroxide Type E, solid dibenzoyl peroxide-52% (as paste)	26	pounds
UN3175, waste solids containing flammable liquid (mineral spirits, turpentine)	446	pounds
UN3265, waste corrosive liquid, acidic, organic	12	pounds
Universal waste, mercury-containing lamps	1,961	pounds
Used oil	1,017	gallons

Figure E2.2-1 SPS Service Water System

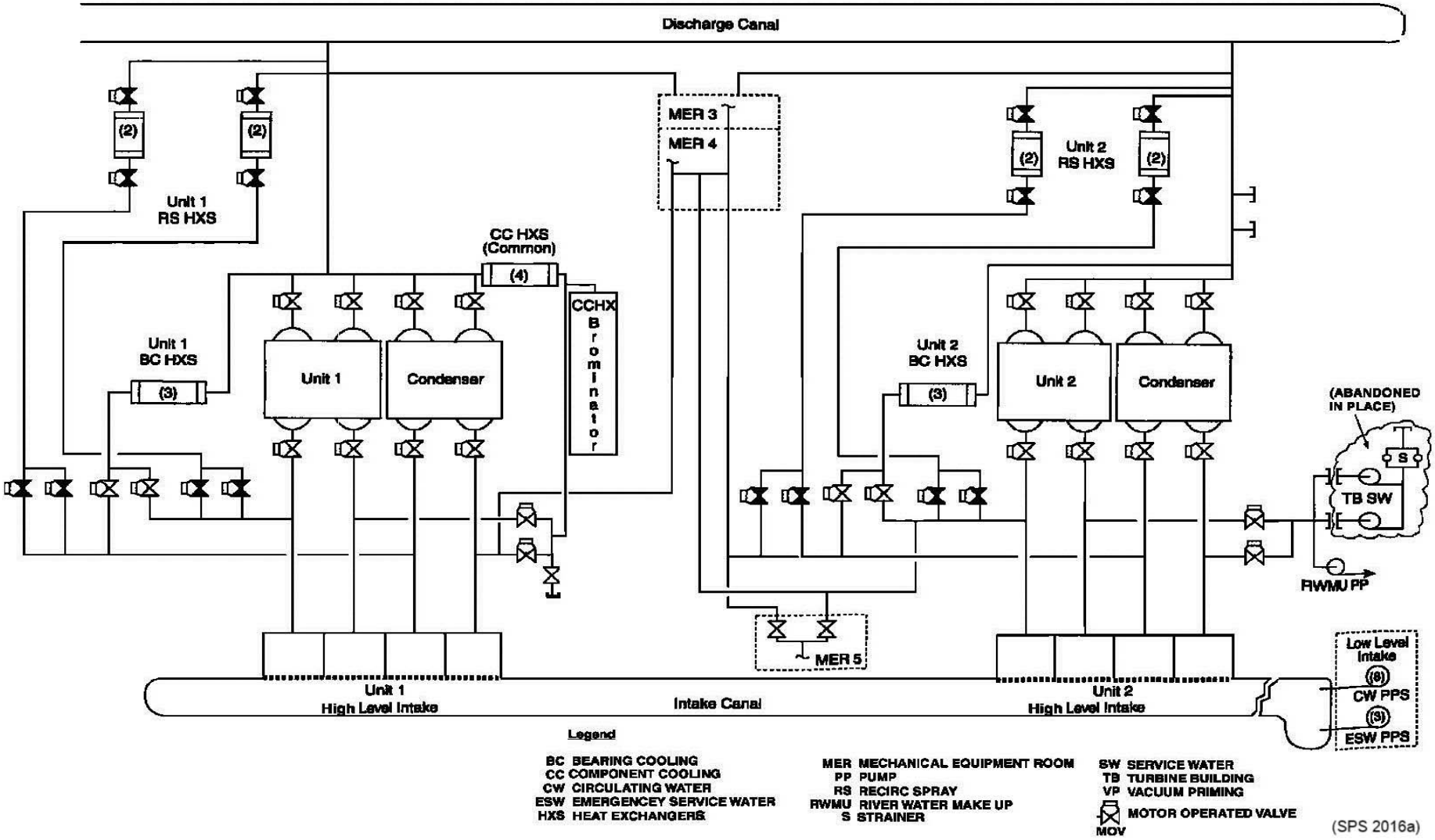


Figure E2.2-2 SPS Low-Level Cooling Water Intake Structure

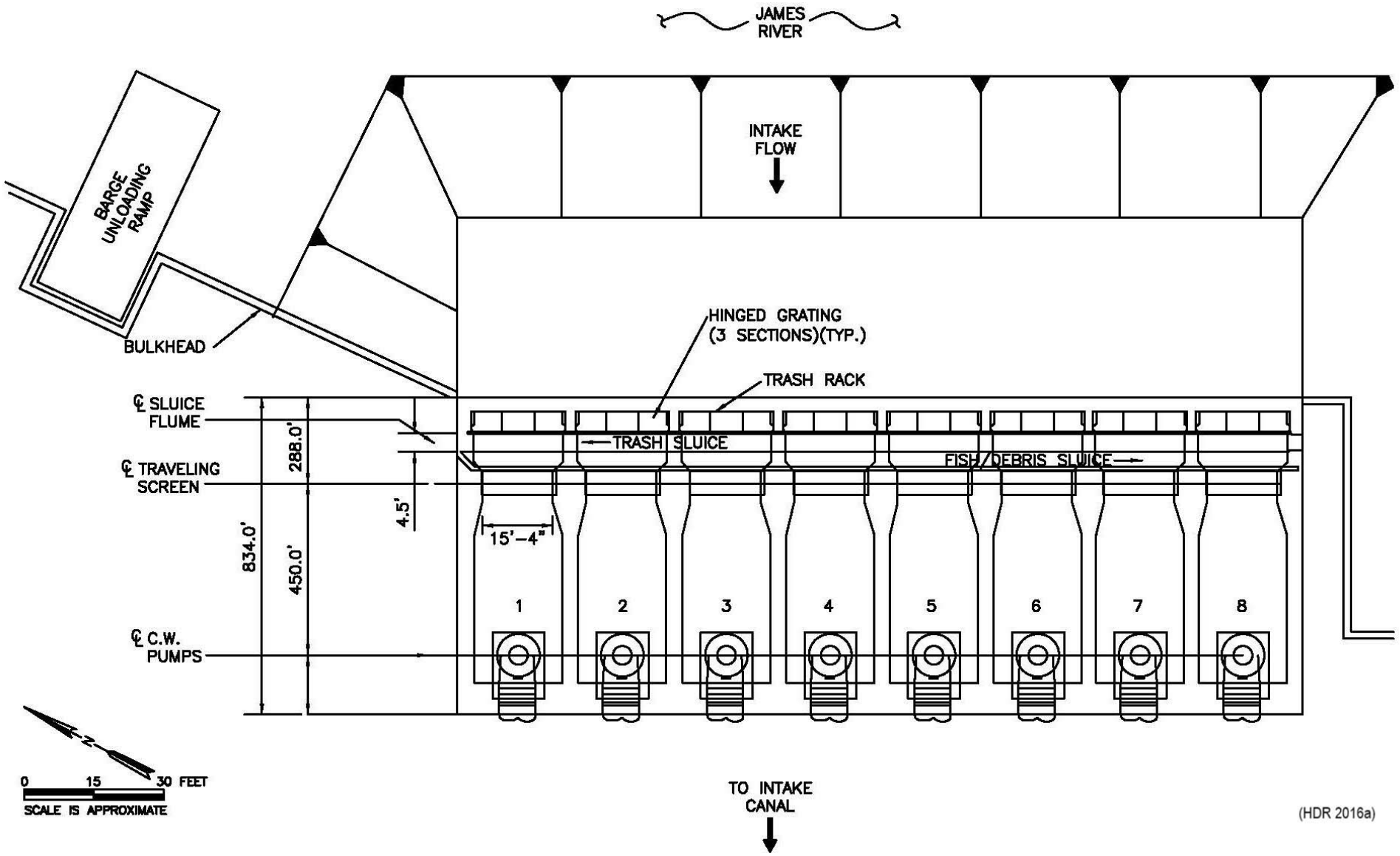


Figure E2.2-3 Section View, SPS Low-Level Cooling Water Intake Structure

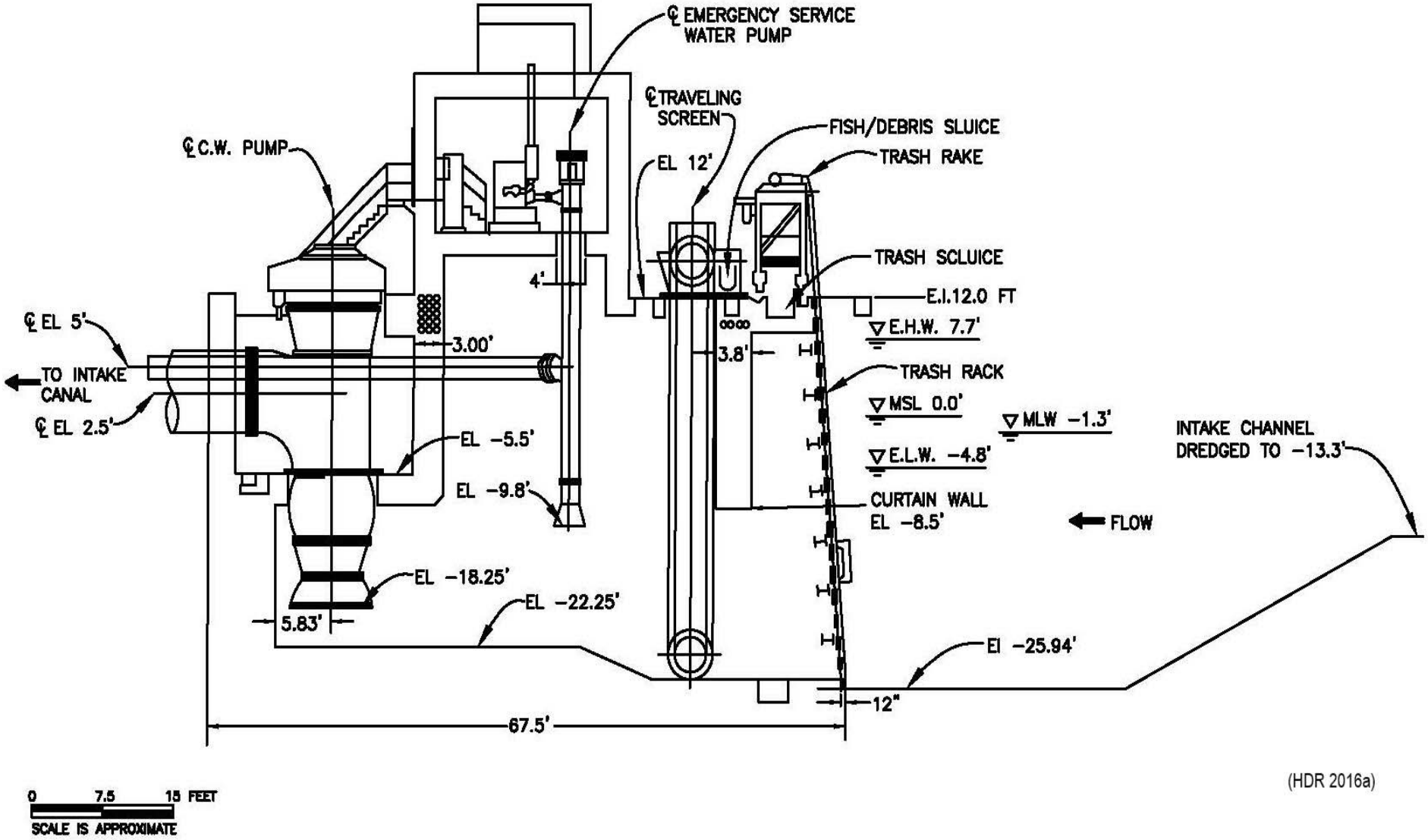


Figure E2.2-4 SPS Component Cooling Water System

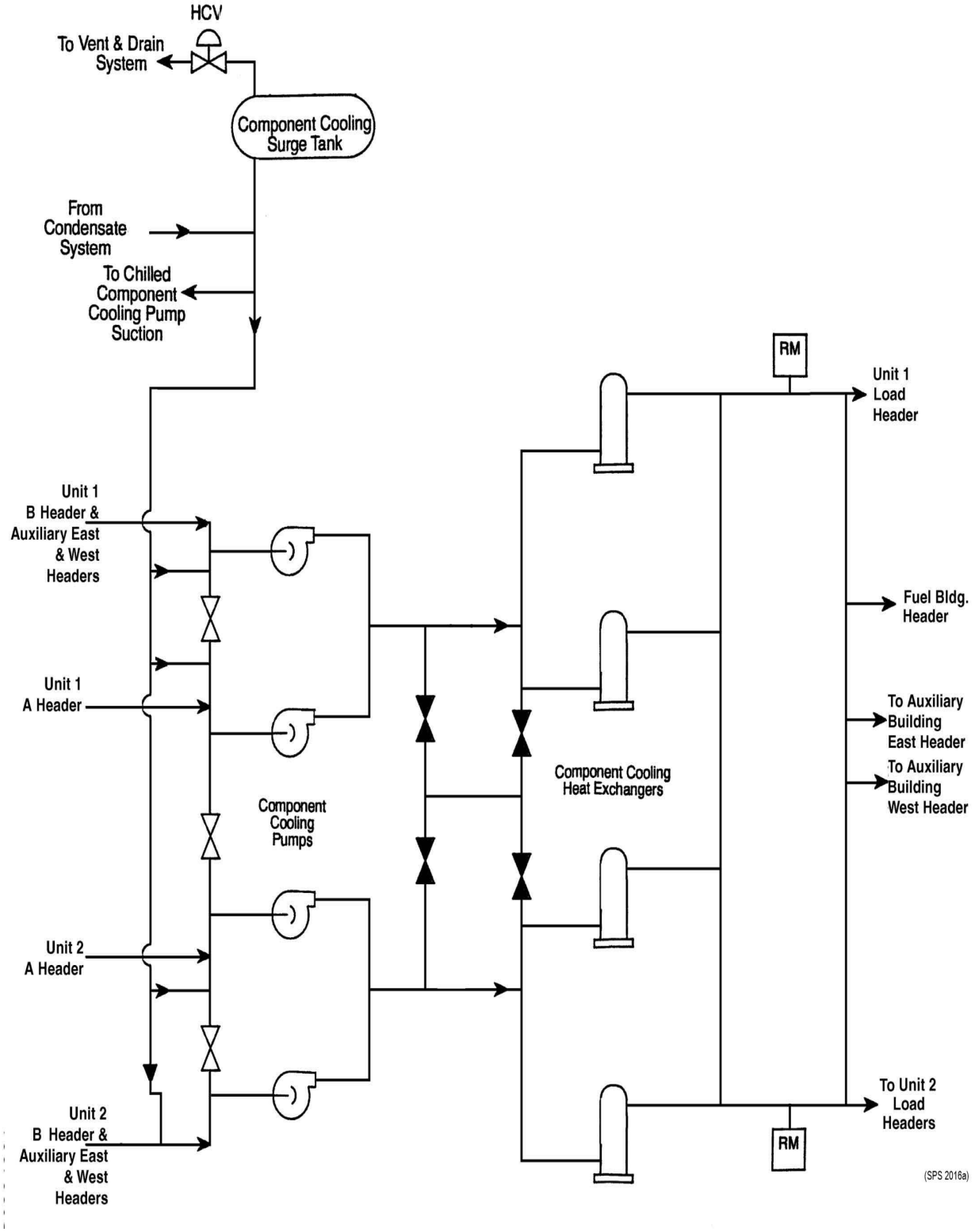


Figure E2.2-5 SPS In-Scope Transmission Lines

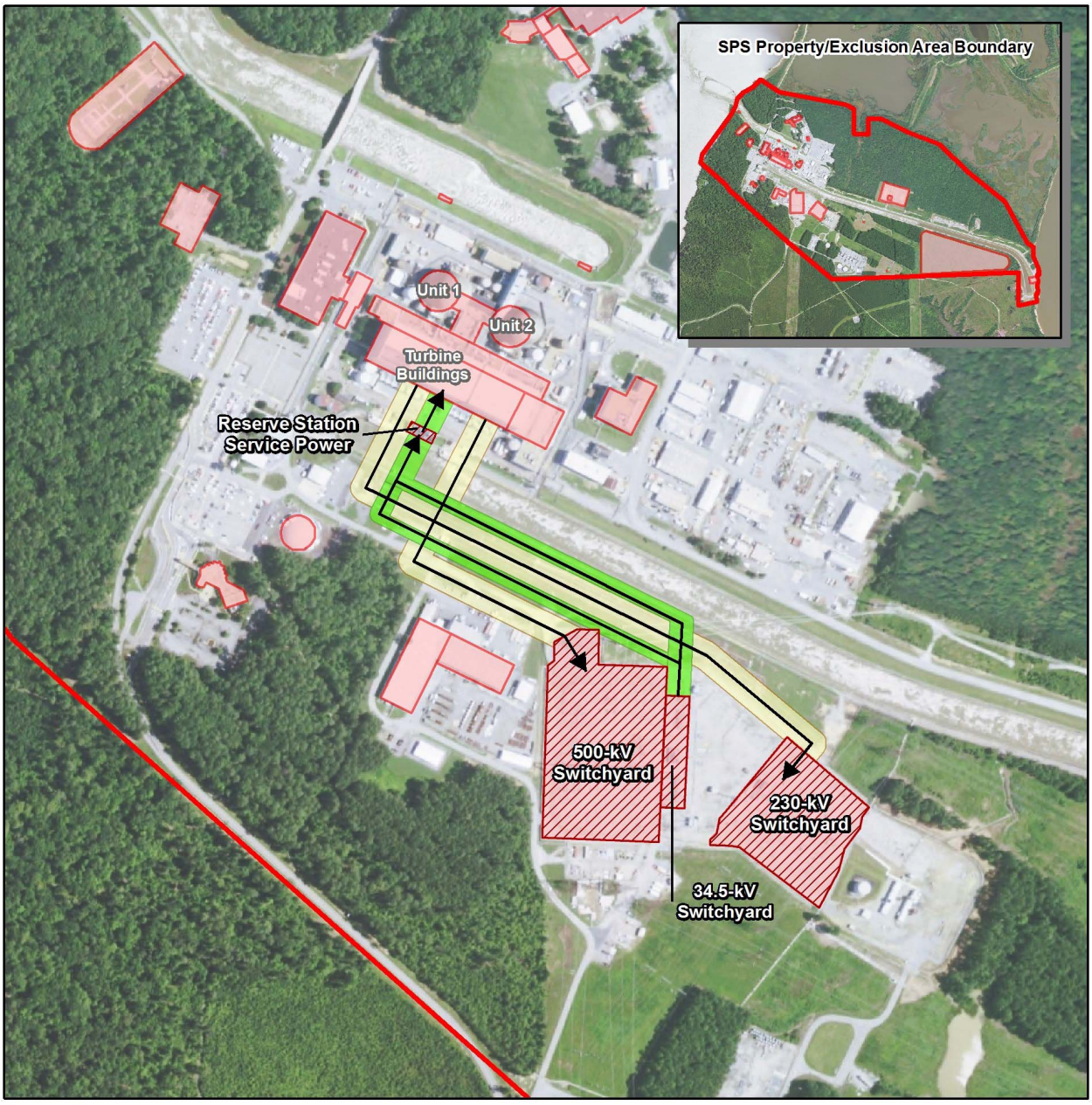
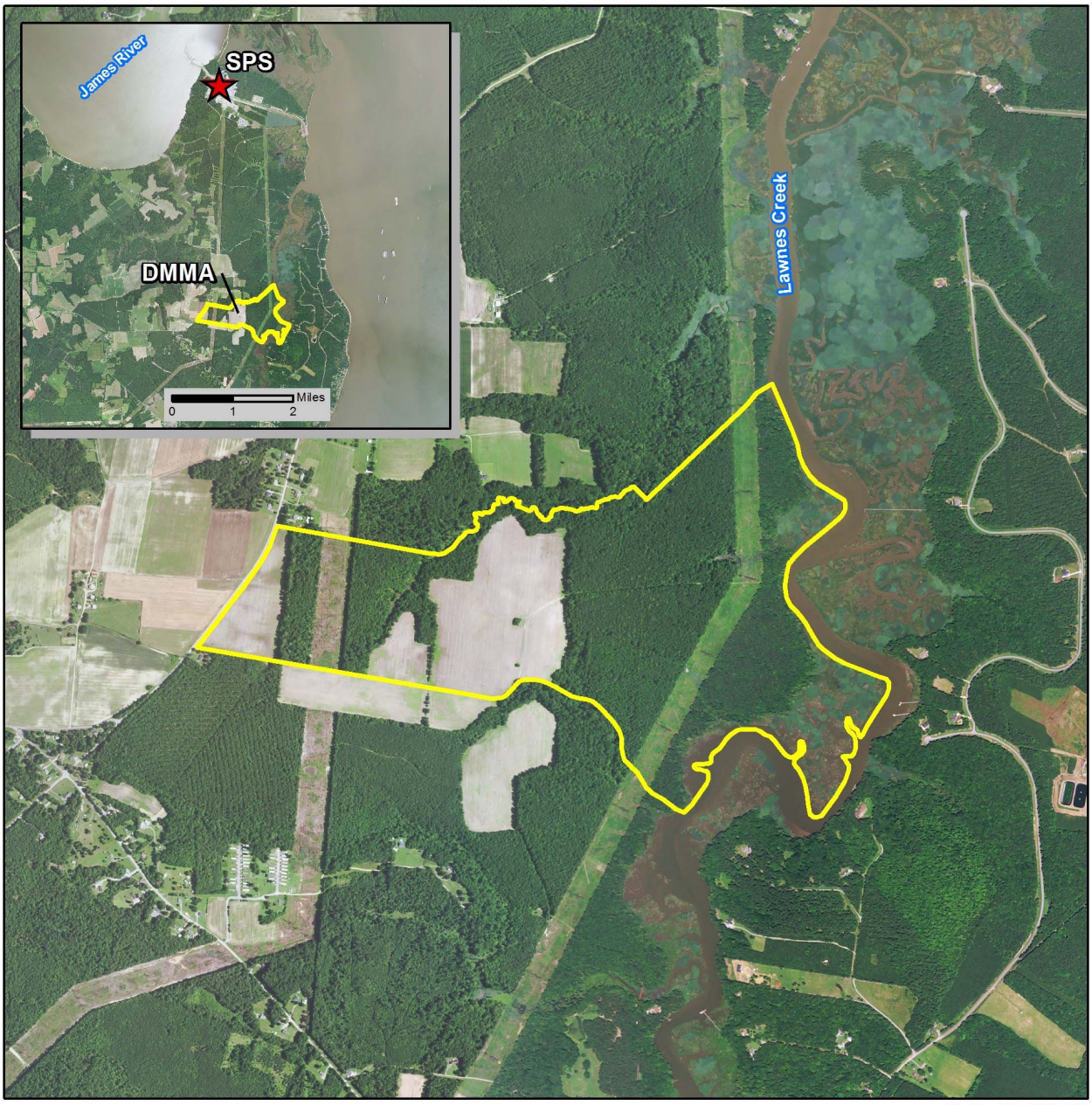


Figure E2.2-6 SPS Dredge Materials Management Area



E2.3 REFURBISHMENT ACTIVITIES

In accordance with 10 CFR 51.53(c)(2), a license renewal applicant's ER must contain a description of the applicant's plan to modify the facility or its administrative control procedures as described in accordance with § 54.21. If license renewal-related refurbishment is planned at a facility, the applicant's ER would include analysis for environmental impacts of the proposed refurbishment activity. [10 CFR 51.53(c)(3)(ii)].

The incremental aging management activities implemented to allow operation of a nuclear power plant beyond the original 40-year license term were assumed to fall under one of two broad categories. One of these categories involves refurbishment actions, which usually occur infrequently and possibly only once in the life of the plant for any given item. The other category is SMITTR actions, most of which are repeated at regular intervals and schedules. (NRC. 2013a, Section 2.1.1)

NRC requirements for the renewal of OLs for nuclear power plants include preparation of an integrated plant assessment (IPA) [10 CFR 54.21]. The IPA must identify systems, structures, and components (SSCs) subject to an aging management review. The objective of the IPA is to determine whether the detrimental effects of aging could preclude certain SSCs from performing in accordance with the current licensing basis during the additional 20 years of operation requested in the subsequent license renewal application (SLRA). An example of an SSC subject to aging is the reactor vessel.

The SPS IPA that Dominion conducted under 10 CFR 54, which is described in the body of the SLRA, has identified no license renewal-related refurbishment or replacement actions needed to maintain the functionality of SSCs, consistent with the current licensing basis, during the proposed subsequent period of extended operation. Dominion does not anticipate the continued operations of SPS to adversely affect the environment. Dominion also does not anticipate the need for any refurbishment for purposes of subsequent license renewal as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

E2.4 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

In accordance with 10 CFR 51.53(c)(2), a license renewal applicant's ER must contain a description of the applicant's plans to modify the facility or its administrative control procedures as described in accordance with § 54.21. This report must describe in detail the modifications directly affecting the environment or any plant effluents.

The programs for managing the effects of aging on certain structures and components within the scope of license renewal at the site are described in the body of the SLRA (see Appendix B of the SPS SLRA). The evaluation of structures and components required by 10 CFR 54.21 identified the activities necessary to manage the effects of aging on structures and components during the subsequent period of extended operation beyond the initial license renewal term.

E2.5 EMPLOYMENT

The non-outage workforce (SPS permanent full-time employees) at the SPS site consists of approximately 941 persons (Table E2.5-1) and an additional 140 temporary supplemental employees who support plant operations in rotating shifts. There are no plans to add additional permanent employees to support plant operations during the proposed SLR operating term, and as noted in Section E2.3, no license renewal-related refurbishment activities have been identified. Neither are there plans to add additional permanent operational staff to support any SMITTR activities at the plant during the proposed SLR operating term.

During refueling outages, which usually last approximately 30 days per unit, there are typically an additional 1,000-1,500 contractor employees onsite. Refueling and maintenance outages for SPS Units 1 and 2 are on a staggered 18-month schedule per unit.

Table E2.5-1 SPS Employee Residence Information, February 2017

State, County, and City/Town	Permanent Full-Time Employees
VIRGINIA	
Brunswick	1
Warfield	1
Charles City	1
Charles City	1
Chesapeake[(b)]	35
Chesapeake	35
Chesterfield	33
Chester	17
Chesterfield	10
Midlothian	41
Moseley	31
Richmond	31
Colonial Heights[(b)]	23
Colonial Heights	13
Dinwiddie	12
Dinwiddie	21
Sutherland	21
Franklin[(b)]	92
Franklin	2
Gloucester	9
Gloucester	3

Table E2.5-1 SPS Employee Residence Information, February 2017

State, County, and City/Town	Permanent Full-Time Employees
Hayes	5
White Marsh	1
Hampton[(b)]	37
Hampton	37
Hanover	2
Mechanicsville	2
Henrico	4
Henrico	2
Sandston	2
Hopewell[(b)]	4
Hopewell	4
Isle of Wight	276
Battery Park	2
Carrollton	42
Carrsville	2
Rescue	1
Smithfield	185
Windsor	34
Zuni	10
James City	8
Toano	8

Table E2.5-1 SPS Employee Residence Information, February 2017

State, County, and City/Town	Permanent Full-Time Employees
Louisa	3
Louisa	2
Mineral	1
New Kent	6
Lanexa	2
Providence Forge	2
Quinton	2
Newport News[(b)]	82
Newport News	82
Norfolk[(b)]	8
Norfolk	8
Nottoway	1
Blackstone	1
Petersburg[(b)]	3
Petersburg	3
Poquoson[(b)]	5
Poquoson	5
Portsmouth[(b)]	12
Portsmouth	12
Prince George	27
Disputanta	12
North Prince George	5

Table E2.5-1 SPS Employee Residence Information, February 2017

State, County, and City/Town	Permanent Full-Time Employees
Prince George	10
Richmond[(b)]	1
Richmond	1
Southampton	17
Courtland	2
Ivor	13
Sedley	2
Suffolk[(b)]	74
Suffolk	74
Surry	108
Claremont	2
Dendron	18
Elberon	18
Spring Grove	12
Surry	58
Sussex	27
Wakefield	14
Waverly	13
Virginia Beach[(b)]	21
Virginia Beach	21
Williamsburg[(b)]	92
Williamsburg	92

Table E2.5-1 SPS Employee Residence Information, February 2017

State, County, and City/Town	Permanent Full-Time Employees
York	26
Seaford	2
Yorktown	24
NORTH CAROLINA	
Hertford	1
Como	1
Northampton	2
Henrico	2
NEW YORK	
Nassau	1
Massapequa	1
Employees - Zip Codes Unable to Confirm	7
TOTAL	941

a. Based on SPS staff assigned city/town zip code.
b. Virginia independent cities.
Note: Employee numbers do not include temporary contract staff or outage workers.

E2.6 ALTERNATIVES TO THE PROPOSED ACTION

The proposed action as described in Section E2.1 is for the NRC to subsequently renew the SPS renewed OLs for an additional 20 years. Because the NRC decision is to renew or not renew the existing SPS renewed OLs, the only fundamental alternative to the proposed action is the no-action alternative, which would result in the NRC not renewing the SPS renewed OLs. The no-action alternative does not provide a means for meeting current and future regional electricity needs. Because SPS provides baseload generation for the Dominion service area, the 1,676 MWe (summer) of generation loss would need to be replaced with a reliable source of equivalent baseload power. Therefore, unless replacement for the loss of the SPS baseload generation is considered under the no-action alternative, that alternative would not satisfy the purpose and need for the proposed action. Dominion has considered a range of replacement power alternatives from which to select those alternatives to be further analyzed for replacement of SPS baseload power generation.

E2.6.1 ALTERNATIVES EVALUATION PROCESS

Dominion developed the following set of evaluation criteria to review SPS replacement alternatives:

- The purpose of the proposed action (SLR) is the continued production of 1,676 MWe (summer) of baseload generation.
- Alternatives evaluated in this ER would need to provide baseload generation.
- Alternatives considered must be fully operational by 2032 considering development of the technology, permitting, construction of the facility, and connection to the grid.
- Alternatives must be electricity-generating sources that are technically feasible and commercially viable.

E2.6.2 ALTERNATIVES CONSIDERED

Using a screening process based on the above criteria, Dominion considered the full range of alternatives considered in the GEIS (NRC. 2013a) in light of the need to meet the criteria as well as federal regulations and Virginia's voluntary renewable portfolio standards. Consideration of generation options also is undertaken by Dominion annually for preparation of its integrated resource plan (IRP), so this screening and selection of generating options to meet the power demands of Dominion's customers was relied upon for evaluating replacement alternatives for SPS.

Dominion's 2018 IRP presents the company's long-range strategy to meet customer's energy needs with cost-effective and reliable resources. The 2018 IRP is a planning document that looks at current and future energy needs over a 15-year planning period from 2019 through 2033, and considers both supply- and demand-side opportunities (Dominion. 2018).

The IRP's strategies for meeting the power needs of Dominion's customers considered compliance with existing and future environmental regulations. Overall, the IRP addresses the company's approach to the development of new generation that focuses on reducing power station carbon dioxide emissions. Dominion recognizes that even though the EPA's Clean Power Plan has not been implemented, other federal and state regulatory action on carbon emissions may occur in the future (Dominion. 2018). For example, the VDEQ has released a draft proposal that will cap carbon dioxide emissions at state electric generating stations. If future energy sources are developed based on compliance with regulations that place limits on carbon emissions, the trend would be for adding renewable and other low-emission resources that require Dominion to maintain reliable baseload power sources such as SPS. Therefore, alternatives or a combination of alternatives selected for consideration under the no-action alternative were limited to those that can provide reliable baseload generation.

The following generation sources were selected as reasonable replacement alternatives based on capability to provide reliable baseload power:

- Natural gas-fired plant alternative (natural gas-fired combined-cycle [NGCC] turbine) located at the SPS site that provides generation equivalent to the 1,676 MWe (summer) generated by SPS.
- New advanced light water reactor (ALWR) nuclear plant with net electricity generation comparable to SPS.
- New small modular reactor (SMR) nuclear plant at the SPS site with net electricity generation comparable to SPS.
- Combination of alternatives that consists of an NGCC plant, solar photovoltaic (PV), and demand-side management (DSM), that provides generation equivalent to the 1,676 MWe (summer) generated by SPS. The NGCC plant would be sited at the SPS site, while solar PV would be sited at a location with access to Dominion's transmission system.

The alternatives selected as reasonable replacement baseload generation alternatives are presented in Section E7.2.1.

Dominion determined the following alternatives were not considered reasonable replacements in comparison to renewal of the SPS OLs:

- Power purchases
- Conservation
- Other Dominion plant reactivation or extended service life
- Wind
- Solar
- Geothermal
- Hydropower
- Municipal solid waste and landfill gas-fired facilities
- Biomass and wood waste
- Agriculture-derived fuels
- Energy crops
- Coal-fired integrated gasification combined cycle (IGCC) technology
- Fuel cells
- Ocean wave and current energy
- Petroleum liquids
- Coal-fired plants

The alternatives not selected as reliable baseload generation for replacing the SPS generation are presented in Section E7.2.2.

Intentionally Blank

E3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

SPS Units 1 and 2 are located on approximately 840 acres of land on the Gravel Neck Peninsula, owned and operated by Virginia Electric and Power Company (Dominion Energy Virginia or Dominion), in Surry County, Virginia. The Gravel Neck Combustion Turbines Station (GNCTS) oil/natural gas-fired generating plant, also owned and operated by Dominion Energy Virginia, is also located on this property and provides additional power generation as needed. (SPS. 2001, Section 2.1) The location of GNCTS and its proximity to SPS structures are shown on Figure E3.1-1.

E3.1 LOCATION AND FEATURES

SPS is located on Gravel Neck Peninsula in the northeastern corner of Surry County, Virginia, along the south side of the James River. The plant is approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. The SPS location is latitude 37° 9' 58" north and longitude 76° 41' 55" west for Unit 1 and latitude 37° 9' 57" north and longitude 76° 41' 53" west for Unit 2. (SPS. 2016a, Section 2.1.1.1; SPS. 2001, Section 2.1) As shown in Table E3.11-1, the city of Virginia Beach is the largest population center in the region, and is approximately 45 miles east-southeast of SPS. Figure E3.1-1 shows the SPS property boundary, facility structures, switchyard, and the EAB. Topographic features adjacent to SPS and within the property boundary are shown in Figure E3.1-2.

E3.1.1 VICINITY AND REGION

The vicinity of SPS is defined as the area within a six-mile radius of a center point established equidistant between the Unit 1 anFd Unit 2 containment structures (Dominion. 2016e). As seen in Figure E3.1-3, the vicinity includes portions of Surry, Isle of Wight, James City, and York counties; the community of Scotland; and the independent cities of Newport News and Williamsburg. Virginia has 38 incorporated cities politically and administratively independent of counties (EV. 2018). Table E3.11-1 provides a list of cities and towns located within a 50-mile radius of SPS. In 2015, Newport News had an estimated population of 182,385, up from a population of 180,719 in 2010 and 180,150 in 2000. The city of Williamsburg had an estimated population of 15,052 in 2015, up from 14,068 in 2010 and 11,998 in 2000. (USCB. 2016a) Scotland is a census-designated place (CDP) with an estimated 2011-2015 population of 135, down from 203 in 2010. The town of Surry is the Surry County seat and is located approximately eight miles west-southwest of SPS. The town of Surry had an estimated 2011-2015 population of 235, down from a population of 244 in 2010. (USCB. 2016b)

Surry and Isle of Wight counties are predominately rural, characterized by farmland, wooded tracts of land, and marshy wetlands. At the tip of the Gravel Neck Peninsula, the Hog Island Wildlife Management Area (WMA), located immediately north of the site (Figure E3.1-5), is reached by a public access road traversing the SPS site, but with controlled security access. Public parking and viewing points are provided by the state within the refuge. The tip of the peninsula is very marshy and almost detached by many streams and creeks. (SPS. 2016a, Section 2.1.1.1) As described in Table E3.11-2, Surry County's population grew from 6,829 in 2000 to 7,058 in 2010, and decreased to an estimated 6,709 in 2015, but Isle of Wight County's population grew from 29,728 in 2000, to 35,270 in 2010, to an estimated 36,314 in 2015. (SPS. 2016a) York and James City counties and the cities of Newport News and Williamsburg are more urban, characterized by recreational areas and growing population centers. (SPS. 2016a, Section 2.1.1.1) York County's population grew from 56,297 in 2000, to 65,464 in 2010, to an estimated 67,837 in 2015; James City County grew from 48,102 in 2000, to 67,009 in 2010, to an estimated 73,147 in 2015. (SPS. 2016a)

The region of SPS is defined as the area within a 50-mile radius of a center point established equidistant between the Unit 1 and Unit 2 containment structures (Dominion. 2016e). As seen in Figure E3.1-4 and described in Table E3.11-1, to the east and southeast of the site are a number of large, populated Virginia independent cities, including Newport News, Hampton, Portsmouth, Suffolk, Chesapeake, Norfolk, and Virginia Beach. The general area is a major Atlantic coast seaport and U.S. naval base, and the largest industry is shipbuilding. (SPS. 2016a, Section 2.1.1.1) The Virginia state capital, Richmond, is approximately 50 miles west-northwest of the site. As seen in Figure E3.1-6, the James River is a predominant natural feature in the region. The shoreline of the Atlantic Ocean begins some 40 miles east of the site (SPS. 2016a, Section 2.1.1.1).

All or parts of 31 counties and 14 independent cities are located within the 50-mile radius of SPS (Table E3.11-2). Of the counties, 25 are in Virginia and six are in North Carolina, as seen in Figure E3.1-4. As of 2015, there were six independent cities with populations of over 100,000 located within the 50-mile region. These are: Chesapeake, Hampton, Newport News, Norfolk, Richmond, and Virginia Beach (Table E3.11-1). In addition, there is one CDP (Mechanicsville), and three independent cities (Petersburg, Portsmouth, and Suffolk) with populations over 25,000 within the 50-mile region.

As seen in Figures E3.1-3 and E3.1-4, the James River, with a shipping channel for ships and barges, passes within 2.3 miles of SPS (SPS. 2016a, Section 2.1.4.1). North of the James River, Interstate 64 (I-64) runs northwest to southeast between the cities of Richmond and Newport News/Hampton, where the river enters Chesapeake Bay. Interstate 95 (I-95) is a major north-south interstate that traverses the 50-mile region, running past Richmond south into North Carolina. SR 650, a state secondary road, provides the only land access to SPS. Portions of SR 10 and SR 31 pass within six miles of SPS, with the approach of SR 10 passing within approximately five miles of the site. The only railway within 10 miles is the CSX Transportation Railway, which is six

miles at its nearest approach to SPS. The site is bordered on the east and west by the James River and is accessible by water craft at the east side pier. (SPS. 2016a, Section 2.1.4.1) Within six miles of the site, the Jamestown-Scotland Ferry provides automotive accessibility between the north and south shores of the James River, connecting SR 31 (VDOT. 2016a). Along with the SPS heliport, there are three airports within 10 miles of the site: Williamsburg-Jamestown Airport, Felker Army Airfield (AAF), and the Melville Airstrip. Newport News/Williamsburg International Airport, the nearest full-service commercial airport, is located approximately 11 miles east-southeast from SPS. (SPS. 2016a, Sections 2.1.4.1 and 2.1.5.3)

The closest offsite industrial facility to SPS is the Anheuser-Busch brewery plant (5.5 miles north-northeast). There are no known mines or stone quarries within five miles of SPS. Columbia Gas Transmission Corporation and Colonial Pipeline Company own pipelines which cross the southeastern corner of the SPS property boundary. A spur pipeline branches into the SPS site from each of these lines to supply natural gas and No. 2 fuel oil, respectively, to the GNCTF. There are no other pipelines within five miles of SPS. (SPS. 2016a, Sections 2.1.4.1, 2.1.4.2 and 2.1.4.3)

E3.1.2 STATION FEATURES

The principal structures at SPS are identified in Section E2.2. The plant property lines, which are the same as the site boundary and exclusion area boundary (EAB), are shown in Figure E3.1-1. Dominion owns, in fee simple, all of the land within the site boundary, both above and beneath the surface, with the exception of SR 650, which traverses the site to the Hog Island WMA to the north. No subsurface mineral investigations are anticipated within the SPS property boundaries during the proposed SLR operating term. With the exception of public access to Hog Island on SR 650, Dominion has the authority to control activities within the EAB, including exclusion and removal of personnel and property. In the event of an emergency, local law enforcement officers will take control of traffic on SR 650. The site boundary is clearly posted to ensure that it will not be transgressed by unauthorized individuals. (SPS. 2016a, Sections 2.1.1.2, 2.1.2.1, and 2.1.2.3) Due to SPS's location on a peninsula, residential proximity is nearest on the southern land side of the station. The nearest resident to SPS is located approximately 0.4 miles to the west-southwest of the main industrial area, while the next closest resident is approximately 1.7 miles to the south of SPS. (SPS. 2017b)

In addition to the two nuclear reactors and their turbine buildings, intake and discharge canals, auxiliary buildings, switchyard, and ISFSI, Dominion operates the GNCTS oil/natural gas-fired generating plant on SPS property. Operations of the combustion turbine station do not affect SPS operations. (SPS. 2001, Sections 2.1 and 3.5)

Gravel Neck Peninsula, where SPS is located, is at the upstream limit of saltwater incursion into the James River; upstream of Gravel Neck Peninsula is tidal river, while downstream is an estuary (SPS. 2001, Section 2.1). The ground surface at the site is generally flat (Figure E3.1-2) with steep banks sloping down to the river and the low-level waterfowl refuge to the north. Station ground grade has been established at an elevation of 26.5 feet above the U.S. Coast & Geodetic Survey (USC&GS) mean sea level datum at Hampton Roads, Virginia (that area of Virginia including Newport News, Norfolk, Portsmouth, Hampton, and surrounding cities and towns). Drainage throughout the area is toward Hampton Roads, on the Atlantic Ocean near the mouth of Chesapeake Bay. (SPS. 2016a, Section 2.1.1.2)

E3.1.3 FEDERAL, NATIVE AMERICAN, STATE, AND LOCAL LANDS

A number of public lands are located within the vicinity of SPS, as listed in Table E3.1-1 and illustrated in Figure E3.1-5. These include, but are not limited to: the Colonial National Historical Park and Historic Jamestowne, run by the National Park Service (NPS); the Chippokes Plantation State Park and Hog Island WMA, both managed by the Commonwealth of Virginia; and local attractions such as Fort Huger, Bacon's Castle, and the Old Brick Church. As seen in Figures E3.1-5 and E3.1-6, the only military installation within six miles of the site is the U.S. Army Transportation Center at Fort Eustis. Nearby, but outside the six-mile vicinity, the U.S. Naval Reservation, including the U.S. Naval Weapons Station, occupies a large portion of the land north and northeast of SPS between the James and York rivers. (SPS. 2016a, Section 2.1.4.2). The Captain John Smith Chesapeake National Historic Trail (CAJO) travels nearly 3,000 miles across the Chesapeake Bay and its river tributaries. A portion of the CAJO associated with the James River water route falls within the 6-mile vicinity of the plant bordering various historical sites along the river, including Jamestown to the northwest, and also Hog Island WMA located on the north end of Gravel Neck Peninsula.

As shown in Figure E3.1-6, there are a variety of national and state parks, national and state wildlife refuges and management areas, conservation areas, and military installations located in the 50-mile region. There are no federally recognized Indian reservations or Native American-owned lands held in trust by the federal government within the 50-mile region. Within the meaning of the federal law, in 2015 the federal government officially recognized the Pamunkey Tribe, located approximately 33 miles north-northwest of SPS in King William County. (USDOI. 2016a; USDOI. 2016b)

In January 2018, six additional Virginia tribes were federally recognized by an act of Congress. These newly recognized tribes are the Chickahominy, the Eastern Chickahominy, the Upper Mattaponi, the Rappahannock, the Monacan, and the Nansemond. With this recognition, the tribes and its members are made eligible for the services and benefits provided by the federal government to federally recognized Indian tribes (e.g., housing, education, and medical care) without regard to the existence of a reservation for the tribe. The act designates multi-county service areas for tribal members, with several located within the 50-mile radius of SPS. (Congress.gov. 2018; Portnoy, J. 2018)

The Commonwealth of Virginia has formally recognized the Pamunkey Tribe (state reservation); the Chickahominy Tribe located in Charles City County (approximately 29 miles northwest of SPS); the Eastern Chickahominy Tribe located in New Kent County (approximately 24 miles northwest of SPS); and the Mattaponi Tribe (state reservation) located in King William County (approximately 36 miles north-northwest of SPS) (NCSL. 2016; NPS. 2016a). State Indian reservations are lands held in trust by a state for an Indian tribe (USDOI. 2016b). The Chickahominy and Eastern Chickahominy tribes have been designated by the Commonwealth of Virginia as state-designated tribal statistical areas (SDTSA) for the U.S. Census Bureau (USCB). Although no lands are held in trust, SDTSAs generally encompass a compact and contiguous area that contains a concentration of people who identify with a state-recognized American Indian tribe in which there is structured or organized tribal activity. (USCB. 2016c; USCB. 2016d)

E3.1.4 FEDERAL AND NON-FEDERAL RELATED PROJECT ACTIVITIES IN THE VICINITY OF SPS

To date, no additional federal and non-federal projects have been identified as taking place in the vicinity of SPS. Also, no new business developments or current business expansions have been announced.

As presented in Section E3.0, the GNCTS oil/natural gas-fired generating plant is also located on the same property as SPS and provides additional power generation as needed to support the Dominion electric power service area. No major change to operations or plans for future expansion of the generating plant have been announced by Dominion.

SPS has an ISFSI used to store spent fuel in licensed and approved dry cask storage containers on the SPS site (Section E2.2). This SPS ISFSI is licensed separately from SPS Units 1 and 2, and would remain in place until the U.S. Department of Energy (DOE) takes possession of the spent fuel and it is removed from the site for permanent disposal or processing. Currently, the SPS ISFSI includes three separate spent fuel storage pads, and Dominion is in the process of adding a fourth pad to the site to increase storage capacity. Installation of a fourth pad within the current ISFSI area is scheduled to be completed by the end of 2020. The addition of a fifth spent fuel storage pad to the current SPS ISFSI area to further increase storage capacity is under consideration, but plans are in the conceptual stage and no installation schedule has been established.

Dominion has completed environmental permitting for an upgrade of electrical transmission capabilities for customers located in the southeastern Virginia peninsula region. As described in Section E2.2.5.1, the Surry-Skiffes Creek portion of the improvements includes the installation of a new 500-kV transmission line from the Skiffes Creek switching station in James City County, Virginia, to the Surry switching station located in the SPS 500-kV switchyard. The entire length of the proposed project is approximately eight miles, with 1.5 miles of the line located on Dominion land at SPS in Surry County, 4.1 miles of overhead line crossing the James River, and 2.3 miles of the line located on land in southern James City County. (Dominion. 2016a) The Surry-Skiffes Creek line for electrical transmission is a separate project and is addressed in Section E4.12.

As noted in Section E2.2.7.2, Dominion is developing an offsite DMMA, to be located on Hog Island Road, approximately four miles south of SPS (Figure E2.2-6), and is planned to be utilized once the onsite dredge material management pond reaches capacity. The offsite DMMA is currently undergoing permitting and evaluation processes, and construction has not yet been completed. (Dominion. 2016c) The offsite DMMA is being developed to support current station operations and is not in scope for SLR.

Table E3.1-1 Federal, State, and Local Lands Totally or Partially within a 6-Mile Radius of SPS

Name[a]	Management	Distance[b]	Direction	Nearby Place	County or Independent City
Bacon's Castle	Local	4	SSW	Surry	Surry
Busch Gardens Williamsburg	Local	6	NNE	Williamsburg	James City
Captain John Smith Chesapeake National Historic Trail (CAJO)	Federal	3	NW	Surry	Surry
Chippokes Plantation State Park	State	3	SW	Surry	Surry
College Landing Park	Local	6	North	Williamsburg	Williamsburg
Colonial National Historical Park[c]	Federal	3	NW	Williamsburg	Surry, Williamsburg, James City and York
Colonial Williamsburg Carter's Grove Plantation	Local	5	NE	Williamsburg	James City
Fort Eustis[c]	Federal	5	East	Newport News	Newport News
Fort Huger	Local	5	SSE	Smithville	Isle of Wight
Hog Island WMA[d]	State	0.0	North	Surry	Surry
Jamestown National Historic Site (Historic Jamestowne)	Federal	5	NW	Williamsburg	James City
Old Brick Church	Local	5	SSW	Surry	Surry

(IWCM. 2016; NPS. 2016b; SCVT. 2016; SWPE. 2016; USDA. 2016a; VDGIF. 2016a; VSCC. 2015)

a. List is based on best available public information and includes lands that are totally or partially located within a six-mile radius of SPS.
b. Distances are approximate miles (rounded to the nearest whole number and calculated based on SPS location and land centroid data).
c. The distances reported for Colonial National Historic Park and Fort Eustis are rounded and based on the closest point of their property boundary the SPS site.
d. Hog Island WMA is immediately adjacent to the northern boundary of SPS, resulting in the reported distance of zero.

Intentionally Blank

Figure E3.1-1 SPS Plant Layout

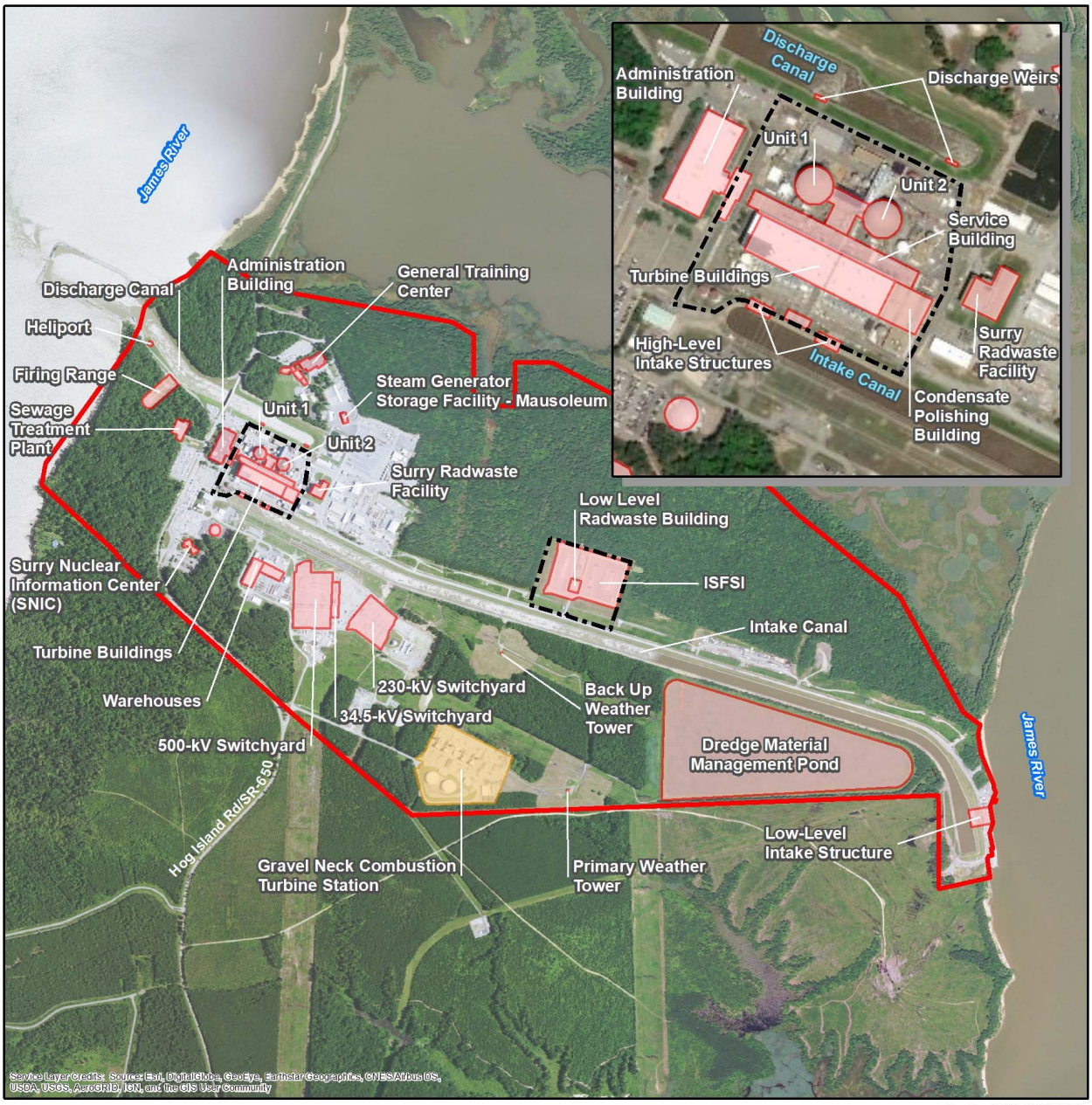


Figure E3.1-2 SPS Property and Area Topography

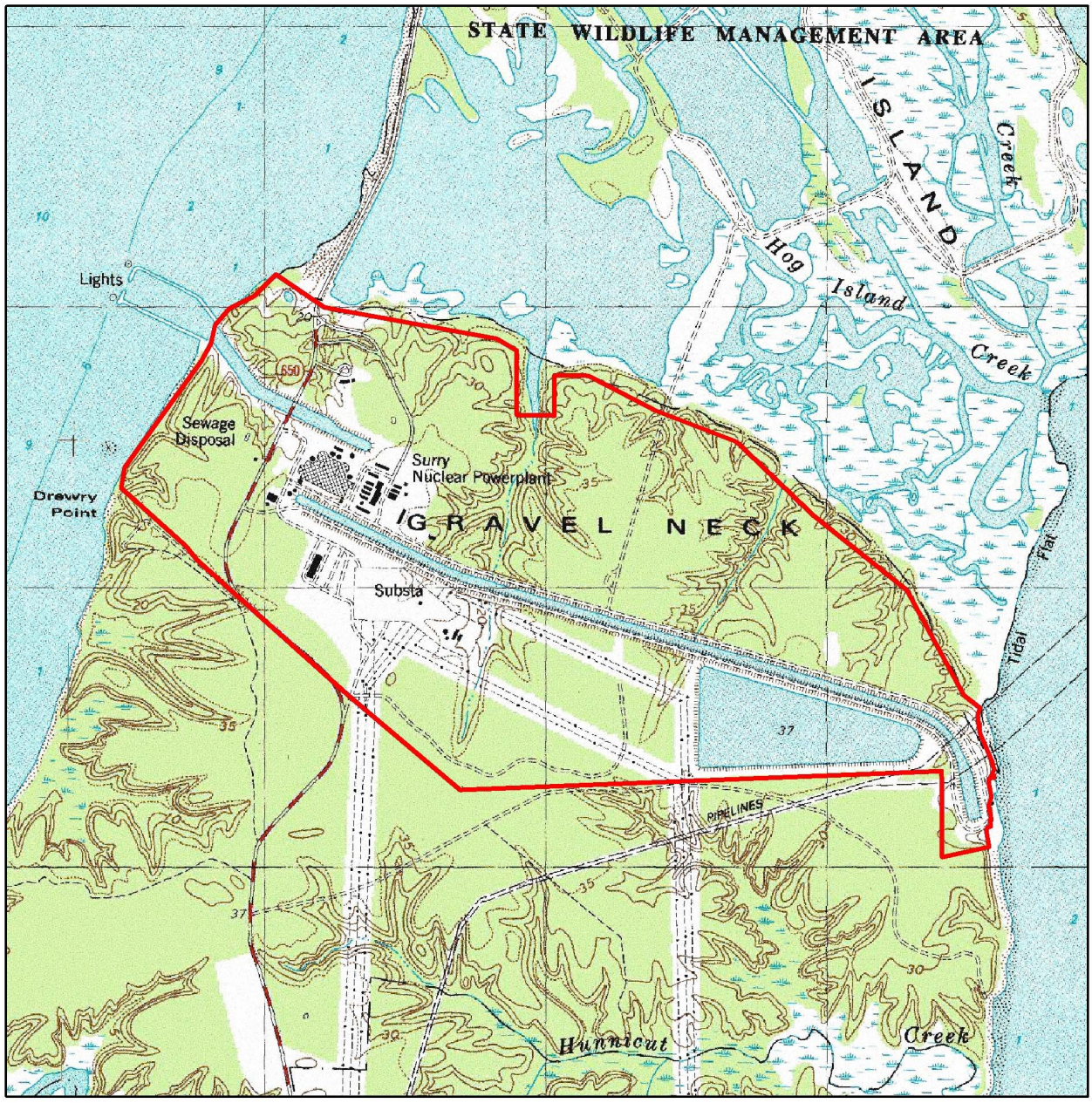


Figure E3.1-3 SPS Site and 6-Mile Radius of SPS

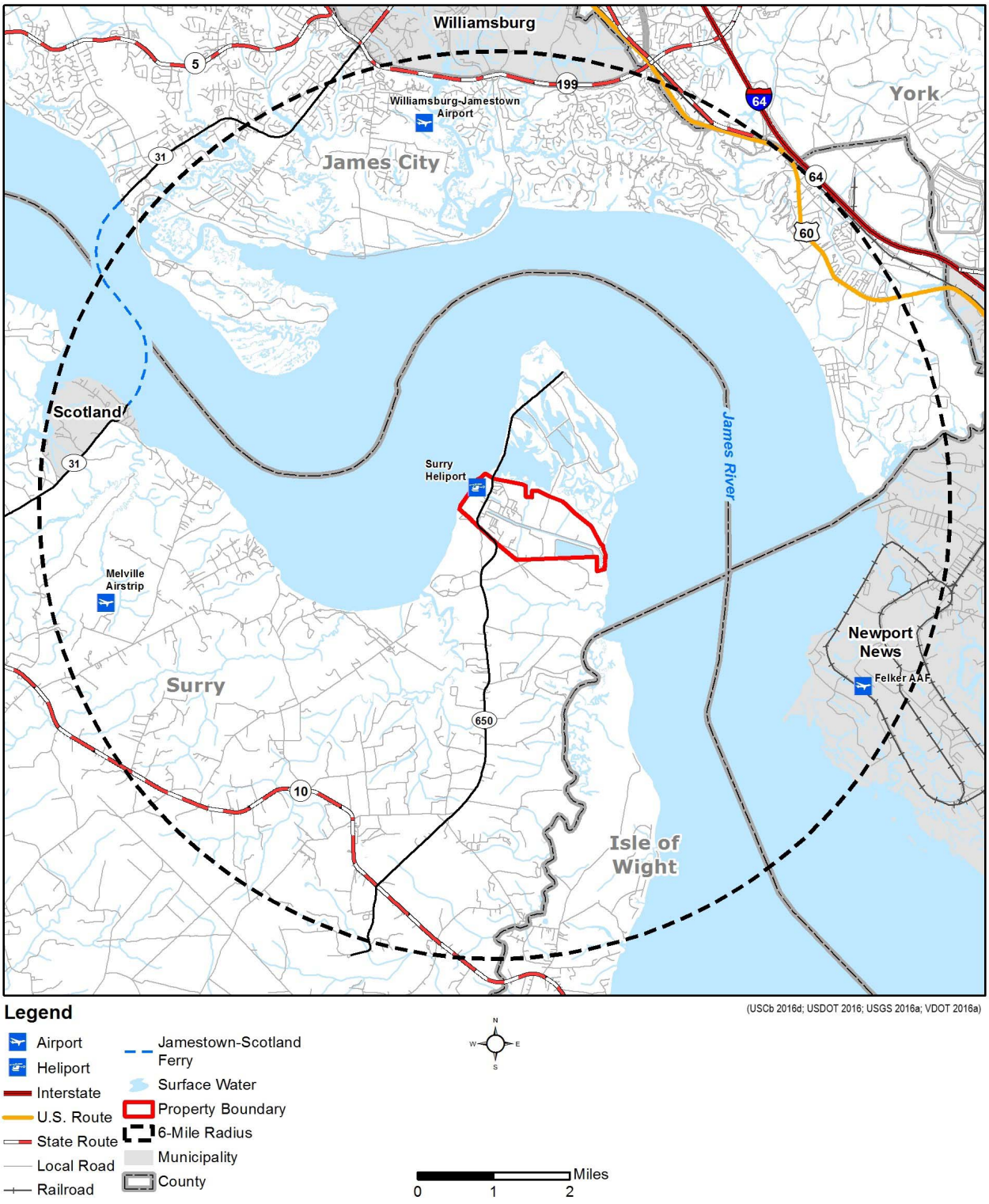


Figure E3.1-4 SPS Site and 50-Mile Radius of SPS

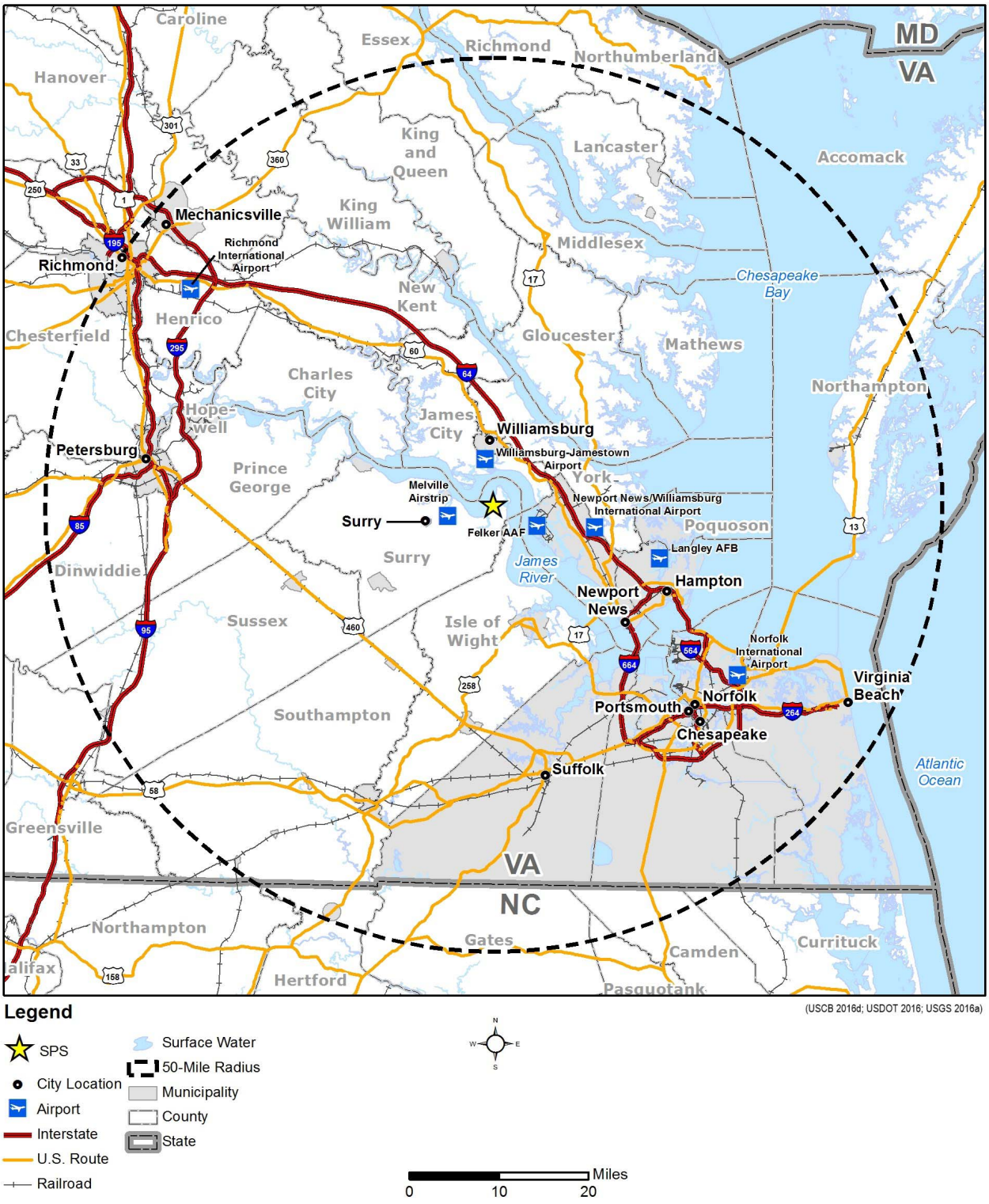
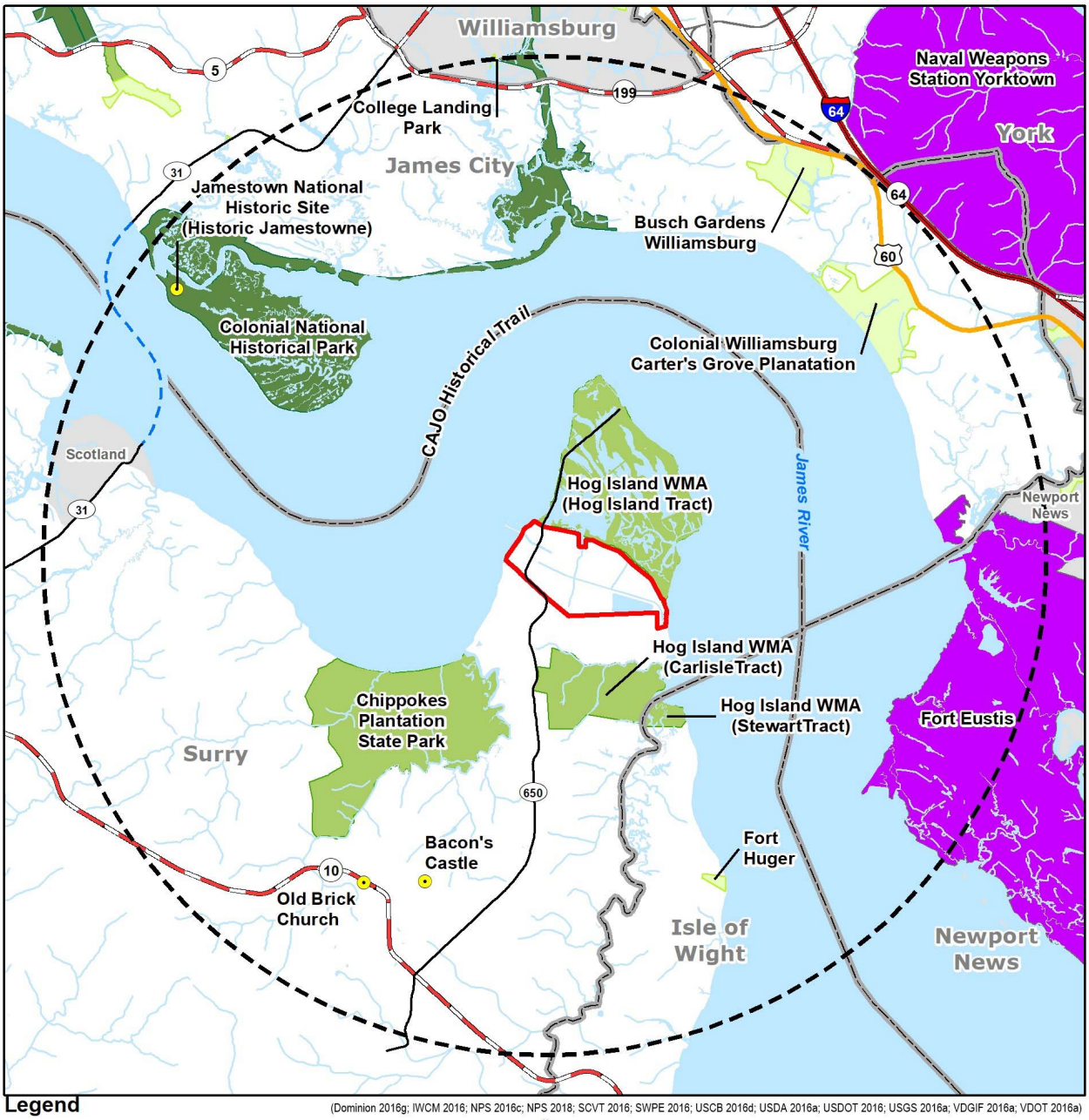
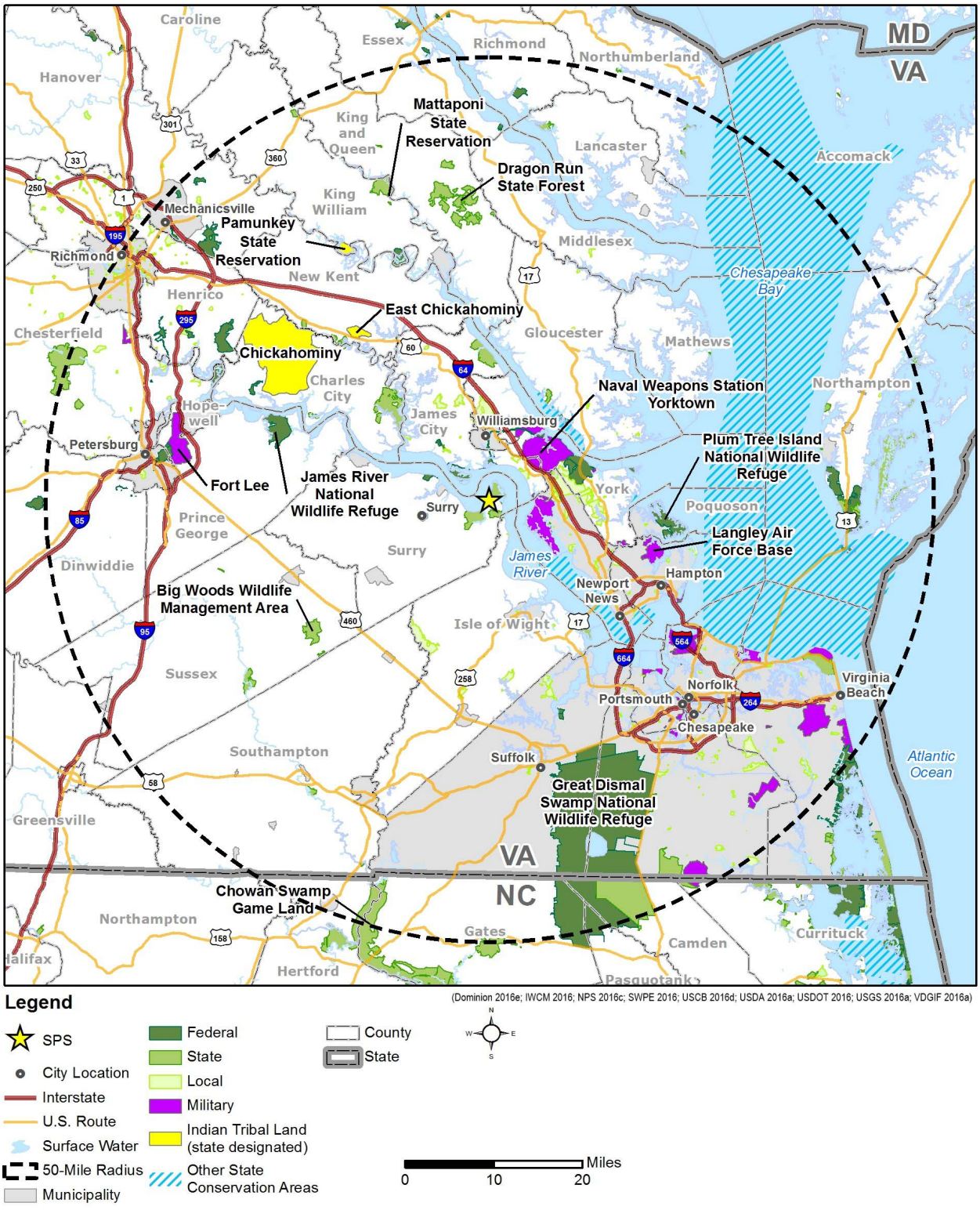


Figure E3.1-5 Federal, State, and Local Lands within a 6-Mile Radius of SPS



(Dominion 2016g; IWCM 2016; NPS 2016c; NPS 2018; SCVT 2016; SWPE 2016; USCB 2016d; USDA 2016a; USDOT 2016; USGS 2016a; VDGIF 2016a; VDOT 2016a)

Figure E3.1-6 Federal, State, and Local Lands within a 50-Mile Radius of SPS



E3.2 LAND USE AND VISUAL RESOURCES

Land use descriptions focus on Surry County, Isle of Wight County, the city of Newport News, and the city of Williamsburg, because as described in Section E2.5, approximately 60% of the permanent SPS workforce live in these counties and cities, and because SPS pays property taxes to Surry County.

E3.2.1 ONSITE LAND USE

SPS is located in the northeastern corner of Surry County, Virginia, on a point of land called Gravel Neck Peninsula that juts into the James River from the south (SPS. 2016a, Section 2.1.1). The 840-acre site extends as a band across the peninsula. Steep bluffs drop to the river on either side and to the tip of the peninsula, which is low and marshy. Hog Island WMA, a Commonwealth WMA, is located on the tip of the peninsula. (SPS. 2001 Section 2.1) The town of Surry, approximately eight miles west-southwest of SPS, is the county seat. As described in Table E3.11-1, the city of Virginia Beach, Virginia, is the largest population center in the region, and is approximately 45 miles east-southeast of SPS.

As shown in Table E3.2-1 and illustrated in Figure E3.2-1, forest is the largest land use/land cover category within the SPS property boundary, covering approximately 48% of the site. These onsite forested areas are classified primarily as deciduous forest (23.7%), evergreen forest (12.6%), and mixed forest (11.3%). The areas within the SPS property boundary that have been developed to support plant operations are the next largest land use/land cover category, with approximately 31%. The remaining seven land use/land cover categories found onsite comprise approximately 21%. (MRLC. 2016)

SPS has been granted an industrial area land use designation and is regulated for an M-2 general industrial zoning district. Under an M-2 district, Surry County conditional use permitting allows for utility service and power plant land use. Areas adjacent to SPS are identified by a land use designation of agricultural-rural residence (A-R) zoning district. (SC. 2016a)

Dominion owns, in fee simple, all the land within the site boundary, both above and beneath the surface, with the exception of SR 650, which traverses the site to the Hog Island WMA to the north. As described in Section E3.1, no activities unrelated to plant operations (other than transit through the area) are permitted in the exclusion area without Dominion approval. (SPS. 2016a, Sections 2.1.1.2 and 2.1.2.2) Neither are there any anticipated future plans to explore for subsurface minerals within the property boundary during the proposed SLR operating term.

As noted in Section E2.2.7.2, Dominion is developing an offsite DMMA, to be located on Hog Island Road, approximately four miles south of SPS (Figure E2.2-6), and is planned to be utilized once the onsite dredge material management pond reaches capacity. The offsite DMMA is currently undergoing permitting and evaluation processes and construction has not yet been completed. (Dominion. 2016c) The offsite DMMA is being developed to support current station operations and is not in scope for SLR.

E3.2.2 OFFSITE LAND USE

As shown in Tables E3.11-2 and E3.11-3 , while Surry County's population was estimated to decrease between 2010 and 2015, total county population is projected to increase through 2053. Isle of Wight County has seen an increase in total population since 2010, which is also expected to increase through 2053. Both Newport News and Williamsburg have experienced population increases since 2010 and are projected to continue their population growth trend through 2053.

As described in Section E3.1, the vicinity (six-mile radius) surrounding SPS includes portions of Surry, Isle of Wight, James City, and York counties along with portions of Virginia independent cities Newport News and Williamsburg. The land use/land cover categories located within the vicinity of SPS are illustrated in Figure E3.2-2. The James River is the predominant natural feature in the vicinity, and as noted in Table E3.2-2, open water is the largest land use/land cover category at approximately 41%. The next largest land use/land cover category in the vicinity are forested areas (21%), deciduous forest (10.7%), evergreen forest (5.0%), and mixed forest (5.5%). On the north side of the James River, York and James City counties and the cities of Newport News and Williamsburg are more urban, characterized by recreational areas and growing population centers (SPS. 2016a, Section 2.1.1.1). Developed lands are the third largest land use/land cover category identified within the six-mile vicinity, at approximately 10%. The remaining seven land use/land cover categories found within the vicinity comprise approximately 28%. (MRLC. 2016)

Surry County occupies approximately 178,527 acres of land, of which 45,122 acres (25.3%) are proportioned to farmland. The 2012 Census of Agriculture reports that the county had a total of 127 farms, with an average farm size of 355 acres. Approximately 108 farms produced crops, with primary crops reported as corn for grain (5,832 acres), wheat (6,397 acres), sorghum (276 acres), soybeans (15,649 acres), cotton (1,898 acres), forage (1,531 acres), and peanuts (1,864 acres). Livestock is also an important agricultural product in the county, with livestock commodities such as cattle and calves (21 farms), hogs and pigs (10 farms), layers (12 farms), and sheep and lambs (3 farms) reported. Other agricultural uses of farmland within the county included woodlands (8,537 acres on 67 farms), permanent pasture and rangeland (52 farms), and pastureland (3,166 acres on 61 farms). (USDA. 2016b)

Isle of Wight County occupies approximately 202,000 acres of land, of which 75,642 acres (37.4%) are proportioned to farmland. In 2012, it was reported that the county had a total of 213 farms, with an average farm size of 355 acres. Approximately 168 farms produced crops, with primary crops reported as corn for grain (6,440 acres), wheat (7,761 acres), sorghum (3,820 acres), soybeans (20,958 acres), cotton (14,088 acres), forage (1,704 acres), and peanuts (2,183 acres). Livestock is also an important agricultural product in the county, with livestock commodities such as cattle and calves (38 farms), hogs and pigs (11 farms), layers (33 farms), broilers and other meat-type chickens (7 farms), and sheep and lambs (7 farms) reported. Other agricultural uses of farmland within the county included woodlands (14,714 acres on 107 farms), permanent pasture and rangeland (4,000 acres on 95 farms), and pastureland (4,853 acres on 109 farms). (USDA. 2016b)

The Commonwealth of Virginia mandates that cities and counties have comprehensive land use plans. As specified in the Code of Virginia § 15.2-2223, local planning commissions are required to "prepare and recommend a comprehensive plan for the physical development of the territory within its jurisdiction" The comprehensive plan is required to show the locality's long-range recommendations for the general development of the territory covered by the plan. It may include, but is not limited to, the following (COV. 2016):

- Transportation planning;
- Designation of areas for various types of public and private development and use (e.g., residential, industrial, agricultural, etc.);
- Designation of a system of community service facilities (e.g., parks, forests, waste disposal areas, etc.);
- Designation of historical areas and areas for urban renewal or other treatment;
- Designation of areas for implementation of reasonable groundwater protection measures;
- A capital improvements program, a subdivision ordinance, a zoning ordinance, etc.;
- The location of existing or proposed recycling centers;
- The location of military bases, military installations, etc.;
- The designation of corridors or routes for electric transmission lines of 150 kilovolts or more; and
- Designation of areas and implementation of measures for construction, rehabilitation and maintenance of affo4rdable housing.

Comprehensive plans are in place for Surry County, Isle of Wight County, the city of Newport News, and the city of Williamsburg, and reflect planning efforts and public involvement in the planning process (IWC. 2016a; NN. 2016; SC. 2016a; Williamsburg. 2016).

Surry County is a primarily rural agricultural county. Its dominant land uses are agriculture and forestry, with many historical sites preserved for historical significance as well as everyday use as homes. These historical uses in Surry County are mixed with uses such as SPS and farms where the latest agricultural technology is utilized to produce hogs, cattle, grains, forestry products, peanuts, and cotton. The rural quality of Surry County endures through housing and development programs that encourage the preservation of agriculture and the woodlands. Surry County's comprehensive plan indicates that growth pressures have not accelerated beyond the county's control. (SC. 2016a)

Throughout most of Isle of Wight County's past, growth has been gradual, and the county has remained predominantly rural in character. The development pattern of Isle of Wight County is characteristic of a rural county on the fringe of an expanding metropolitan area. In recent decades development within the county has been increasing in response to the development and expansion of the nearby Hampton Roads region (including, but not limited to, Suffolk, Portsmouth, Chesapeake, Norfolk, and Virginia Beach). As seen in Table E3.11-2, the populations in these communities are projected to continue to increase through 2053. As residential and industrial development increase within Isle of Wight County, it is expected that additional commercial (retail, service, business, and office) development will follow. The Isle of Wight County comprehensive plan goals are to direct commercial growth to defined development service districts, and residential development within rural/agricultural and forest districts should be limited to minimize incompatibilities and conflict. (IWC. 2016a)

The City of Newport News is an international seaport located on the world's largest natural harbor, and is known for success in the shipbuilding industry. The city's economy is also diversifying into business, technology, and scientific research and development. In Newport News, approximately 31% of the city's land is developed for residential uses, with the rest of the land designated for commercial, office, research and development, industrial, community facilities, transportation and utilities, military and federally owned, and right-of-way and public streets. Only 9.1% of the city's land remains vacant and undeveloped. Since the 1990s, the consumption of vacant land has dropped because new development is being built on land previously used or redeveloped. Redevelopment creates sites for residential, commercial, industrial, and other uses by converting obsolete uses to new uses. (NN. 2016)

Williamsburg is notable chiefly because it is a city with a unique and important history. All of the city's previous comprehensive plans have recognized that the colonial heart of the city could neither be properly preserved nor made conveniently accessible without careful consideration of a much wider area. Based on a land use survey conducted in 2011, approximately 52% of the city's 5,780 acres was developed. Approximately 15% of development has been residential and 15% of development has been for institutional purposes. Within Williamsburg, 6% of the land use is devoted to parks, recreation, and parkway use, and 17% is devoted to sensitive environmental

areas and surface water features. The remainder is broken down under commercial, public and semi-public, transportation, etc. Approximately 29% of the land within the city is vacant property that borders active use and represents land available for residential, commercial, college, and mixed-use development. The vacant land category does not include land designated as sensitive environmental and surface water areas, but a large portion of this vacant land is slated for development in the near future. City leaders have developed the comprehensive plan to protect the character and integrity of the Colonial Williamsburg Historic Area, the historic campus of the College of William and Mary, and the city's historic neighborhoods and commercial areas. (Williamsburg. 2016)

E3.2.3 VISUAL RESOURCES

As presented in Section E3.1, SPS is located on Gravel Neck Peninsula in the northeastern corner of Surry County, Virginia, on the south side of the James River. Figure E3.1-1 shows the building site layout and the property boundary in association with the James River. As presented in Section E3.2.1, the largest land use categories on the SPS site property are forested at approximately 48% and developed at approximately 31%.

The tallest structures on the site are the reactor containment buildings, which are approximately 159 feet in height. Predominant visual features at SPS are the reactor containment buildings, the turbine buildings, and transmission lines. The site structures located within the protected area of the plant are set back from the shoreline of the James River and surrounded by forest, offering limited offsite viewing opportunities. Because of the wooded setting, remote location, and absence of refurbishment plans for purposes of SLR, SPS would continue to have minimal visual impact on neighboring properties or from the viewpoint of the James River, including the CAJO water route (see Section E3.1.3).

Table E3.2-1 Land Use/Land Cover, SPS Property

Category	Acres	Percent
Open Water	9.34	1.1
Developed	259.31	31.0
Open Space	62.72	7.5
Low Intensity	50.26	6.0
Medium Intensity	78.95	9.4
High Intensity	67.39	8.0
Barren Land (rock/sand/clay)	14.23	1.7
Deciduous Forest	198.15	23.7
Evergreen Forest	105.86	12.6
Mixed Forest	94.74	11.3
Shrub/Scrub	55.15	6.6
Grassland/Herbaceous	7.56	0.9
Cultivated Crops	32.69	3.9
Woody Wetlands	47.59	5.7
Emergent Herbaceous Wetlands	12.68	1.5
Total	**837.32[(a)]**	**100.0**

(MRLC. 2016)

a. The acreages presented in this table are based on the Multi-Resolution Land Characteristics Consortium (MRLC) land use/land cover data. These data are presented in a raster (pixel-based) format and because of their square geography, they do not exactly match the SPS property boundary. This geographic variation creates a small difference between the total acreage reported in Table E3.2-1 compared to the SPS property acreage stated throughout the ER.

Table E3.2-2 Land Use/Land Cover, 6-Mile Radius of SPS

Category	Acres	Percent
Open Water	30,395.79	41.3
Developed	7,215.82	9.8
Open Space	4,562.20	6.2
Low Intensity	1,466.25	2.0
Medium Intensity	821.97	1.1
High Intensity	365.39	0.5
Barren Land (rock/sand/clay)	158.34	0.2
Deciduous Forest	7,851.42	10.7
Evergreen Forest	3,708.43	5.0
Mixed Forest	4,078.27	5.5
Shrub/Scrub	2,529.52	3.4
Grassland/Herbaceous	550.20	0.7
Pasture/Hay	2,519.73	3.4
Cultivated Crops	5,380.84	7.3
Woody Wetlands	5,205.37	7.1
Emergent Herbaceous Wetlands	4,082.28	5.5
Total	**73,676.01**	**100.0**

(MRLC. 2016)

Figure E3.2-1 Land Use/Land Cover, SPS Property

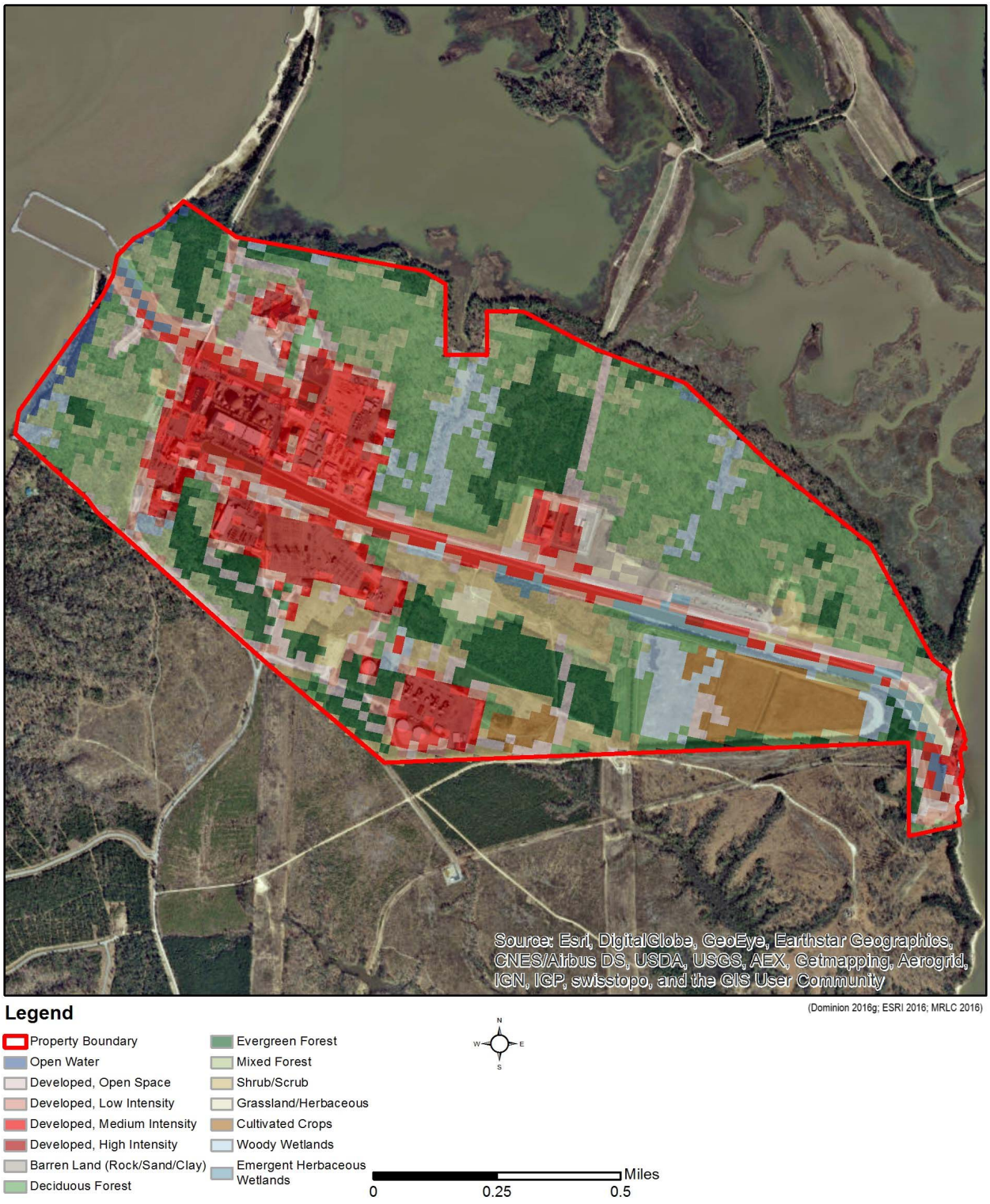
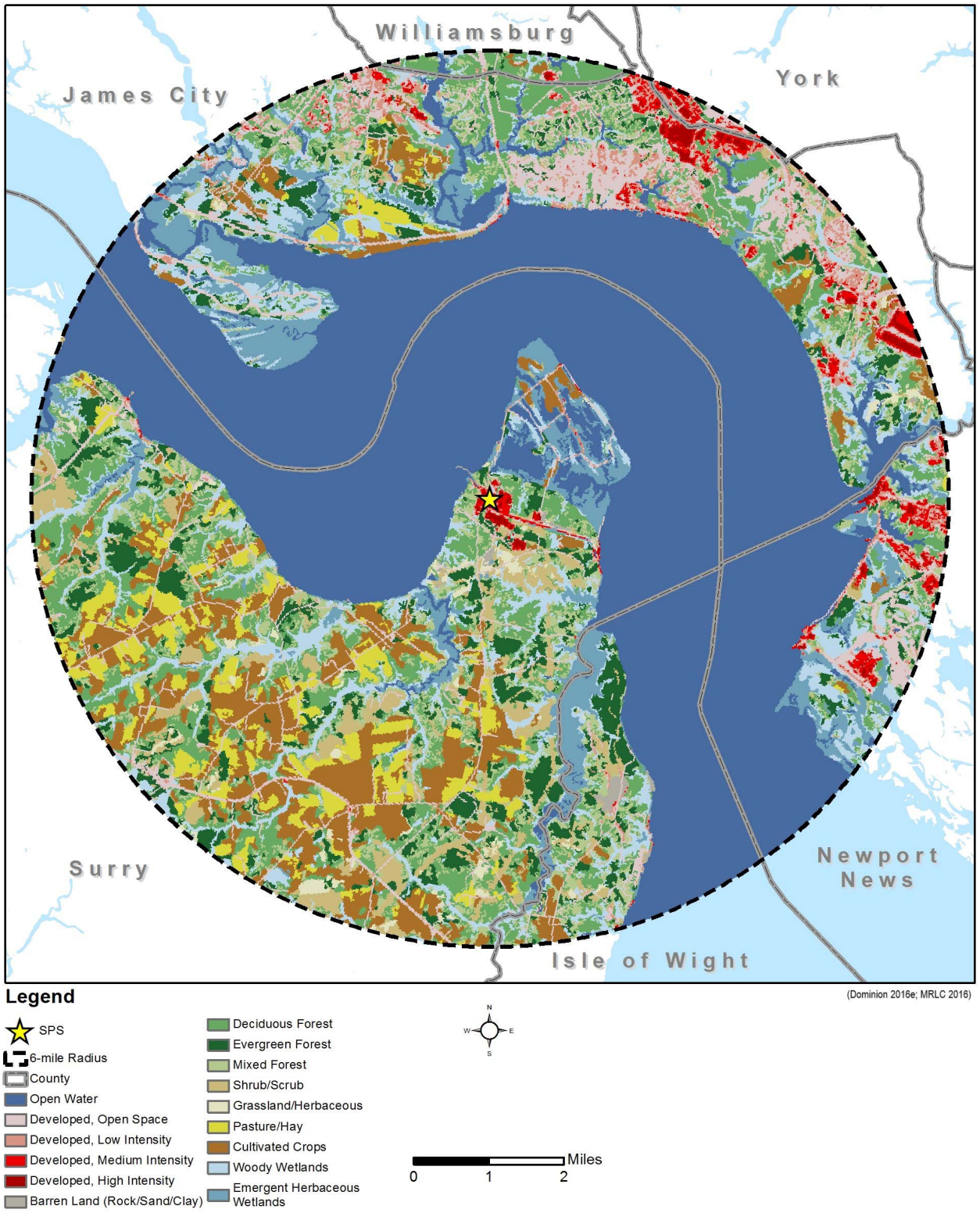


Figure E3.2-2 Land Use/Land Cover, Six-Mile Radius of SPS



E3.3 METEOROLOGY AND AIR QUALITY

The meteorology, climate, and air quality of SPS were previously evaluated during the SPS Units 1 and 2 initial operating license and initial license renewal approval processes (NRC. 1972, Section II.D.3; NRC. 2002a, Section 2.2.4; SPS. 2001, Section 2.12).

SPS is located midway between the cities of Norfolk and Richmond, Virginia, in a climatological transition region between the maritime climate of Norfolk and the continental climate of Richmond (NRC. 2002a, Section 2.2.4). A high-level overview of the plant layout is provided in Figure E3.1-1.

Climatological data presented below have been provided to represent a range of meteorological conditions considered typical for the SPS site region. Richmond and Norfolk are the closest first-order National Weather Service (NWS) data collection stations to SPS with a significant period of meteorological data, and thus have been used to describe the representative climatic conditions. Richmond and Norfolk climatological information has been used in previous SPS licensing environmental reviews, thus making their continued use appropriate for comparison. (NRC. 1972, Section II.D.3; NRC. 2002a Section 2.2.4; SPS. 2016a, Section 2.2)

E3.3.1 GENERAL CLIMATE

Richmond, Virginia, is located in east-central Virginia at the head of navigation on the James River and along a line separating the coastal plain (Tidewater Virginia) from the piedmont. The Blue Ridge Mountains lie about 90 miles to the west and the Chesapeake Bay 60 miles to the east. The climate is classified as modified continental. Summers are warm and humid and winters generally mild. The mountains to the west act as a partial barrier to outbreaks of cold continental air in winter. The cold winter air is delayed long enough to be modified, then further warmed as it subsides in its approach to Richmond. The open waters of the Chesapeake Bay and the Atlantic Ocean contribute to humid summers and mild winters. The coldest weather in Richmond normally occurs in late December and January, when low temperatures (°F) usually average in the upper 20s, and the high temperatures in the upper 40s. Temperatures seldom lower to 0°F, but there have been several occurrences of below zero temperatures. Summertime high temperatures above 100°F are not uncommon, but do not occur every year. Precipitation is rather uniformly distributed throughout the year. Dry periods lasting several weeks do occur, especially in autumn when long periods of pleasant, mild weather are most common. There is considerable variability in total monthly precipitation amounts from year to year. Hurricanes passing near Richmond have produced record rainfalls. In 1955, three hurricanes brought record rainfall to Richmond within a six-week period. The most noteworthy of these were hurricanes Connie and Diane, which brought heavy rains five days apart. (NOAA. 2016a)

Norfolk, Virginia, is located near the coast and the southern border of the state. It is almost surrounded by water, with the Chesapeake Bay immediately to the north, Hampton Roads harbor to the west, and the Atlantic Ocean only 18 miles to the east. It is traversed by numerous rivers and waterways, and its average elevation AMSL is 13 feet (North American Vertical Datum of 1988 [NAVD88]). (FEMA. 2014; NOAA. 2016b) There are no nearby hilly areas, and the land is low and level throughout the city. The climate is generally marine. The geographic location of the city with respect to the principal storm tracks is especially favorable, being south of the average path of storms originating in the higher latitudes and north of the usual tracks of hurricanes and other tropical storms. The winters are usually mild, while the autumn and spring seasons usually are temperate. Summers, though warm and long, frequently are tempered by cool periods, often associated with northeasterly winds off the Atlantic. Temperatures of 100°F or more occur infrequently. Extreme cold waves seldom penetrate the area, and temperatures of 0°F or below are almost nonexistent. Winters pass, on occasion, without a measurable amount of snowfall. Most of the snowfall in Norfolk is light and generally melts within 24 hours. (NOAA. 2016b)

The SPS site is situated in a humid subtropical climate zone characterized by warm, humid summers with cool to mild winters. During the summer months, this region is dominated by tropical maritime air masses, while during the winter season this area is in a transitional zone between polar continental and tropical maritime air masses. (SPS. 2016a, Section 2.2.2) For detailed meteorological information about SPS, please see Section E3.3.2. The climatic characteristics of the SPS site vicinity are influenced by the Atlantic Ocean, the Chesapeake Bay, and the Appalachian Mountains. The Atlantic Ocean has a moderating effect on the temperature for the SPS region, whereas the Appalachians act as a barrier to deflect Midwestern winter storms to the northeast of the SPS region. Winters are mild and short, spring and fall weather is usually very comfortable, and summers are long, hot, and humid, frequently tempered by cool periods associated with east and northeast winds off the Atlantic Ocean. (SPS. 2016a, Section 2.2.2)

E3.3.2 METEOROLOGY

E3.3.2.1 Wind Direction and Speed

The Bermuda High that develops off the coast of the United States during the spring and summer seasons results in a moist, southerly flow of air from the Caribbean and South Atlantic to the SPS region. During the fall and winter seasons, a semi-permanent high-pressure cell develops over the midwestern region of the United States, resulting in a prevailing northwesterly flow of air into the SPS region. (SPS. 2016a, Section 2.2.2)

Surface wind data for Richmond and Norfolk have been used to define long-term wind conditions for the region (Table E3.3-12).

For Richmond, the 41-year period of record data show the annual prevailing wind direction (i.e., the direction from which the wind blows most often) is from 200 degrees (i.e., from the south-southwest). Monthly prevailing winds are from the south-southwest during much of the spring and summer, from March through August. From September to November, and during February, the mean prevailing wind is northerly. The mean wind speed over the past 33-year period of record was 7.7 miles per hours (mph). A maximum three-second wind speed of 72 mph was recorded in September 2003. (NOAA. 2016a)

For Norfolk, the 48-year period of record data shows the annual prevailing wind direction is from 220 degrees (i.e., from the southwest). Monthly prevailing winds are from the south-southwest from April through August, and November and December. The remainder of the year, the winds are generally more northeasterly. The mean wind speed over the past 33-year period of record has been 9.6 mph. A maximum three-second wind speed of 74 mph was recorded in September 2003 and November 2009. (NOAA. 2016b)

Mean monthly wind speeds at the SPS site are provided in Table E3.2-2, based on a 30-year record (1987-2016) of measurements from the onsite meteorological monitoring system, lower level (34.7 feet above ground level). The average wind speed on an annual basis was 4.7 mph, indicating the site wind speeds are slightly lower than conditions at Richmond or Norfolk. The onsite monitoring data indicate the wind at SPS is from 220 degrees (i.e., from the southwest) much of the time during every month of the year. The onsite data also indicate that the wind is from the northwest for a significant period of time (especially during January and February), and from the east (especially in September). Annual wind rose diagrams for the period 2012-2016 are provided in Figures E3.3-1, E3.3-2, E3.3-3, E3.3-4, and E3.3-5. Based on SPS monitoring data as illustrated by wind rose presentation, the wind at SPS is affected by continental meteorological conditions for a greater percentage of time than those from the Atlantic Ocean.

E3.3.2.2 Temperature

Representative regional temperature averages and extremes are available from the Richmond and Norfolk monitoring stations. The local climate data summary for the Richmond area indicates that the mean daily maximum temperature is highest during July (88.5°F) and decreases to the seasonal low in January (47.4°F). The Richmond area experiences normal temperatures above 90°F approximately 42 days per year from April through October. The highest temperature of record (105°F) occurred in July 2010. The mean daily minimum temperature is above 50°F from May through September and is at its lowest in January, when the mean daily minimum decreases to 28.4°F. Record low temperatures less than 0°F have been recorded in December through February, with below freezing temperatures normally occurring approximately 74 days per year from October through April. The lowest temperature of record in Richmond is -12°F, occurring in January 1940. (NOAA. 2016a) Monthly and annual daily mean temperature data and temperature extremes for the Richmond area are summarized in Table E3.3-3.

The local climate data summary for the Norfolk area indicates that the mean daily maximum temperature is highest during July (87.4°F) and decreases to its lowest in January (48.9°F). The Norfolk area experiences normal temperatures above 90°F for 27 days per year from April through October. The highest recorded temperature of record of 105°F occurred in July 2010. The mean daily minimum temperature is above 50°F from May through October and is 32.5°F in January. Record low temperatures less than 0°F have been recorded during January (-3°F in 1985). Normal temperatures below freezing occur approximately 42 days per year from November through April. (NOAA. 2016b) Monthly and annual daily mean temperature data and temperature extremes for the Norfolk area are summarized in Table E3.3-4.

Average temperatures in the area of SPS are 42°F in January and 79°F in July, with annual extremes of approximately 5°F low and 105°F high. The final environmental statement (FES) for Unit 1 presented temperature averages for the period from 1931-1960 for Richmond, Norfolk, Hopewell, and Newport News recording stations. (NRC. 1972, Section II.D.3, Table 2.1) The temperature averages for Richmond and Norfolk from the FES are included in Table E3.3-5.

For comparison of regional temperatures over the past several decades, Table E3.3-5 presents monthly and annual temperature averages from the Unit 1 FES for the period between 1931 and 1960 for Richmond and Norfolk. Table E3.3-5 also includes the most recent National Climatic Data Center (NCDC) data for 96-year and 71-year periods of record for Richmond and Norfolk, respectively. While the Richmond average monthly temperatures since the SPS initial license renewal have fluctuated above and below historic averages, the annual average temperatures have been at or below the annual average temperature cited in the FES (59.9°F) for 11 of the past 15 years since 2002 (NRC. 1972, Table 2.1; NOAA. 2016a). By contrast, records for Norfolk indicate the annual average temperatures have exceeded the 60.1°F average annual temperature cited in the FES for 13 of the past 15 years (NRC. 1972, Table 2.1; NOAA. 2016b).

Review of data collected from the SPS Units 1 and 2 meteorological tower monitoring stations for the period of record from 1987-2016 indicates that the mean monthly temperature at the site is highest during July (78.1°F) and decreases to the lowest in January (40.2°F). The SPS site experiences temperatures above 90°F from April through October. The highest recorded temperature of record of 103°F occurred in July 2010. Temperatures less than 0°F were not recorded at the site between 1987-2016, but below freezing temperatures may occur from November through mid-April. The lowest temperature (2°F) for the past 30 years was recorded in January 1994.

The monthly average temperatures, and record minimum and maximum temperatures (°F) recorded by the SPS meteorological monitoring system at the site for the past 30 years (1987-2016) are provided in Table E3.3-6.

E3.3.2.3 Precipitation

The summer months from July through September are usually associated with the greatest amount of precipitation. The Bermuda High that develops off the coast of the United States during the spring and summer seasons results in a moist, southerly flow of air from the Caribbean and South Atlantic to the SPS region. During the fall and winter seasons, a semi-permanent high-pressure cell develops over the midwestern region of the United States, resulting in a prevailing northwesterly flow of air into the SPS region. (SPS. 2016a, Section 2.2.2)

The precipitation records of normal rainfall totals for the Richmond area indicate that precipitation of 0.01 inches or more occurs on average for 114 days per year, with seven or more days per month receiving at least some precipitation. The annual average precipitation in Richmond is 43.60 inches per year. Precipitation in the area is relatively well-distributed throughout the year with a mean of approximately three or more inches falling during most months. The seasonal maximum precipitation occurs during the summer (approximately 31% falling July through September), which also coincides with record events where more than six inches have occurred in a 24-hour period. There is considerable variability in total monthly amounts from year to year. While the summer months may experience significant rainfall events, those months can also be very dry. (NOAA. 2016a) The precipitation patterns for the Norfolk area are relatively similar to Richmond, although the Norfolk area receives approximately three inches more average total precipitation per year (NOAA. 2016b).

Normal regional precipitation and extremes are presented in Table E3.3-7. The maximum 24-hour precipitation total recorded at Richmond, 8.79 inches, occurred in August 1955. The maximum 24-hour rainfall total recorded at Norfolk, 11.40 inches, occurred in August 1964. Both Richmond and Norfolk received a record minimum monthly rainfall total (0.01 inches) in October 2000.

Although onsite rainfall measurement is not required by regulation, precipitation measurements are collected at ground level at the SPS Units 1 and 2 meteorology monitoring station on an hourly basis. Review of data collected for the period from 1987-2016 (with the exception of 2006 and 2007) indicates that the average monthly precipitation is highest in July (5.25 inches), August (4.30 inches), and September (4.26 inches) and is lowest in February (2.61 inches) (Table E3.3-8). The SPS data also indicate that while significant rainfall may occur in some years during June to September, these months can also receive very little precipitation, which is consistent with the precipitation of Richmond and Norfolk. Based on data collected over the 29-year period, the SPS site receives approximately 42 inches of precipitation per year, slightly less than either Richmond or Norfolk.

E3.3.2.4 Snow and Glaze

Snow is not common during winter in Tidewater Virginia (defined as the coastal plain of Virginia extending west to the fall line). A snowfall of 10 inches or more a month in Tidewater Virginia is expected to occur once every four years. In general, the total accumulated snow for Tidewater Virginia is approximately 10 inches each year. Precipitation occurs mostly as rain in the site area. (SPS. 2016a, Section 2.2.2) In the Richmond area, snow usually remains on the ground only one or two days at a time. Ice storms (freezing rain or glaze) are not uncommon, but they are seldom severe enough to do any considerable damage. A notable exception was the glaze storm of January 27-28, 1943, when nearly one inch of ice accumulation caused heavy damage to trees and overhead transmission lines. (NOAA. 2016a)

Richmond receives on average approximately 12.4 inches of snow per year. Since 1988, annual snowfall has ranged from as little as 0.8 inches (2007-2008) to 28 inches (2009-2010). (NOAA. 2016a) In Norfolk, winters pass, on occasion, without a measurable amount of snowfall. Most of the snowfall in Norfolk is light and generally melts within 24 hours. One exceptional period is when Norfolk received approximately 21.8 inches during the winter of 2010-2011 (NOAA. 2016b). Snowfall at the site is not recorded by SPS.

E3.3.2.5 Relative Humidity and Fog

The closest available fog data for the SPS region are from the NWS observation stations at Richmond International Airport, Richmond, and Norfolk International Airport, Norfolk, Virginia. The local climatological data for Richmond indicate an average of 22.5 days per year of heavy fog, while the data for Norfolk indicate an average of 13.8 days per year of heavy fog. Heavy fog is defined by the NWS as fog which reduces visibility to 0.25 mile or less. (NOAA. 2016a; NOAA. 2016b) The frequency of fog conditions reported at SPS is expected to be more similar to the annual average of heavy fog reported at Richmond than at Norfolk. SPS is in close proximity to the James River and has a rural environment, that is, land-use characteristics favorable for rapid radiant cooling of the ambient air with high specific humidity due to proximity of the river. The occurrence of heavy fog in the Norfolk area is less than in the Richmond area due to the moderating influence of the Atlantic Ocean. (SPS. 2016a, Section 2.2.1.1)

E3.3.2.6 Severe Weather

E3.3.2.6.1 Thunderstorms

Thunderstorms are occasional in the site region, with a normal occurrence of about 37 per year (NRC. 2002a, Section 2.2.4). Thunderstorms are frequent during the summer months, with the greatest occurrence during the month of July. Only a small percentage of the thunderstorms can be classified as severe. (SPS. 2016a, Section 2.2.2) The mean number of days with thunderstorms in each month for Richmond and Norfolk is provided in Table E3.3-9. Based on National Centers for Environmental Information (NCEI) records, Surry County, Virginia, has recorded 57 significant thunderstorm events since 1986 with most of the thunderstorms occurring in June, July, and August. (NCEI. 2017a)

E3.3.2.6.2 Tornadoes

During the period of January 1951 through December 1987, a total of 49 tornadoes on land were reported within a 50-mile radius of the SPS site, for an average of 1.3 tornadoes per year within this radius (SPS. 2016a, Section 2.2.2.1).

Based on NCEI records, a total of seven tornadoes have been recorded in Surry County, Virginia, since 1986. Two tornadoes occurred in August 1993, one in August 2004, one in May 2005, one in April 2008, one in April 2011, and one in February 2016. The highest tornado intensity observed in Surry County was EF3 in April 2011, while the rest were F0 (two tornadoes) or F1/EF1 (four tornadoes). (NCEI. 2017b)

E3.3.2.6.3 Hurricanes

On average, fewer than two hurricanes each year come close enough to the coast to affect Virginia. These hurricanes can bring torrential rainfall to Tidewater Virginia, and high tides that result in flood conditions for low-lying areas along the coast. Less than one hurricane per year actually crosses the state. (SPS. 2016a, Section 2.2.2)

Based on NCEI data, three hurricanes have occurred in Surry County since 1986, all in September. They include hurricane and tropical storm Dennis on September 1, 1999; hurricane Floyd on September 15, 1999; and hurricane Isabel on September 18, 2003. (NCEI. 2017c)

Hurricane and tropical storm Dennis produced one of the most prolonged periods of tropical cyclone-related conditions across eastern Virginia from August 30 through September 5, 1999. The highest sustained wind speed recorded was 52 mph at Langley Air Force Base. Other sustained wind speeds were 43 mph at the Norfolk International Airport, and 38 mph at Wallops Island. The highest gusts recorded were 76 mph at Langley Air Force Base, 53 mph at the Norfolk International Airport, and 46 mph at Wallops Island. A tornado rated F2 occurred in association with Dennis and touched down in the city of Hampton. (NCEI. 2017c)

Hurricane Floyd was a Category 1 hurricane as it crossed the Wakefield weather forecast office (WFO) county warning area. Sustained tropical storm force winds with gusts to near hurricane force occurred over the northwest quadrant of the storm over interior portions of northeastern North Carolina and along the coastal waters of the Wakefield marine area. The highest sustained wind speed recorded was 69 mph at Chesapeake Light. Other sustained wind speeds were 46 mph at Langley Air Force Base, 44 mph at Norfolk Naval Air Station, and 41 mph at Oceana Naval Air Station. The highest gusts recorded were 100 mph at the James River Bridge, 84 mph at Chesapeake Light, and 63 mph at Langley Air Force Base. Two confirmed tornadoes occurred in association with Floyd. (NCEI. 2017c)

Hurricane Isabel was a Category 1 hurricane as it crossed the Wakefield WFO county warning area. Sustained tropical storm-force winds with frequent gusts to hurricane force occurred over eastern Virginia, along and near the Chesapeake Bay and Atlantic coastal waters. Isabel made landfall near Ocracoke Inlet in North Carolina, tracked northwest into central Virginia just west of Richmond, then continued northward into western Pennsylvania. The highest sustained wind speed recorded was 72 mph at Chesapeake Light. Other sustained wind speeds were 69 mph at Gloucester Point, 61 mph at the Chesapeake Bay Bridge Tunnel, 58 mph at Norfolk Naval Air Station, 57 mph at Sewells Point, and 55 mph at Oceana Naval Air Station. The highest gusts recorded were 107 mph at Gwynns Island (Mathews County), 100 mph at Reedville (Middlesex County), 93 mph at Chesapeake Light, 91 mph at Gloucester Point, and 83 mph at Norfolk Naval Air Station. Only one confirmed tornado occurred in association with Isabel. (NCEI. 2017c)

E3.3.2.7 Atmospheric Stability

Atmospheric stability is a meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined by the difference in temperature between two heights. A seven-category atmospheric stability classification scheme (ranging from A for extremely unstable to G for extremely stable) based on temperature differences is set forth in the NRC's Regulatory Guide 1.23, Revision 1 (NRC. 2007). When the temperature decreases rapidly with height (typically during the day when the sun is heating the ground), the atmosphere is unstable and atmospheric dispersion is greater. Conversely, when temperature increases with height (typically during the night as a result of the radiative cooling of the ground), the atmosphere is stable and dispersion is more limited. The stability category between unstable and stable conditions is D (neutral), which would occur typically with higher wind speeds and/or higher cloud cover, irrespective of day or night. (NRC. 2013c, Section 2.9.1.4).

Based on a five-year average (2011-2015), onsite temperature difference data recorded at SPS indicate that stable atmospheric conditions (E to G) occurred about 49.5% of the time and unstable conditions (A to C) occurred about 18.8% of the time. The remaining observations (about 31.7%) fell into the neutral (D) category. Stability class distributions at SPS covering the period 2011-2015 are presented in Table E3.3-10.

E3.3.3 AIR QUALITY

E3.3.3.1 Clean Air Act Nonattainment Maintenance Areas

The Clean Air Act (CAA) was established in 1970 [42 USC § 7401 et seq.] to reduce air pollution nationwide. The EPA has developed primary and secondary National Ambient Air Quality Standards (NAAQS) under the provisions of the CAA. The EPA classifies air quality within an air quality control region (AQCR) according to whether the region meets or exceeds federal primary and secondary NAAQS. An AQCR or a portion of an AQCR may be classified as being in attainment or nonattainment, or it may be unclassified for each of the six criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$, fine particulates, and PM_{10}, coarse particulates), ozone, and sulfur dioxide (SO_2).

Emissions from non-radiological air pollution sources, including the criteria pollutants, are controlled through compliance with federal, state, and local regulations. Attainment areas are areas where the ambient levels of criteria air pollutants are designated as being "better than," "unclassifiable/attainment," or "cannot be classified or better than national standards" (depending on the pollutant and other factors).

The SPS site is in Surry County, Virginia, which is part of the State Capital Intrastate AQCR [40 CFR 81.145]. NUREG-1437, Supplement 6, noted that the Commonwealth of Virginia was designated as a nonattainment area for the one-hour ozone standard at the time of the initial license renewal environmental review for SPS (NRC. 2002a, Section 2.2.4). As of March 2017, all the counties (Charles City, Chesterfield, Dinwiddie, Goochland, Greensville, Hanover, Henrico, New Kent, Powhatan, Prince George, Surry, Sussex) within the State Capital Intrastate AQCR are now in attainment of the NAAQSs [40 CFR 81.347]. The nearest nonattainment area in the Commonwealth of Virginia is the Washington D.C. area (one-hour ozone, 1997, and eight-hour ozone standards, 2008) more than 80 miles northwest of the SPS site. Within the Commonwealth of Virginia, the EPA has designated two Class 1 areas where visibility is an important issue: James River Face Wilderness and Shenandoah National Park. The boundary of the closer of these areas, James River Face Wilderness, is more than 150 miles west of SPS [40 CFR 81.433].

E3.3.3.2 Air Emissions

SPS holds a Title V air emission permit due to its co-location with the fossil fuel-fired GNCTS. Although SPS may periodically utilize a portable auxiliary boiler or generator(s) during outages, nonradioactive gaseous effluents result primarily from testing of emergency generators and diesel pumps. Because SPS utilizes a once-through cooling system for condenser cooling purposes, there are no cooling towers or associated particulate emissions.

To protect Virginia's ambient air quality standards and ensure that impacts from facilities that generate air emissions are maintained at acceptable levels, the VDEQ governs the discharge of regulated pollutants by establishing specific conditions in the air permit. SPS and GNCTS are jointly permitted under a 2018 Title V Air Permit No. PRO50336 (VDEQ. 2018). Dominion is not aware of any issues that will significantly change the permit compliance of SPS. Permitted emission sources and conditions established in SPS' Air Permit No. PRO50336 are shown in Table E3.3-11. The emission unit numbers identified in Table E3.3-11 are those cited in the 2018 air permit (VDEQ. 2018).

While SPS and GNCTS are permitted jointly, they each have their own permitted emission sources, and each emissions unit at each station is regulated by the applicable regulations cited in the permit. In addition, the emissions reports submitted to the VDEQ each year contain tabular summary information related to each permitted emissions unit for each station, and criteria pollutants and applicable hazardous air pollutants are summed and reported for each station in the annual update and emission statement submitted to the VDEQ. Annual emissions for the five years from 2012-2016 are shown in Table E3.3-12. (Dominion. 2012; Dominion. 2013b; Dominion. 2014a; Dominion. 2015c; Dominion. 2016h)

As presented in Chapter 9, there have been no notices of violation or non-compliances associated with SPS air emissions over the five years from 2012-2016.

As presented in Section E2.3, no license renewal-related refurbishment or other license renewal-related construction activities have been identified. In addition, Dominion's review did not identify any future upgrade or replacement activities necessary for plant operations (e.g., diesel generators, diesel pumps) that would affect SPS's current air emissions program. Therefore, no increase or decrease of air emissions is expected over the proposed SLR operating term.

Studies have shown that the amount of ozone generated by even the largest industry transmission lines in operation (765 kV) would be insignificant (Dominion. 2013a, Section 4.3.1.1). As presented in Section E2.2.5, SPS's in-scope transmission lines are 230 and 500 kV. Therefore, the amount of ozone generated from in-scope transmission lines is anticipated to be minimal.

E3.3.4 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

No SPS data exist for mobile sources such as visitors and delivery vehicles. Therefore, Dominion calculated GHG emissions on those direct (stationary and portable combustion sources in Table E3.3-11 reported in Dominion's annual updates and air emissions statements) and indirect (workforce commuting) plant activities where information was readily available.

GHG emissions generated at SPS are presented in Table E3.3-13. Dominion uses mineral oil with oxidation inhibitors for efficient cooling and to promote fluid longevity in electrical equipment such as transformers, and does not purchase electrical equipment (e.g., transformers) filled with perfluorocarbon liquids. Therefore, there have been no perfluorocarbon additions to electrical equipment at SPS or the switchyard/substation over the five years from 2012-2016. As presented in Section E9.5.2.3, Dominion maintains a program to manage stationary refrigeration appliances at SPS to recycle, recapture, and reduce emissions of ozone-depleting substances and is in compliance with Section 608 of the CAA (Dominion. 2014b). Therefore, Dominion did not include potential emissions as result of leakage, servicing, repair, and disposal of refrigerant equipment in Table E3.3-13.

Table E3.3-1 Regional Wind Conditions

	Period of Record[a]	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Richmond, Virginia[b]														
Mean speed (mph)	33	8.3	8.6	9.1	9.0	7.8	7.3	6.9	6.4	6.8	6.9	7.5	7.6	7.7
Prevailing direction (degrees from)	41	210	360	210	200	200	210	200	200	010	010	360	210	200
Max three-second speed (mph)	21	54	63	61	58	63	70	58	70	72	46	47	64	72
Max speed year of occurrence	—	2013	2008	2011	2011	2009	2015	2016	2011	2003	1996	2011	2011	Sept. 2003
Norfolk, Virginia[c]														
Mean speed (mph)	33	10.1	10.4	11.0	11.0	10.0	9.1	8.5	8.0	9.2	9.2	9.3	9.5	9.6
Prevailing direction (degrees from)	48	360	030	050	230	230	240	220	220	050	050	240	240	220
Max three-second speed (mph)	21	54	63	61	58	63	70	58	70	72	46	47	64	72
Max speed year of occurrence	—	2013	2008	2011	2011	2009	2015	2016	2011	2003	1996	2011	2011	Sept. 2003

a) In years.

b) (NOAA. 2016a)

c) (NOAA. 2016b)

Table E3.3-2 SPS Wind Conditions (1987-2016)

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Mean speed (mph)	5.1	5.4	5.6	5.6	4.8	4.4	4.0	3.8	4.1	4.2	4.5	4.8	4.7
Prevailing direction (degrees from)	320	310	090	220	220	220	220	220	90	220	220	220	220

Table E3.3-3 Regional Temperatures, Richmond, Virginia

	Period of Record[a]	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Mean daily maximum (^{o}F)	96	47.4	50.4	59.1	69.6	77.7	85.2	88.5	86.8	81.0	70.7	60.5	50.4	68.9
Highest daily maximum (^{o}F)	87	81	83	93	96	100	104	105	104	103	99	86	81	105
Year of occurrence	—	2002	1932	1938	1990	1941	1952	2010	2007	1954	1941	1993	1998	July 2010
Mean daily minimum (^{o}F)	96	28.4	29.9	36.9	45.7	55.1	63.7	68.3	67.0	60.4	48.2	38.7	31.2	47.8
Lowest daily minimum (^{o}F)	87	-12	-10	10	23	31	40	51	46	35	21	10	-1	-12
Year of occurrence	—	1940	1936	2009	1985	1956	1967	1965	1934	1974	1962	1933	1942	Jan. 1940

a. In years.

(NOAA. 2016a)

Table E3.3-4 Regional Temperatures, Norfolk, Virginia

	Period of Record[a]	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Mean daily maximum (^{o}F)	71	48.9	50.7	58.3	68.1	76.0	83.5	87.4	85.6	80.0	70.4	61.3	52.7	68.6
Highest daily maximum (^{o}F)	68	80	82	88	97	100	101	105	104	99	95	86	82	105
Year of occurrence	—	2002	2012	1990	1960	1991	2008	2010	1980	2014	1954	1974	2015	July 2010
Mean daily minimum (^{o}F)	71	32.5	33.4	40.1	48.6	57.8	66.1	71.1	70.2	64.9	53.7	43.7	36.0	51.5
Lowest daily minimum (^{o}F)	68	-3	8	18	28	36	45	54	49	45	27	20	7	-3
Year of occurrence	—	1985	1965	2015	1982	1966	1967	1979	1982	1967	1976	1950	1983	Jan 1985

a. In years.

(NOAA. 2016b)

Table E3.3-5 Regional Temperature Historic Comparison (°F)

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Richmond[a] (1931–1960)	38.7	40.1	46.6	57.0	66.4	74.4	77.9	76.2	70.2	58.9	48.4	39.5	59.9
Richmond[b] (1920–2016)	37.9	40.1	48.0	57.7	66.4	74.6	78.4	76.9	70.7	59.4	49.6	40.8	58.4
Norfolk[a] (1931–1960)	42.1	42.8	49.0	57.7	67.1	75.0	78.8	77.7	72.6	62.4	52.2	43.8	60.1
Norfolk[c] (1945–2016)	40.7	42.0	49.2	58.4	66.9	75.0	79.3	77.9	72.4	62.1	52.5	44.4	60.1

a. (NRC. 1972)

b. (NOAA. 2016a)

c. (NOAA. 2016b)

Table E3.3-6 SPS Site Temperatures 1987–2016

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Monthly average (^{o}F)[a]	40.2	41.8	49.1	58.3	66.1	74.2	78.1	76.6	70.9	60.3	51.3	43.8	59.3
Highest daily maximum (^{o}F)	79.1	80.5	85.8	92.6	95.8	98.3	102.9	98.6	95.0	90.1	82.8	79.7	102.9
Year of occurrence	2002	1997	1998	2002	1996	2010	2010	2007	2014	2007	1993	1998	July 2010
Lowest daily minimum (^{o}F)	1.6	7.2	16.3	29.1	37.6	46.4	54.9	54.6	46.9	33.5	24.4	7.0	1.6
Year of occurrence	1994	2015	2009	1992	1989	1996	2001	1994	1991	1988	2000	1989	1994

a. Calculated average of all temperature measurements for each month and of all measurements for the period 1987–2016.

Table E3.3-7 Regional Precipitation

	Period of Record[a]	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Richmond[b] NOAA defines "normal" as over a 30-year period.														
Normal monthly precipitation (inches)	30	3.04	2.76	4.04	3.27	3.78	3.93	4.51	4.66	4.13	2.98	3.24	3.26	43.60
Maximum monthly precipitation (inches)	79	7.97	5.97	8.65	8.32	9.79	9.93	18.87	16.30	16.60	9.39	9.60	8.16	18.87
Year occurred		1978	1979	1984	2008	2016	2004	1945	2004	1999	1971	2009	2009	1945
Maximum 24-hour (inches)	79	3.31	2.67	3.43	3.54	3.40	4.61	5.73	8.79	6.52	6.50	4.07	3.16	8.79
Year occurred		1962	1979	1992	2008	2003	1963	1969	1955	1999	1961	1956	1958	1955
Minimum monthly precipitation (inches)	79	0.64	0.48	0.20	0.64	0.87	0.38	0.51	0.52	0.08	0.01	0.17	0.40	0.01
Year occurred		1981	1978	2006	1963	1965	1980	1983	1943	2005	2000		1980	2000
Norfolk[c] NOAA defines "normal" as over a 30-year period.														
Normal monthly precipitation (inches)	30	3.40	3.12	3.68	3.41	3.41	4.26	5.14	5.52	4.76	3.42	3.15	3.26	46.53
Maximum monthly precipitation (inches)	68	9.93	8.21	10.36	7.25	10.12	10.53	14.37	14.32	13.80	10.12	9.20	7.57	14.37
Year occurred		1987	1998	1994	1984	1979	2006	1994	1992	1979	1971	2009	2009	July 1994
Maximum 24-hour (inches)	68	3.80	4.78	4.02	5.90	3.41	6.85	6.98	11.40	8.93	9.24	5.01	2.80	11.40
Year occurred		1967	1998	1994	1991	1980	1963	2016	1964	2006	2016	2009	2008	Aug 1964
Minimum monthly precipitation (inches)	68	1.05	0.65	0.52	0.43	0.64	0.37	0.36	0.67	0.26	0.01	0.08	0.67	0.01
Year occurred		1981	2006	2006	1985	1991	1954	1993	2008	1986	2000	2001	1988	Oct 2000

a. In years.

b. (NOAA. 2016a)

c. (NOAA. 2016b)

Table E3.3-8 SPS Precipitation Records (1987–2016)

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Normal* monthly precipitation (inches)	3.00	2.61	3.45	3.08	3.65	3.74	5.25	4.30	4.26	3.09	2.76	2.80	41.98
Maximum monthly precipitation (inches)	7.12	5.54	7.91	7.61	7.27	10.38	13.57	12.98	16.35	7.24	7.94	6.96	16.35
Year occurred	1987	1998	1994	2014	1988	2015	2012	2004	1999	2012	2009	2009	1999
Minimum monthly precipitation (inches)	0.37	0.85	0.00	0.87	0.77	1.28	0.66	0.79	0.06	0.00	0.24	0.62	0.00
Year occurred	2004	2000	2005	2010	1991	1997	1993	1995	2016	2000	2001	1988	2000, 2005

*NOAA defines “normal” as over a 30-year period.

Table E3.3-9 Regional Thunderstorms

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Richmond[a]													
Mean days per month	0.3	0.3	1.5	2.3	5.0	6.4	8.2	6.0	2.7	0.8	0.6	0.2	34.3
Norfolk[b]													
Mean days per month	0.3	0.5	1.7	2.5	4.6	5.3	7.9	6.3	2.6	1.1	0.5	0.3	33.6

a. (NOAA. 2016a)

b. (NOAA. 2016b)

Table E3.3-10 SPS Stability Class Distributions

Percent Frequency of Occurrence by Pasquill Stability Class[(a)]							
Year	**A**	**B**	**C**	**D**	**E**	**F**	**G**
2011	9.22	3.85	4.46	31.64	33.85	9.27	7.71
2012	9.96	4.22	4.25	29.99	33.13	9.90	8.35
2013	9.60	3.79	4.48	32.31	34.43	8.89	6.49
2014	11.97	4.63	5.29	30.76	30.85	9.85	6.65
2015	9.17	3.92	4.64	35.41	29.32	9.17	8.37
2011–2015	**10.07**	**4.14**	**4.62**	**31.67**	**32.63**	**9.44**	**7.43**

a. Classes are as follows (NRC. 2007):

Class A: Extremely unstable

Class B: Moderately unstable

Class C: Slightly unstable

Class D: Neutral

Class E: Slightly stable

Class F: Moderately stable

Class G: Extremely stable

Table E3.3-11 Permitted Air Emission Sources

Emission Source	Description	Capacity Rating	Permit Conditions
ES – 101[a]	Unit A Babcock & Wilcox oil-fired boiler	90.6 mmBtu/hr	PM (TSP) – 0.28 lbs/mmBtu PM_{10} – 0.28 lbs/mmBtu SO_2 – 478.4 lbs/hour Opacity – <20%; except during one six-minute period of not more than 60% opacity (Condition III.A.2).
ES – 102[a]	Unit B Babcock & Wilcox oil-fired boiler	90.6 mmBtu/hr	
IS – 101[b]	Caterpillar 3600 Series diesel backup electric generator	4640 HP	To be used only for providing power at SPS during interruption of service from the normal power supplier and for periodic testing. Opacity – Existing engines shall not exceed 20% opacity, except during one six-minute period in any one hour in which visible emissions shall not exceed 60% opacity.
IS – 102 a[b]	Backup electric generator	3950 HP	SO_2 – 2.64 lbs/mmBtu NOx Opacity (<20%)

Table E3.3-11 Permitted Air Emission Sources

IS – 102 b[b]	Backup electric generator	3950 HP	Emissions from the engines and fire pump shall be controlled by proper operation and maintenance of the units. The permittee shall follow manufacturer's recommendations at a minimum. The emergency engines and fire pump are designed to use #2 fuel oil. Opacity – Existing engines shall not exceed 20 percent opacity, except during one six-minute period in any one hour in which visible emissions shall not exceed 60 percent opacity.
IS – 102 c[b]	Backup electric generator	3950 HP	
IS-103[b]	Emergency diesel generator (Administrative Building) (pre-2006)	465 HP	
IS-104 a[b]	Detroit emergency diesel-powered water pump (pre-2006)	261 HP	
IS-104 b[b]	Detroit emergency diesel-powered water pump (pre-2006)	261 HP	
IS-104 c[b]	Detroit emergency diesel-powered water pump (pre-2006)	261 HP	
IS-105[b]	ISFSI emergency diesel generator (pre-2006)	250 HP	
IS-107 a[b]	Backup air compressor (1970) (Lister diesels for EDG IA) (pre-2006)	5 HP	
IS-107 b[b]	Backup air compressor (1970) (Lister diesels for EDG IA) (pre-2006)	5 HP	
IS-107 c[b]	Backup air compressor (1970) (Lister diesels for EDG IA) (pre-2006)	5 HP	
IS-128[b]	FAP Caterpillar Olympian emergency diesel generator (pre-2006)	72 HP	
IS-130[b]	Backup diesel air compressor (Station IA) (post 2012)	560 HP	
ES-103[b]	Cummins diesel backup electric generator (CAS) (2011)	402 HP	
IS-108[b]	Cummins fire pump (2010)	332 HP	
ES-131[b]	Garage emergency diesel generator– Allis-Chalmers (pre-2006)	162 HP	
IS-132[a]	Propane emergency generator (pre-2006)	65 HP	None
IS-135[a]	Propane emergency generator (pre-2006)	45 HP	None

(Dominion. 2015b; VDEQ. 2018)

a. Also subject to 40 CFR Part 63, Subpart JJJJJJ: National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources.

Note: Dominion annual updates and emissions statements from 2011–2014 group the three emergency generators and nine emergency generators listed in the table above for reporting purposes.

b. Stationary combustion sources are also subject to 40 CFR Part 63, Subpart ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.

Table E3.3-12 SPS Reported Annual Air Emissions Summary, 2011–2015

SPS Annual Emissions (tons/year)						
Year	**SO_2**	**NO_X**	**CO**	**PM_{10}**	**VOCs**	**HAPs**
2011	0.33	10.91	2.86	0.30	0.30	NA
2012	0.15	8.17	2.14	0.18	0.25	NA
2013	0.17	8.31	2.15	0.21	0.28	NA
2014	0.17	7.01	1.79	0.20	0.26	NA
2015	0.12	12.33	3.16	0.64	0.58	NA
2016	0.11	6.57	1.62	0.21	0.28	0

(Dominion. 2012; Dominion. 2013b; Dominion. 2014a; Dominion. 2015c; Dominion. 2016i)

Table E3.3-13 SPS Annual Greenhouse Gas Emissions Inventory Summary, 2011–2015

Carbon Dioxide Equivalent (CO_2e) Emissions, Metric Tons[a]					
Emission Source	**2011**	**2012**	**2013**	**2014**	**2015**
Combustion sources[a]	1,243.5	386.0	376.5	306.2	4,198.8
Workforce commuting[b]	4,294	4,294	4,294	4,294	4,294
TOTAL	**5,537.5**	**4,680.0**	**4,670.5**	**4,600.2**	**8,492.8**

(Dominion. 2012; Dominion. 2013b; Dominion. 2014a; Dominion. 2015c; Dominion. 2016h)

a. GHG calculated emissions are based on the following:

- Fuel usage for combustion sources shown in Dominion annual updates and emissions statements for 2011-2015 indicated by the referenced sources of Table E3.3-12; EPA 2015 Table 1 GHG Emission Factors for Greenhouse Gas Inventories - Distillate Fuel Oil No. 2; and 40 CFR 98 Table A-1 to Subpart A Global Warming Potentials.
- Workforce commuting calculations are based on:

  1. Statistical information from the USCB indicates that 3.6% of Virginia workers in the transportation and warehouse and utilities industry carpool to work (USCB. 2015). The number of current SPS employees is 941. Utilizing the 3.6% USCB carpool statistic, a value of 907 passenger vehicles per day was utilized.
  2. The EPA's greenhouse gas equivalencies calculator shows that the CO_2e/vehicle/year was 4,294 metric tons for 907 vehicles (EPA. 2017).
  3. O_2 has a global warming potential (100-year time horizon) of "1" based on Table A-1 to Subpart A of 40 CFR 98.
  4. 4,294 metric tons CO_2/yr x 1CO_2eGWP = 4,294 CO_2e/year.

Figure E3.3-1 2012 SPS Wind Rose

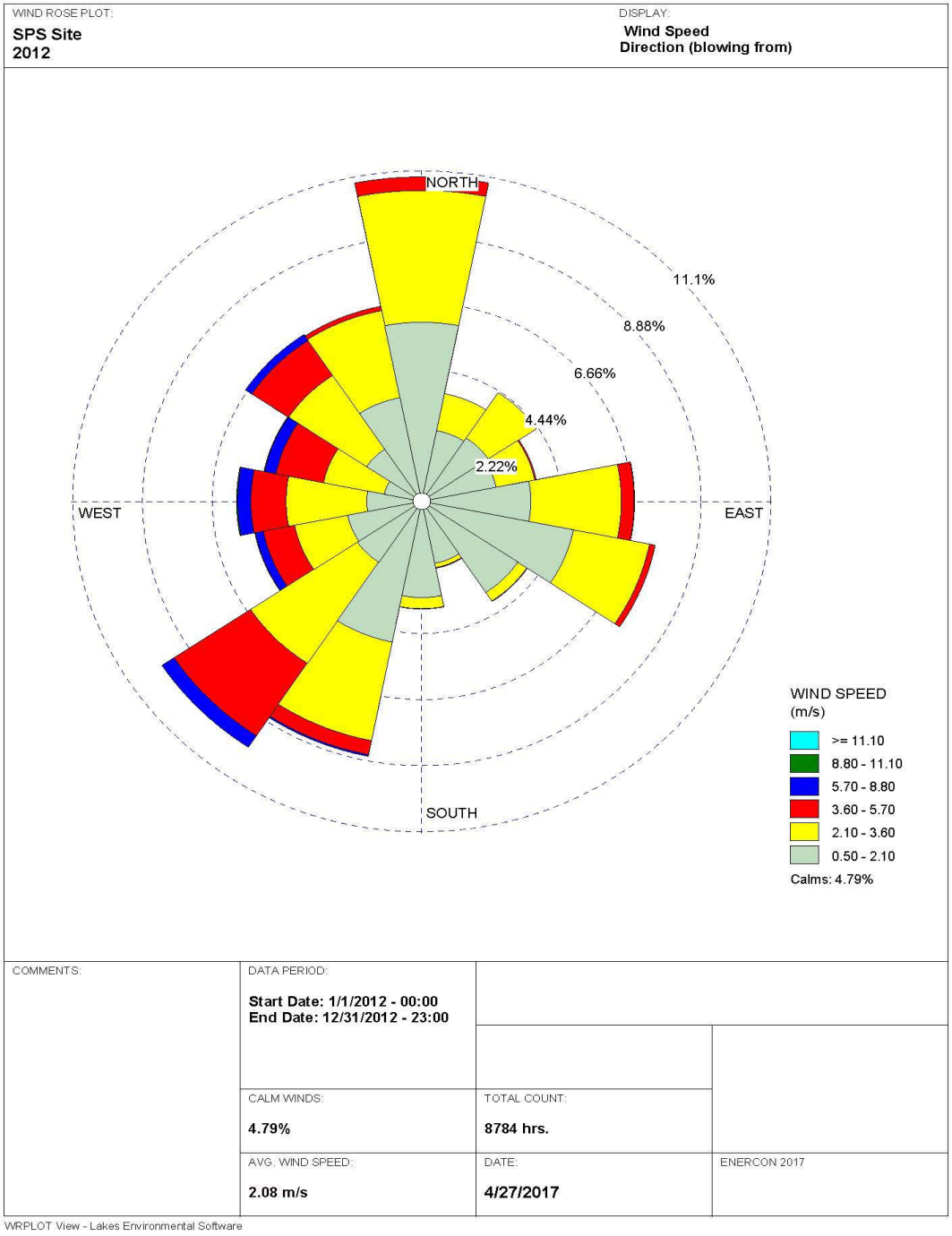


Figure E3.3-2 2013 SPS Wind Rose

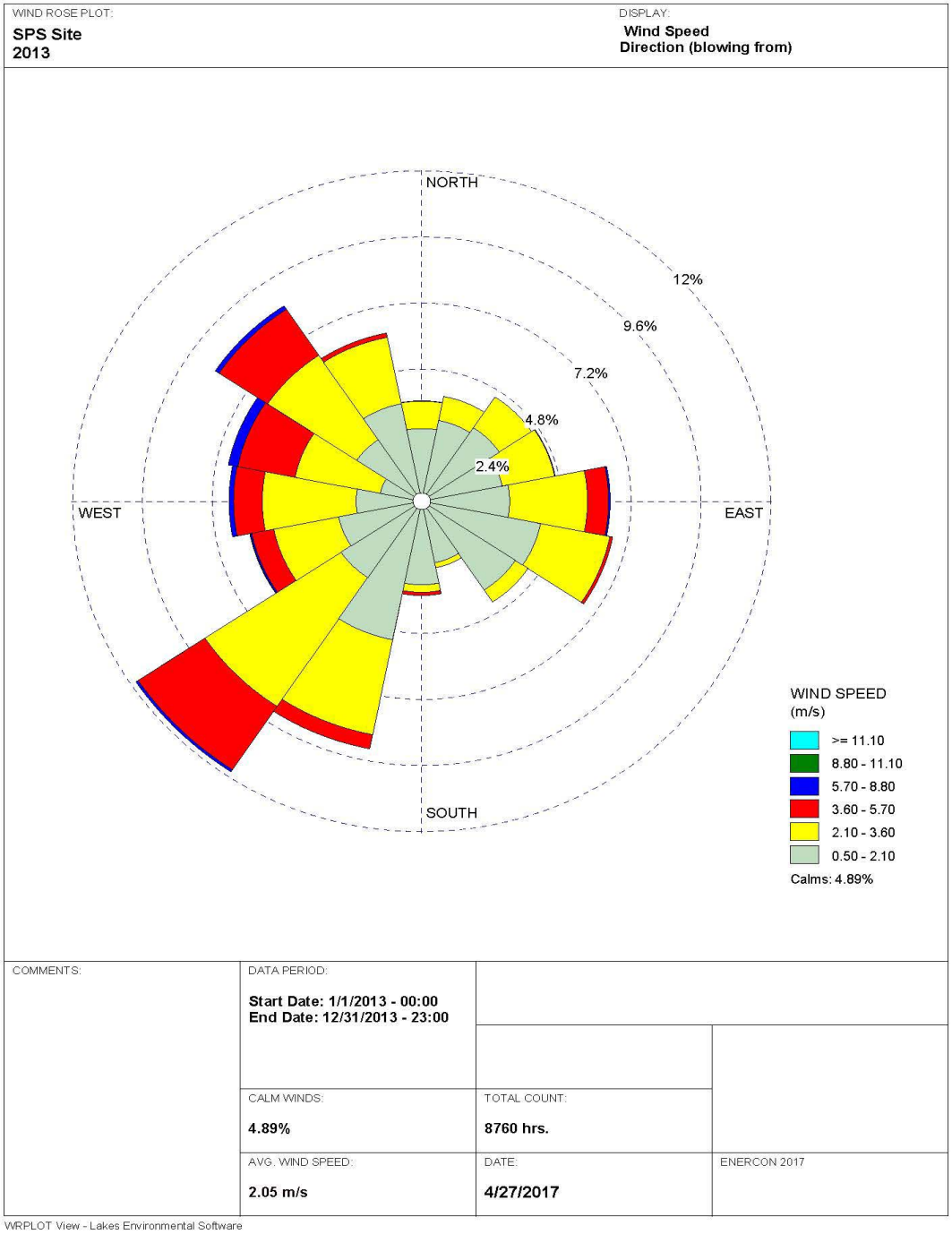


Figure E3.3-3 2014 SPS Wind Rose

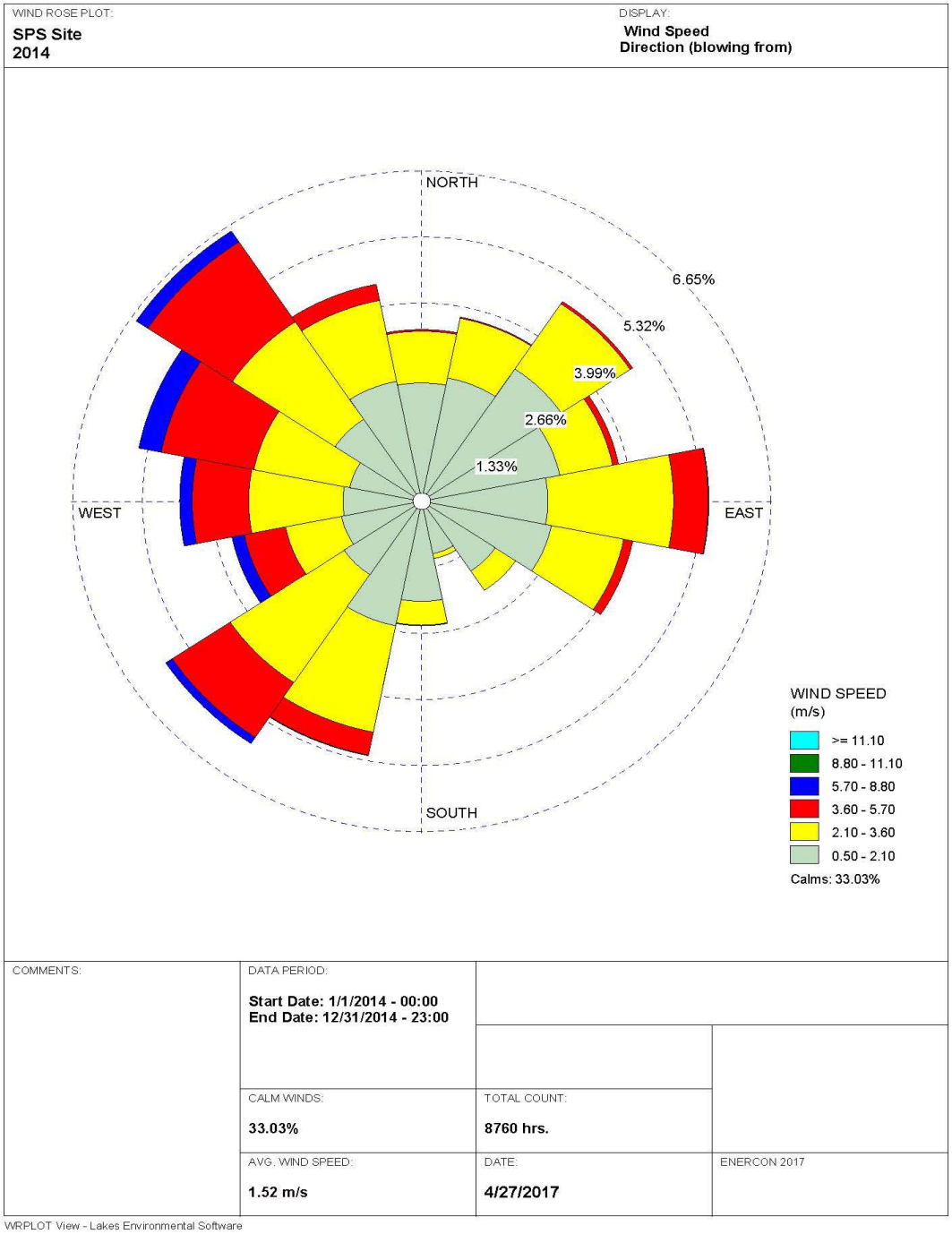


Figure E3.3-4 2015 SPS Wind Rose

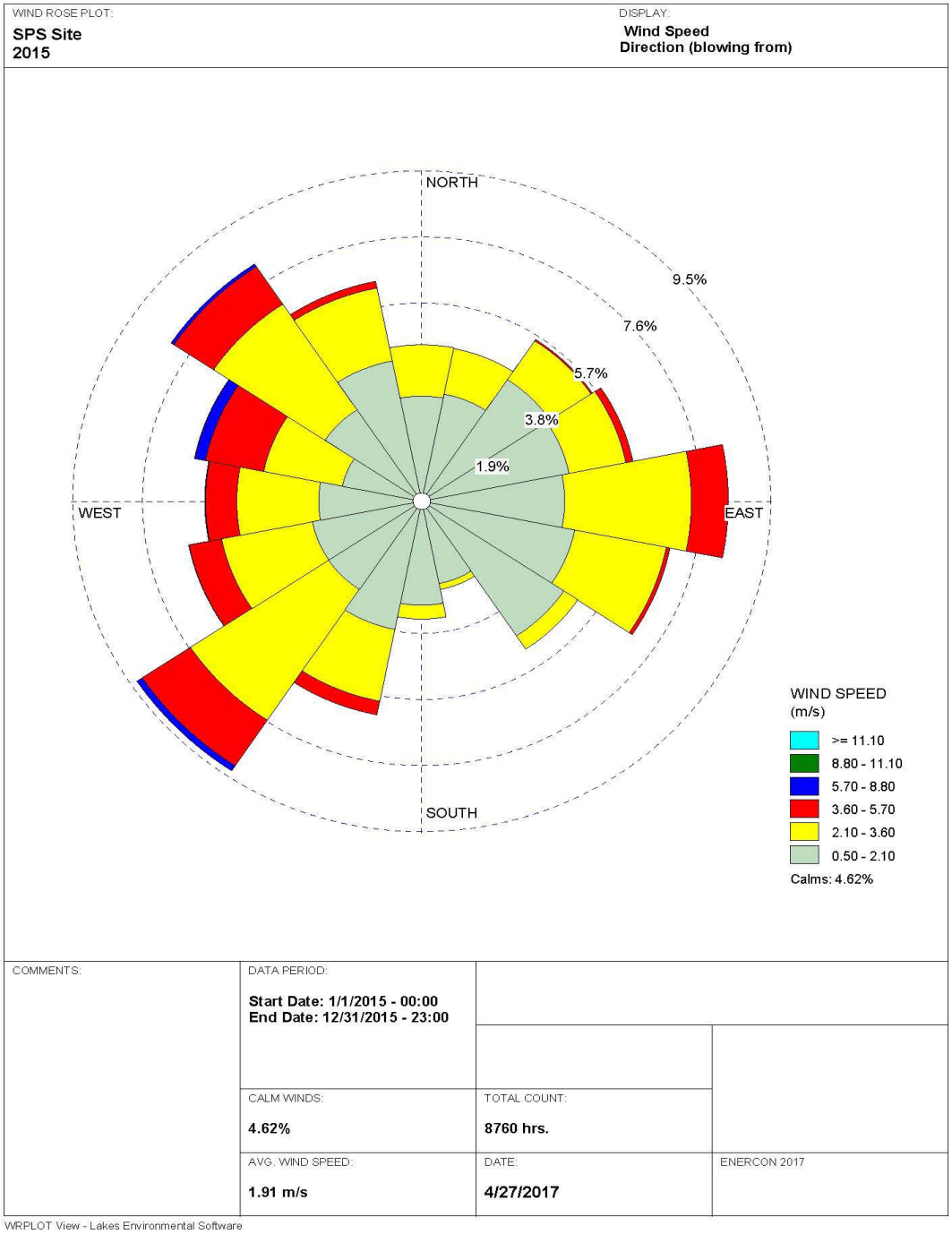
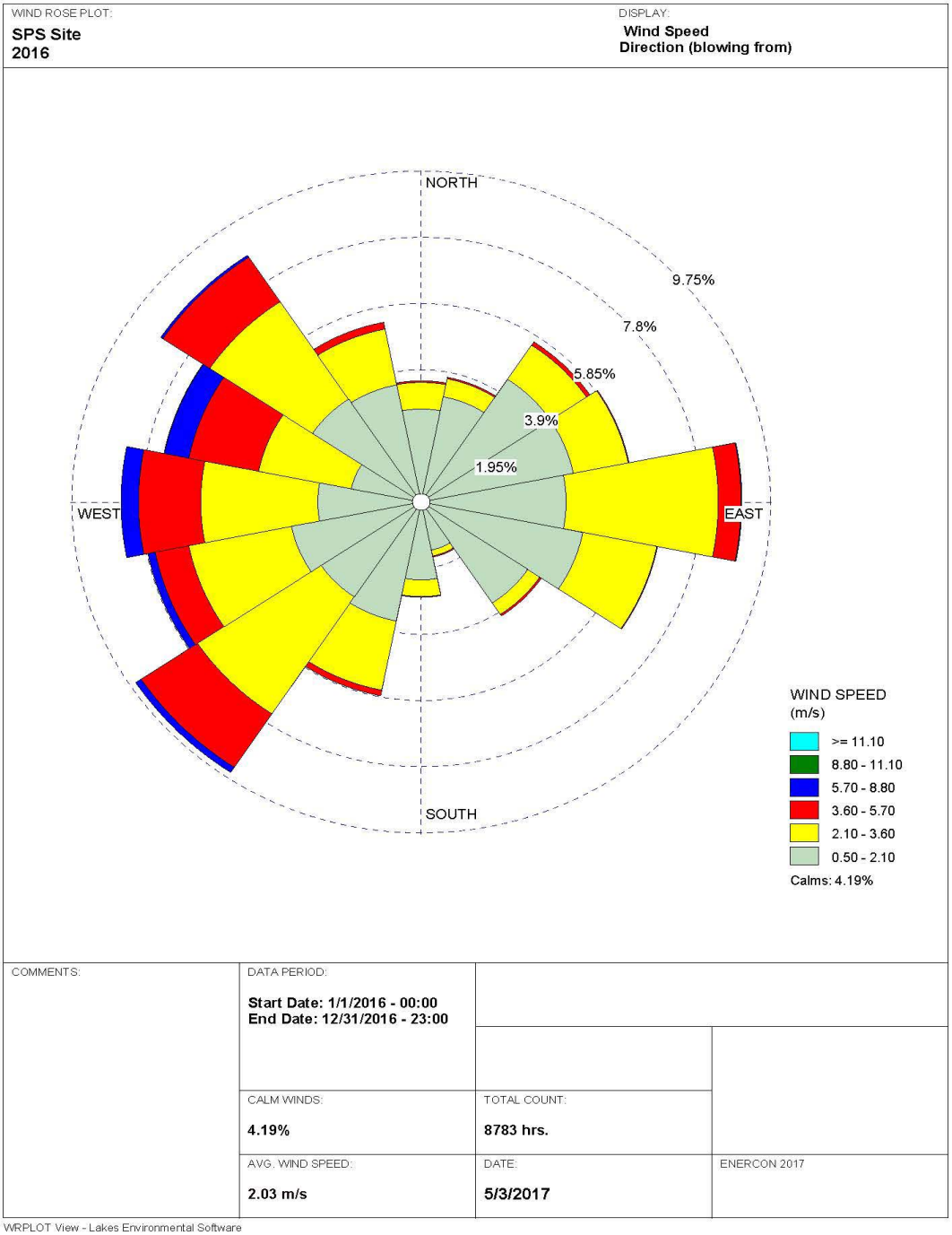


Figure E3.3-5 2016 SPS Wind Rose



E3.4 NOISE

Noise is produced at SPS from industrial plant operations and site activities. SPS has been granted an industrial area land use designation by Surry County and is regulated as an M-2 general industrial zoning district. Areas adjacent to SPS are identified by a land use designation of an A-R zoning district. (SC. 2016a) The Surry County zoning ordinance does not include established maximum permissible sound limits for receiving land use categories, but provisions assert that buffer zones are necessary to ensure the protection and well-being of neighboring areas. The ordinance requires at least a 25-foot buffer yard with small evergreen trees and one row of evergreen shrubs when property zoned as A-R is located adjacent to property zoned as M-2. (SC. 2016b)

The nearest residence is located approximately 0.4 miles west-southwest from the SPS industrial area (SPS. 2017b), which exceeds the buffer distance established by the Surry County zoning ordinance for M-2 zoning districts. While noise monitoring and surveys have been conducted on the SPS site by Dominion, noise studies conducted by Dominion within the SPS boundary and beyond the property boundary are not available.

Industrial background noise at SPS is generally from turbine generators, transformers, loudspeakers, transmission lines, firing range, and the main steam safety valves. The loudest sound emitted from SPS plant systems would be from a limited-duration steam release to the atmosphere through the main steam safety valves or steam generator power-operated relief valves, located adjacent to Units 1 and 2 reactor buildings (SPS. 2016a, Section 9.10.4.13). Sound from a main steam safety valve is observed only when steam pressure is released from the valve on an intermittent basis. SPS Units 1 and 2 main steam safety valves are located approximately 1,775 feet and 1,850 feet, respectively, from the closest point of the property boundary in the southwest direction. The point of the property boundary closest to the firing range is approximately 575 feet northwest and is bordered by the James River (Figure E3.1-1).

Because SPS is located in a rural area (away from urban areas), it is unlikely that noise levels from SPS would affect offsite residences. While SPS has received noise complaints on an intermittent basis over the years, they are generally related to the following:

- Increase in vehicular traffic on county roads and on the Jamestown-Scotland Ferry during outages;
- Emergency plan (EP) siren activation (calls received from the public are generally related to wondering why sirens have been activated versus noise from the sirens);
- Steam releases;
- Gaitronics communication announcements; and
- Weapons training from the SPS Security firing range.

Depending on the planned SPS activity or potential noise generated (e.g., EP siren activation), SPS may make a public announcement to local media beforehand so the public is aware of what is taking place at the plant. If an unplanned noise generation activity takes place and members of the public contact the plant, then a station manager or department director would perform an outreach to the public and answer questions.

SPS monitors noise for levels at or above 85 dBA at and around the plant site for occupational and ambient effects on an as-needed basis. This would include scheduled activities such as outages, systems testing, and if equipment is modified or moved to another location. SPS or its subcontractors performs noise surveys/monitoring for these scheduled activities. SPS requires the utilization of hearing protection devices for noise levels above 85 dBA and double hearing protection for noise levels above 105 dBA. Noise levels at SPS are anticipated to remain the same as under current operating conditions during the proposed SLR operating term.

E3.5 GEOLOGIC ENVIRONMENT

E3.5.1 REGIONAL GEOLOGY

East of the Blue Ridge Mountains, Virginia is described as two broad physiographic units, the Piedmont Province and the Coastal Plain Province. (SPS. 2016a, Section 2.4.2.1)

The Piedmont is essentially a bedrock plateau. Surface deposits are primarily residual soils derived from the weathering of underlying bedrocks, which are basically a complex of meta-sediments of pre-Cambrian and early Paleozoic age, with some areas of sedimentary and igneous rocks of Triassic age. (SPS. 2016a, Section 2.4.2.1)

The boundary between the Piedmont and Coastal Plain provinces, termed the fall line, extends from New Jersey to Alabama and passes through Richmond and Petersburg, Virginia. Slow regional downwarping along the axis of the fall line is reported beginning in early Cretaceous time, about 120 million years ago, and continued through Tertiary time. (SPS. 2016a, Section 2.4.2.1)

South and east of the fall line, the Piedmont surface was depressed to a gentle downward slope until, at Cape Henry, it is about 2,800 feet below sea level. This downwarped surface formed a base on which Cretaceous and later sediments have been deposited in a general wedge-shaped mass, with individual members also being wedge-shaped and thickening toward the southeast. (SPS. 2016a, Section 2.4.2.1)

Based on regional data, these sediments are undeformed. They show no evidence of metamorphism, and even the earliest are still essentially clays and sands. All available evidence indicates that, since early Cretaceous time, the crystalline basement beneath the coastal plain has been tectonically dormant. No faults are known or suspected at the SPS site or in the vicinity of the SPS site. (SPS. 2016a, Section 2.4.2.1)

Located on Gravel Neck Peninsula, in Surry County, Virginia, the SPS site is located in the Coastal Plain Province, approximately halfway between the Atlantic Ocean and the fall line (Figure E3.5-1) (SPS. 2016a, Section 2.4.2.1).

In Virginia, the coastal plain has a stair-step character composed of a series of plains that are successively lower from west to east and are separated from one another by scarps. In the SPS site vicinity, four plains are recognized. From the highest to the lowest they are the 120-foot plain, 90-foot plain, 70-foot plain, and 45-foot plain. Also, three prominent scarps are present, the Surry scarp, the Peary scarp, and the Chippokes scarp. (SPS. 2016a, Section 2.4.2.1)

The surface of the coastal plain slopes gently in an east-to-southeast direction from about 200 feet AMSL at the fall line to sea level at the coast, and thence out under the ocean. The slope is not uniform, but is characterized by essentially flat areas separated by gentle slopes of a few degrees, which are termed scarps. The average slope in the region of the SPS site is about 1.5 feet per mile. (SPS. 2016a, Section 2.4.2.1)

During the progressive downwarping of the crystalline basement of the coastal plain, various portions of the area were above, at, or below sea level, with alternating periods of marine and continental deposition occurring (SPS. 2016a, Section 2.4.2.1). Columnar geologic sections for the site area are shown in Figure E3.5-3.

The morphologic boundaries of Gravel Neck Peninsula are the James River on the western, northern, and eastern sides, and the Chippokes scarp to the south. This scarp is about five miles long, lies in a southeast-northwest direction, is 45-50 feet in height, and has a surface sloping downward toward the northeast at about three degrees. The site area is flat and featureless with an average elevation of about 30 feet AMSL. In the immediate SPS site area, there are no surface features indicative of actual or potential localized subsidence or landslides. There is no history of surface mining, withdrawal of large quantities of fluids such as petroleum, or other human activity which would cause settlement or ground disturbance. Heavy vegetation covers 48% of the SPS site. (SPS. 2016a, Section 2.4.2.1)

E3.5.2 SITE GEOLOGY

In the SPS site area, surface deposits are sediments of the Norfolk Estuarine Formation of Pleistocene age, extending to depths of about 50-80 feet. The upper 20-35 feet of the Norfolk Formation consist of layers of brown and mottled brown sand, silty sand, and organic and inorganic silts and clays. Interspersed are thin lenses of iron-oxide cemented sands. The lower part of the formation consists of layers of gray sand, silty sand, and organic and inorganic silts and clays, many of which contain decayed vegetation and shell fragments. These most probably were

deposited under estuarine, lagoonal, and swamp conditions. The Norfolk Formation was deposited upon an erosional surface of the Yorktown Formation during the late Pleistocene when the sea level rose to approximately 45 feet AMSL. At the end of the Pleistocene, the sea receded. Erosion of the Norfolk sediments is continuing today in the site area. It is accompanied by deposition of recent alluvial deposits in stream valleys, marshes, and lagoons. (SPS. 2016a, Section 2.4.2.1) Figure E3.5-4 shows the distribution of surface deposits surrounding the site.

The Norfolk Formation unconformably overlies the Chesapeake Group of Miocene age. Upper Miocene, Pliocene, and early Pleistocene deposits that may have existed have been removed by erosion. Within the site area, the surface of the Miocene sediments, estimated to be 240 feet thick, is found at elevations varying from -16 to -47 feet AMSL. Consolidation tests made on samples from the Miocene deposits showed them to be overconsolidated by 4-5 tons per square foot in excess of existing overburden pressures. This suggests that 150-200 feet of material previously lying above the present Miocene was removed by erosion before deposition of the Pleistocene deposits. (SPS. 2016a, Section 2.4.2.1)

The Chesapeake Group is of Miocene age and in the SPS site area consists of compact, very stiff, tough clays that are green to dark gray in color, with occasional compact sand and silt members. Shell fragments are common. These soils are strong and stable, with moderate to high shearing strengths. Underlying the Miocene sediments are Eocene, Paleocene, and Cretaceous sediments. These are estimated to be about 45, 55, and 800 feet thick, respectively, based on wells drilled in the general area. From seismic investigations about two miles southeast of the site, crystalline bedrock is estimated to be at a depth of about 1,300 feet. (SPS. 2016a, Section 2.4.2.1)

E3.5.3 SOILS

E3.5.3.1 Onsite Soils and Geology

Prior to excavation, the ground surface in the SPS site area was generally level at about 34 feet AMSL, except for a minor erosional channel with gentle side slopes which entered the area from the west. Adjacent to the station, the bottom of this depression was at about 24 feet AMSL. The discharge canal follows this depression to minimize excavation and disturbance of vegetation. (SPS. 2016a, Section 2.4.9)

The site is essentially flat, except immediately at the river banks and along the north property line, where it slopes gently down to the lowlands of the game preserve. The nearest river bank is approximately 1,800 feet west of the station, where the banks are about 5-25 feet high above the beach. The beach has very gentle slopes, and the river bottom offshore is nearly flat, reaching a six-foot depth about 1,000 feet offshore. (SPS. 2016a, Section 2.4.9)

Finished yard grade in the station area is 26.5 feet AMSL. From ground surface to approximately -38 feet AMSL is a series of alternating strata of clay and sands of Pleistocene age. These lie unconformably on Miocene clays that have in their upper portion a series of thin sand lenses. These thin Miocene sand lenses were found intermittently between about -55 feet AMSL and -62 feet AMSL, and were individually only a few inches to a foot or so in thickness. (SPS. 2016a, Section 2.4.3.1) Figure E3.1-2 shows the topography of the SPS property.

Soil units that occur within the SPS property boundary are described in detail in Table E3.5-1 and shown in Figure E3.5-5, and include the following (USDA. 2016c):

- Ackwater silt loam, 0-2% slopes
- Ackwater silt loam, 2-6% slopes
- Chickahominy silt loam, 0-2% slopes
- Nevarc-Remlik complex, 6-10% slopes
- Nevarc-Remlik complex, 25-65% slopes
- Newflat silt loam, 0-2% slopes
- Udorthents, loamy, 2-6% slopes
- Urban land

During construction, the SPS site was excavated to a generally level grade at an elevation of 26.5 feet AMSL. Temporary excavation for the buildings and containment structures was made to an elevation of approximately seven feet AMSL. After completion of construction, the area was backfilled with compacted soils to an elevation of 26.5 feet AMSL. (SPS. 2016a, Section 2.4.9)

E3.5.3.2 Erosion Potential

Because SPS has been operational since the early 1970s, stabilization measures are already in place to prevent erosion and sedimentation impacts to the site and vicinity. Based on information from the U.S. Department of Agriculture (USDA), all soil units listed in Table E3.5-1 that are subject to erosion have a slight to moderate erosion potential with the exception of the Nevarc-Remlik complex soils (25-65% slopes), which were rated very severe for slope erodibility (USDA. 2016c). The Nevarc-Remlik complex soils (25-65% slopes) are located in areas of steep to moderate slopes surrounding the plant industrial area and do not extend beneath any plant structures.

SPS maintains and implements a stormwater pollution prevention plan (SWPPP) that identifies potential sources of pollution reasonably expected to affect the quality of stormwater, such as erosion, and identifies BMPs that will be used to prevent or reduce the pollutants in stormwater discharges (SCS. 2016).

These practices, as they relate to erosion, include nonstructural preventive measures and source controls, as well as structural controls to prevent erosion or treat stormwater containing pollutants caused by erosion. In addition, any ground disturbance of one or more acres requires a construction stormwater permit to be obtained from the VDEQ. The construction stormwater permit specifies BMPs to reduce erosion caused by stormwater runoff, thereby minimizing the risk of pollution from soil erosion and sediment, and potentially from other pollutants that the stormwater may contact. Although no license renewal-related refurbishment or construction activities are planned, any such activities would continue to be managed in adherence to the SPS SWPPP.

E3.5.3.3 Prime Farmland Soils

USDA Natural Resources Conservation Service maps show areas of prime farmland surrounding and within the developed portion of the SPS property. Locations designated as prime farmlands are small, isolated patches north of the SPS and large areas located west of the developed portion of the SPS and underlying the GNCTS switchyard and ISFSI. (USDA. 2016c) These areas would most likely still be considered prime farmland even though they are part of the property owned by SPS. Even if areas of the property are designated prime farmland, SPS would not be subject to the Farmland Protection Policy Act (FPPA) because the act does not include federal permitting or licensing for activities on private or nonfederal lands. Soil units designated as prime farmland are identified in Table E3.5-1.

E3.5.4 SEISMIC HISTORY

The SPS site is situated in a region that has experienced only infrequent minor earthquake activity. The major earthquakes closest to the site, the Charleston earthquakes of 1886, had their epicenters about 350 miles southwest of the SPS site. No shock within 50 miles of the site has been large enough to cause structural damage. Because the region has been populated for more than 300 years, it is probable that any earthquake of moderate intensity, VI modified Mercalli (MM) or greater, would have been reported during this period. It is very likely that all earthquakes with intensities of V (MM) or greater within the last 200 years have been reported. (SPS. 2016a, Section 2.5.3.1)

The first record of earthquake occurrence in the vicinity of the site was made in the late 18th century. Since then, only about eight earthquakes with epicentral intensities of V (MM) or greater have been reported within 100 miles of the site. Intensity values refer to the MM scale, which is a means of indicating the relative size of an earthquake in terms of its perceptible effects. (SPS. 2016a, Section 2.5.3.1)

From 1774 through September 1995, 44 earthquakes of MM intensity V or greater have been reported within 200 miles of the SPS site. The largest of these are of epicentral intensity VIII. There has been no resultant structural damage at the site, and the associated acceleration is estimated to have been less than 0.05g. (SPS. 2016a, Section 2.5.3.1)

Epicentral locations of earthquakes from 1774 through December 2017 are listed in Table E3.5-2 and shown in Figure E3.5-5 as follows (SPS. 2016a, Table 2.5-2; USGS. 2017a, USGS. 2018):

- All earthquakes greater than magnitude 3M within a 50-mile radius of the site.
- Earthquakes of magnitude 4M or intensity V (MM) or greater between 50 and 200 miles of the site.

There are no known earthquake epicentral locations (greater than magnitude 3M) within a 30-mile radius of the site (SPS. 2016a, Section 2.5.3.1; USGS. 2017a). On August 23, 2011, an M 5.8 earthquake occurred near Mineral, Virginia, approximately 85 miles from the SPS site (Table E3.5-2). The magnitude of the Mineral earthquake mainshock has been reported as both M 5.8 and M 5.7. The Mineral earthquake resulted from reverse faulting at a relatively shallow depth, approximately 4.7 miles, in central Virginia. Seismicity in this region is attributed to the Central Virginia Seismic Zone (CVSZ). (Dominion. 2016i, Section 2.5.1.1.4.d.1) The CVSZ is an area of persistent, low-level seismicity in the Piedmont Province (Dominion. 2016i, Section 2.5.1.2.6.d.1). The August 23, 2011, Mineral earthquake was the largest historical seismic event in the CVSZ (Dominion. 2016j, Section 2.6.2.2.1). While the Mineral earthquake was felt at the SPS site, post-event walkdowns reported conditions satisfactory and no issues were noted.

Most of the nearest recorded earthquakes in the region have occurred in the Piedmont Province, west of the fall line. The closest approach of the fall line to the site is about 50 miles. These shocks are generally related to known faults in the Piedmont Province rocks. Several shocks have occurred in the Richmond, Virginia, area, which is on the fall line. This activity along the fall line is consistent with similar occurrences to both the north and south of the SPS site area. (SPS. 2016a, Section 2.5.3.1)

The U.S. Geological Survey's (USGS's) national seismic hazard map shows that the SPS site is in a region that has a 2% in 50 years (once in 2,500 years) probability of exceeding a peak ground acceleration between 0.08 and 0.12g (USGS. 2015).

Table E3.5-1 Onsite Soil Unit Descriptions

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
1A	Ackwater silt loam 0 to 2% slopes	The Ackwater component makes up 80% of the map unit. Slopes are 0–2%. This component is on stream terraces on coastal plains. The parent material consists of clayey alluvial and marine sediments. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, November, and December. Organic matter content in the surface horizon is about 1%. Non-irrigated land capability classification is 2w. This soil does not meet hydric criteria.	Farmland of statewide importance
1B	Ackwater silt loam 2 to 6% slopes	The Ackwater component makes up 80% of the map unit. Slopes are 2–6%. This component is on stream terraces on coastal plains. The parent material consists of clayey alluvial and marine sediments. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, November, and December. Organic matter content in the surface horizon is about 1%. Non-irrigated land capability classification is 2e. This soil does not meet hydric criteria.	Farmland of statewide importance
7A	Chickahominy silt loam 0 to 2% slopes	The Chickahominy component makes up 85% of the map unit. Slopes are 0–2%. This component is on stream terraces on coastal plains. The parent material consists of clayey alluvial sediments. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at three inches during January, February, March, April, November, and December. Organic matter content in the surface horizon is about 2%. Non-irrigated land capability classification is 4w. This soil meets hydric criteria.	Not prime farmland

Table E3.5-1 Onsite Soil Unit Descriptions

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
28C	Nevarc-Remlik complex 6 to 10% slopes	The Nevarc component makes up 35% of the map unit. Slopes are 6–10%. This component is on marine terraces on coastal plains. The parent material consists of clayey alluvial and marine sediments. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, and December. Organic matter content in the surface horizon is about 1%. Non-irrigated land capability classification is 3e. This soil does not meet hydric criteria. The Remlik component makes up 35% of the map unit. Slopes are 6–10%. This component is on marine terraces on coastal plains. The parent material consists of loamy and sandy alluvial and marine sediments. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 60 inches during January, February, March, and December. Organic matter content in the surface horizon is about 1%. Non-irrigated land capability classification is 4s. This soil does not meet hydric criteria.	Farmland of statewide importance
28F	Nevarc-Remlik complex 25 to 65% slopes	The Nevarc component makes up 40% of the map unit. Slopes are 25-65%. This component is on marine terraces on coastal plains. The parent material consists of clayey alluvial and marine sediments. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, and December. Organic matter content in the surface horizon is about 1%. Non-irrigated land capability classification is 7e. This soil does not meet hydric criteria. The Remlik component makes up 35% of the map unit. Slopes are 25-65%. This component is on marine terraces on coastal plains. The parent material consists of loamy and sandy alluvial and marine sediments. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 60 inches during January, February, March, and December. Organic matter content in the surface horizon is about 1%. Non-irrigated land capability classification is 7e. This soil does not meet hydric criteria.	Not prime farmland

Table E3.5-1 Onsite Soil Unit Descriptions

Map Unit Symbol[a]	Soil Unit Name	Description	Farmland Designation
29A	Newflat silt loam 0 to 2% slopes	The Newflat component makes up 85% of the map unit. Slopes are 0-2%. This component is on stream terraces on coastal plains. The parent material consists of clayey alluvial sediments. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, November, and December. Organic matter content in the surface horizon is about 2%. Non-irrigated land capability classification is 4w. This soil does not meet hydric criteria.	Prime farmland if drained
36B	Udorthents, loamy 2 to 6% slopes	The Udorthents component makes up 90% of the map unit. Slopes are 2-6%. This component is on borrow pits on coastal plains, dumps on coastal plains, fills on coastal plains, gravel pits on coastal plains, and sanitary landfills on coastal plains. The parent material consists of loamy alluvial and marine sediments. Depth to a root restrictive layer is greater than 60 inches. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches.	Not prime farmland
37	Urban land	This map unit consists of areas where more than 85% of the surface is covered by asphalt, concrete, buildings, or other impervious surfaces. Some examples are parking lots and industrial parks. Areas range from about 2-250 acres. Included with this unit in mapping are areas of undisturbed soils. These soils make up about 15% of the unit. Onsite investigation is needed to determine the suitability and limitations of the unit for a particular use. This unit is not assigned to a capability subclass.	Not prime farmland

(USDA. 1986; USDA. 2016c)
a. See Figure E3.5-4 for map unit symbols.

Table E3.5-2 Historic Earthquakes > 3.0 Mb, 1774 to 2017[a]

Date	Time	Epicentral Intensity	Magnitude	Approximate Location	Lat	Long	Area (sq mi)	Distance to Site (Miles)
2/21/1774	14:00	VI	–	Virginia	37.3000	-77.4000	58,000	43.50
2/22/1774	5:00	V-VI	–	Virginia	37.5000	-77.5000	–	50.80
8/23/1802	5:00	V	–	Richmond, Virginia	37.6000	-77.4000	–	49.30
4/30/1807	4:00	V	–	Richmond-Fredericksburg area, Virginia	–	–	–	–
4/22/1812	4:00	IV	–	Richmond, Virginia	37.6000	-77.4000	–	–
12/31/1816	13:00	III	–	Norfolk, Virginia	36.8000	-76.3000	–	33.50
7/15/1824	11:20	V	–	West Virginia-Ohio	–	–	63,000	–
8/9/1826	21:00	I-III	–	Richmond, Virginia	37.6000	-77.4000	–	–
8/10/1826	12:00	II-III	–	Richmond, Virginia	37.6000	-77.4000	–	49.30
3/9/1828	22:00	V	–	West Central Virginia	–	–	218,000	49.30
8/27/1833	6:00	V	–	Charlottesville-Richmond, Virginia	37.7500	-78.0000	61,000	84.30
11/2/1852	18:35	VI	–	E Virginia	37.7500	-78.0000	32,000	84.30
5/2/1853	9:20	V-VI	–	Virginia-West Virginia-Ohio	38.5000	-79.5000	72,000	179.00
8/31/1861	5:22	VI	–	SW Virginia-Western North Carolina	–	–	300,000	–
10/9/1871	–	VII	–	Wilmington, Delaware	39.7500	-75.5000	–	195.00
6/4/1872	22:00	III	–	Chesterfield	37.6000	-77.4000	9,000	46.40
12/22/1875	–	VI	–	Arvonia, Virginia	37.5000	-77.5000	50,000	50.80
3/11/1883	18:57	IV-V	–	Harford County, Maryland	39.5000	-76.5000	–	164.50
3/12/1883	0:00	V	–	Harford County, Maryland	39.5000	-76.4000	–	163.70
1/2/1885	21:16	V	–	Loudon Co. Virginia, Maryland-Virginia Border	39.2000	-77.5000	9,000	149.50
8/9/1885	23:35	V	–	Virginia	37.7000	-78.8000	29,000	121.50
3/8/1889	18:40	VI	–	SE Pennsylvania	40.0000	-76.7500	4,000	197.00
6/28/1897	–	V	–	Roanoke, Virginia	37.3000	-79.9000	9,500	176.50
12/18/1897	18:45	V	–	Ashland, Virginia	37.7000	-77.5000	10,000	57.20
5/8/1906	12:41	V	–	Delaware	38.7000	-75.7000	400	118.20

Table E3.5-2 Historic Earthquakes > 3.0 Mb, 1774 to 2017[a]

Date	Time	Epicentral Intensity	Magnitude	Approximate Location	Lat	Long	Area (sq mi)	Distance to Site (Miles)
2/11/1907	8:22	VI	–	Arvonia, Virginia	37.7000	-78.3000	2,000	94.60
8/23/1908	4:30	V	–	Powhatan, Virginia	37.5000	-77.9000	450	71.00
4/2/1909	2:25	V-VI	–	West Virginia-Maryland-Pennsylvania	39.4000	-78.0000	2,500	174.50
5/8/1910	16:10	V	–	Arvonia, Virginia	37.7000	-78.4000	350	99.50
4/9/1918	21:09	V-VI	–	Luray, Virginia	38.7000	-78.4000	100,000	139.00
4/19/1918	11:55	III	–	Norfolk, Virginia	36.9000	-76.3000	–	33.20
9/5/1919	21:46	VI	–	Front Royal, Virginia	38.8000	-78.2000	–	141.00
8/7/1921	1:30	VI	–	New Canton, Virginia	37.8000	-78.4000	2,800	100.50
12/31/1923	–	V	–	Clarke County, Virginia-Boyse section	39.2000	-78.0000	–	156.50
1/1/1924	–	IV-V	–	Clarke County, Virginia	39.2000	-78.0000	–	156.50
12/25/1924	–	V	–	Roanoke, Virginia	37.3000	-75.9000	–	177.00
7/14/1925	16:20	IV	–	Richmond, Virginia	37.6000	-77.4000	–	49.30
6/10/1927	2:16	V	–	Augusta County, Virginia	38.0000	-79.0000	2,500	140.00
10/30/1928	6:45	IV	–	Richmond, Virginia	37.5000	-77.5000	3,100	50.80
12/25/1929	21:56	VI	–	Albemarle County, Virginia	38.1000	-78.5000	1,000	120.00
1/4/1932	23:05	V	–	Buckingham County, Virginia	37.6000	-78.6000	800	110.30
11/14/1939	21:54	V	–	Salem County, New Jersey	39.6000	-75.2000	6,000	187.20
3/25/1940	–	V	–	Shenandoah Valley, Virginia	38.9000	-78.6000	400	157.50
1/4/1948	–	VI	–	Buckingham, Virginia	37.5000	-78.5000	1,700	108.30
5/8/1949	6:01	IV-V	–	Powhatan-Richmond, Virginia	37.6000	-77.9000	2,700	72.50
11/26/1950	2:45	V	–	Buckingham County, Virginia	37.7000	-78.4000	900	99.50
3/9/1951	2:00	-	–	Richmond, Virginia	37.6000	-77.4000	-	49.30
5/31/1966	6:14	V	–	Powhatan, Virginia	37.6000	-78.0000	28,000	78.80
12/11/1969	18:44	V	–	Richmond, Virginia	37.8000	-77.4000	6,500	61.00
12/11/1969	23:44	V	–	Richmond, Virginia	37.8000	-77.4000	3,500	61.00

Table E3.5-2 Historic Earthquakes > 3.0 Mb, 1774 to 2017[a]

Date	Time	Epicentral Intensity	Magnitude	Approximate Location	Lat	Long	Area (sq mi)	Distance to Site (Miles)
3/1/1973	3:30	V-VI	–	Delaware County, Pennsylvania	39.8000	-75.3000	–	200.00
3/23/1974	9:49	-	–	Shenandoah Valley, Virginia	38.9200	-77.7800	–	135.06
4/28/1974	9:19	IV	–	Wilmington, Delaware	39.7500	-75.5000	–	195.00
11/7/1974	16:31	IV	–	Charlottesville, Virginia	37.7500	-78.2000	–	92.45
2/10/1977	19:14	V (VI)	–	Location not reported	39.7500	-75.5000	–	195.00
2/27/1977	20:05	V	–	Charlottesville, Virginia	37.9000	-78.6300	–	118.11
9/30/1977	20:53	-	–	Louisburg, North Carolina	36.0500	-78.3500	–	120.46
2/25/1978	3:53	IV	–	Reidsville, North Carolina	36.1900	-79.3000	–	159.98
4/26/1978	19:30	-	–	Martinsburg, West Virginia	39.6300	-78.2000	–	189.00
7/16/1978	6:40	V	–	Lancaster, Pennsylvania	39.9300	-76.3400	–	191.85
10/29/1978	12:22	-	–	Louisa County, Virginia	38.0300	-78.1000	–	97.86
11/15/1978	8:33	-	–	Richmond, Virginia	37.6500	-77.5500	–	58.13
11/6/1979	4:05	-	–	Cumberland County, Virginia	37.4400	-78.2600	–	88.72
11/11/1979	7:22	-	–	Richmond, Virginia	37.7200	-77.4700	–	43.48
4/26/1980	4:00	-	–	Hanover County, Virginia	37.7700	-77.5800	–	64.47
5/18/1980	3:31	-	–	Powhatan County, Virginia	37.5800	-77.9400	–	74.70
5/18/1980	22:34	-	–	Louisa County, Virginia	37.9700	-78.0700	–	94.08
8/4/1980	10:13	-	–	Louisa County, Virginia	38.0700	-77.7600	–	85.85
9/21/1980	10:03	-	–	Marlinton, West Virginia	38.1800	-80.0700	–	198.04
9/26/1980	1:32	-	–	Louisa County, Virginia	38.0700	-77.7600	–	86.22
9/26/1980	5:04	–	–	Warrenton, Virginia	38.7800	-77.7200	–	124.97
10/11/1980	22:40	–	–	Louisa County, Virginia	38.1200	-77.8100	–	90.22
10/14/1980	1:20	–	–	Floyd County, Virginia	37.0800	-80.2300	–	195.53
11/25/1980	7:44	–	–	Marlinton, West Virginia	38.1000	-80.1200	–	198.83
1/19/1981	21:54	–	–	Buckingham County, Virginia	37.7300	-78.4400	–	103.95

Table E3.5-2 Historic Earthquakes > 3.0 Mb, 1774 to 2017[a]

Date	Time	Epicentral Intensity	Magnitude	Approximate Location	Lat	Long	Area (sq mi)	Distance to Site (Miles)
1/21/1981	16:30	–	–	Buckingham County, Virginia	37.7700	-78.4200	–	103.99
2/11/1981	13:44	IV	–	Buckingham County, Virginia	37.7200	-78.4400	–	103.70
2/11/1981	13:51	III	–	Buckingham County, Virginia	37.7500	-78.4100	–	102.95
2/11/1981	13:52	Felt	–	Buckingham County, Virginia	37.7200	-78.4500	–	104.21
3/20/1981	4:02	–	–	Richmond, Virginia	37.5200	-77.6800	–	59.96
4/9/1981	7:13	–	–	Powhatan County, Virginia	37.4800	-77.8200	–	66.12
4/9/1981	7:35	–	–	Powhatan County, Virginia	37.4700	-77.8700	–	68.51
4/16/1981	13:49	–	–	Cumberland County, Virginia	37.6100	-78.2200	–	89.78
6/6/1981	8:06	–	–	Bath County, Virginia	38.2100	-79.5100	–	170.57
7/30/1981	12:00	–	–	Louisa County, Virginia	38.1900	-78.0900	–	104.50
10/3/1981	9:56	–	–	Burlington, North Carolina	36.0100	-79.3500	–	168.20
11/23/1981	13:15	–	–	Augusta County, Virginia	38.2400	-79.0500	–	149.15
4/22/1984	20:36	–	4.20	Pennsylvania	39.9210	-76.3550	–	191.24
4/23/1984	1:36	–	–	Lancaster County, Pennsylvania	39.9500	-76.3200	–	192.50
8/17/1984	13:05	–	4.20	Fluvanna County, Virginia	37.8680	-78.3240	–	101.46
2/2/1986	21:50	–	–	Hanover County, Virginia	37.6000	-77.3900	–	48.20
12/9/2003	15:59	–	4.50	16km E of Weber City, Virginia	37.7740	-78.1000	–	87.62
8/23/2011	12:51	–	5.80	14km SSE of Louisa, Virginia	37.9097	-77.9363	–	85.11
8/23/2011	19:04	–	4.20	13km SSE of Louisa, Virginia	37.9147	-77.9545	–	86.11
8/25/2011	0:07	–	4.50	9km SSE of Louisa, Virginia	37.9468	-77.9672	–	88.00
11/30/2017	16:47	–	4.10	9km ENE of Dover, Delaware	39.1977	-75.4325	–	156.27

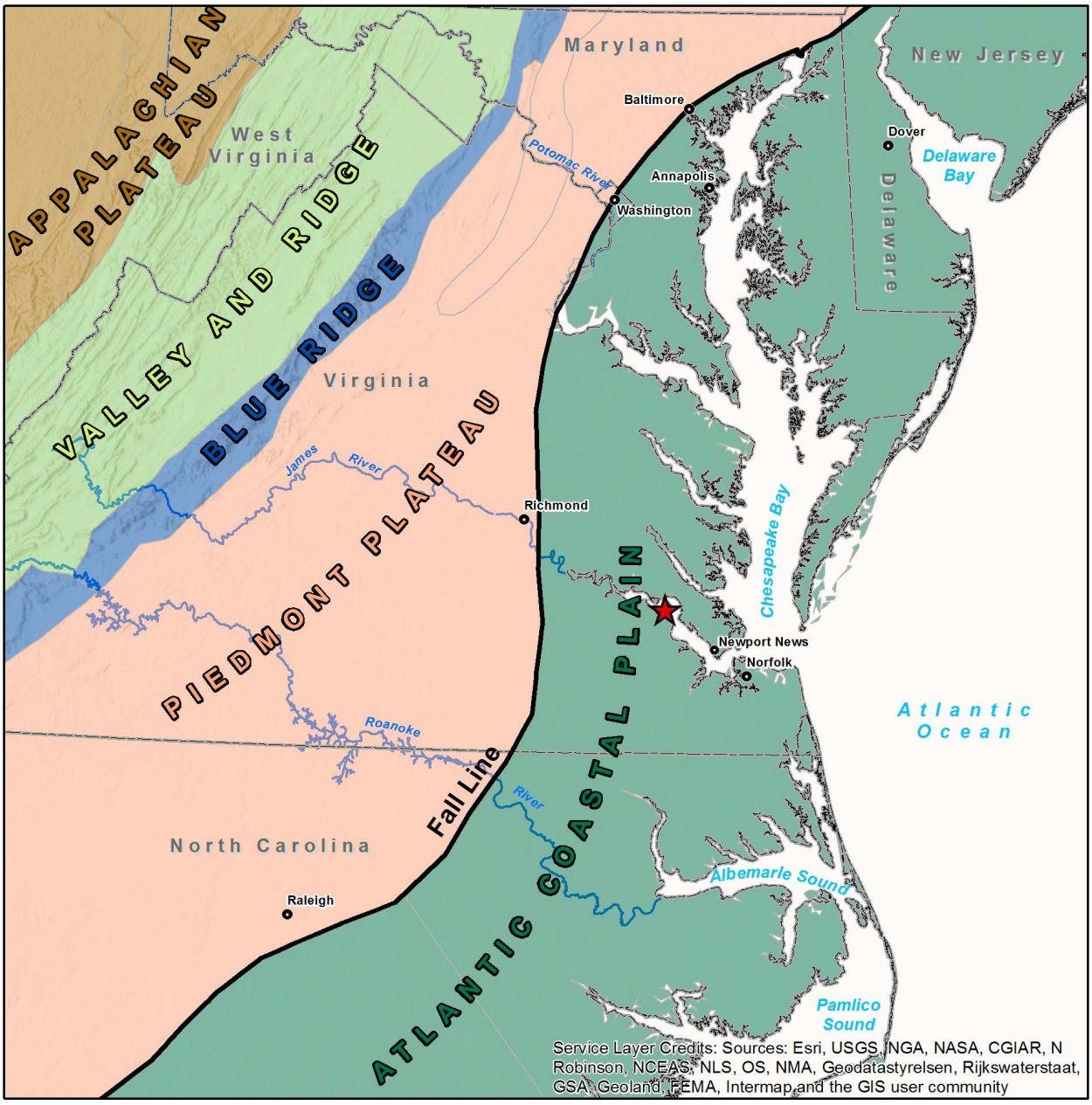
a. All earthquakes within 50 miles and all earthquakes of intensity V/magnitude 4 or greater within 200 miles.

- = Not reported.

(SPS. 2016a, Table 2.5-2; USGS. 2017a; USGS. 2018)

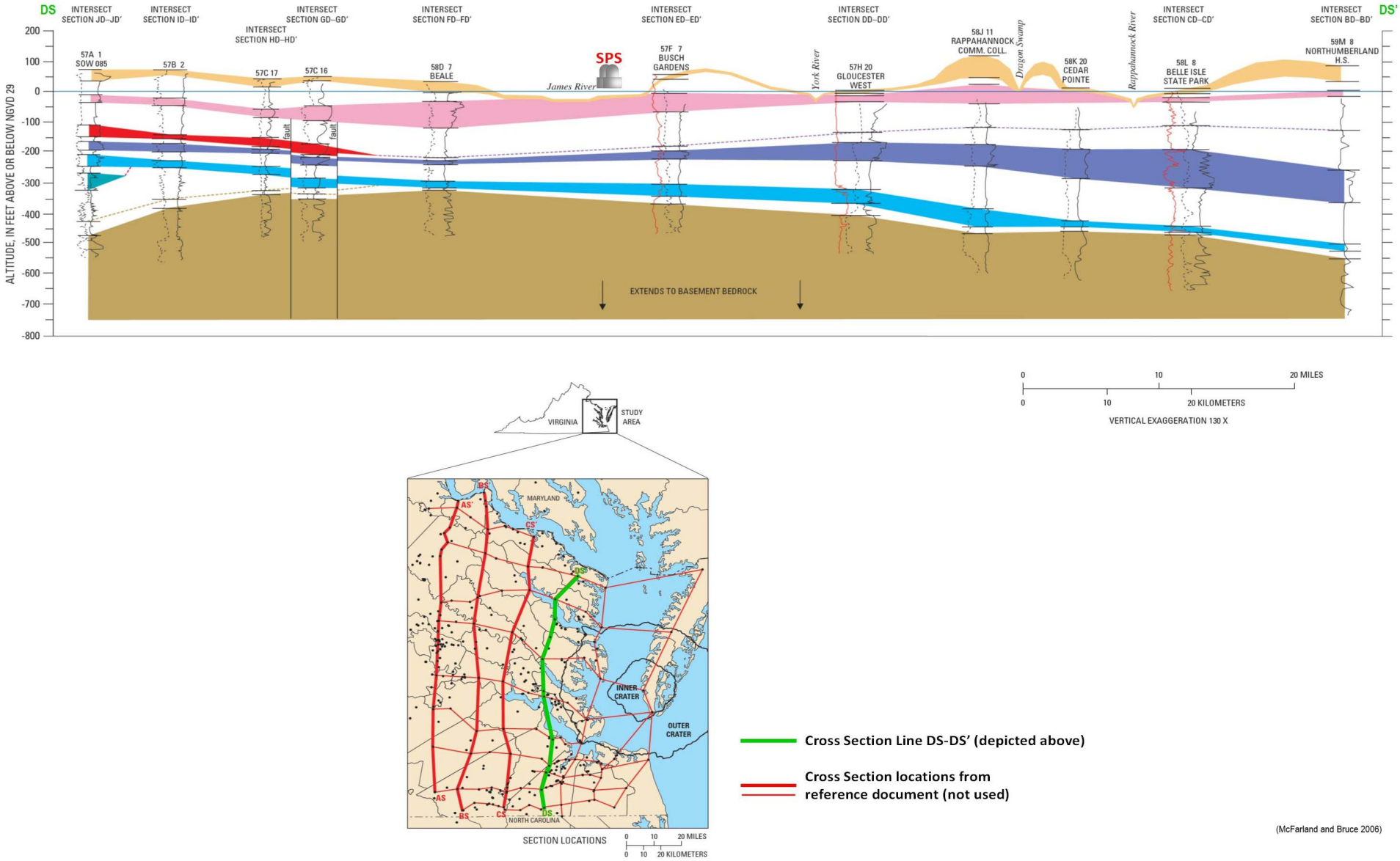
Intentionally Blank

Figure E3.5-1 Physiographic Provinces Associated with the SPS Site



Intentionally Blank

Figure E3.5-2 Columnar Geologic Section, SPS Site Area



(McFarland and Bruce 2006)

Intentionally Blank

Figure E3.5-3 Surficial Geology Map, SPS Property

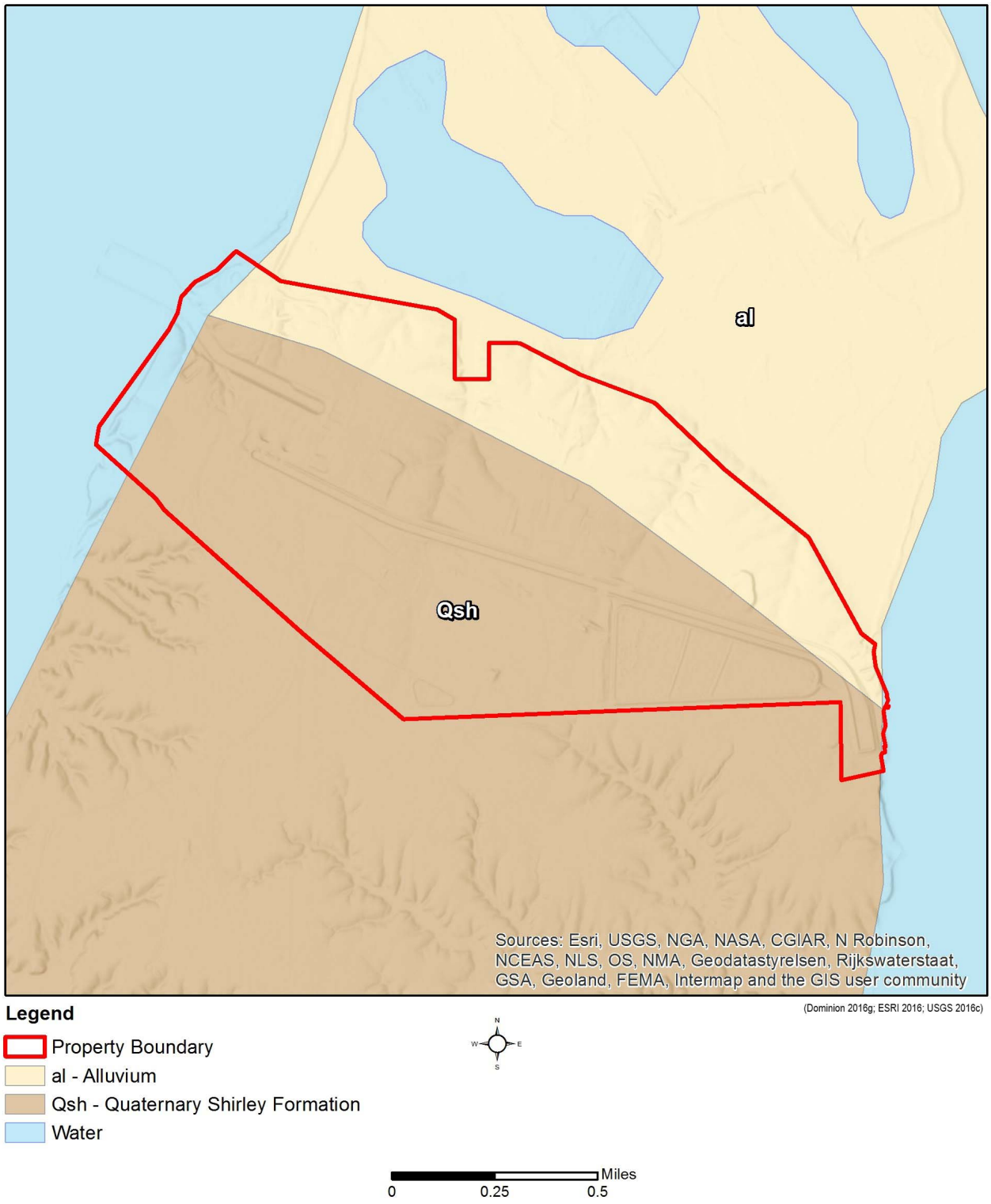


Figure E3.5-4 Distribution of Soil Units, SPS Property

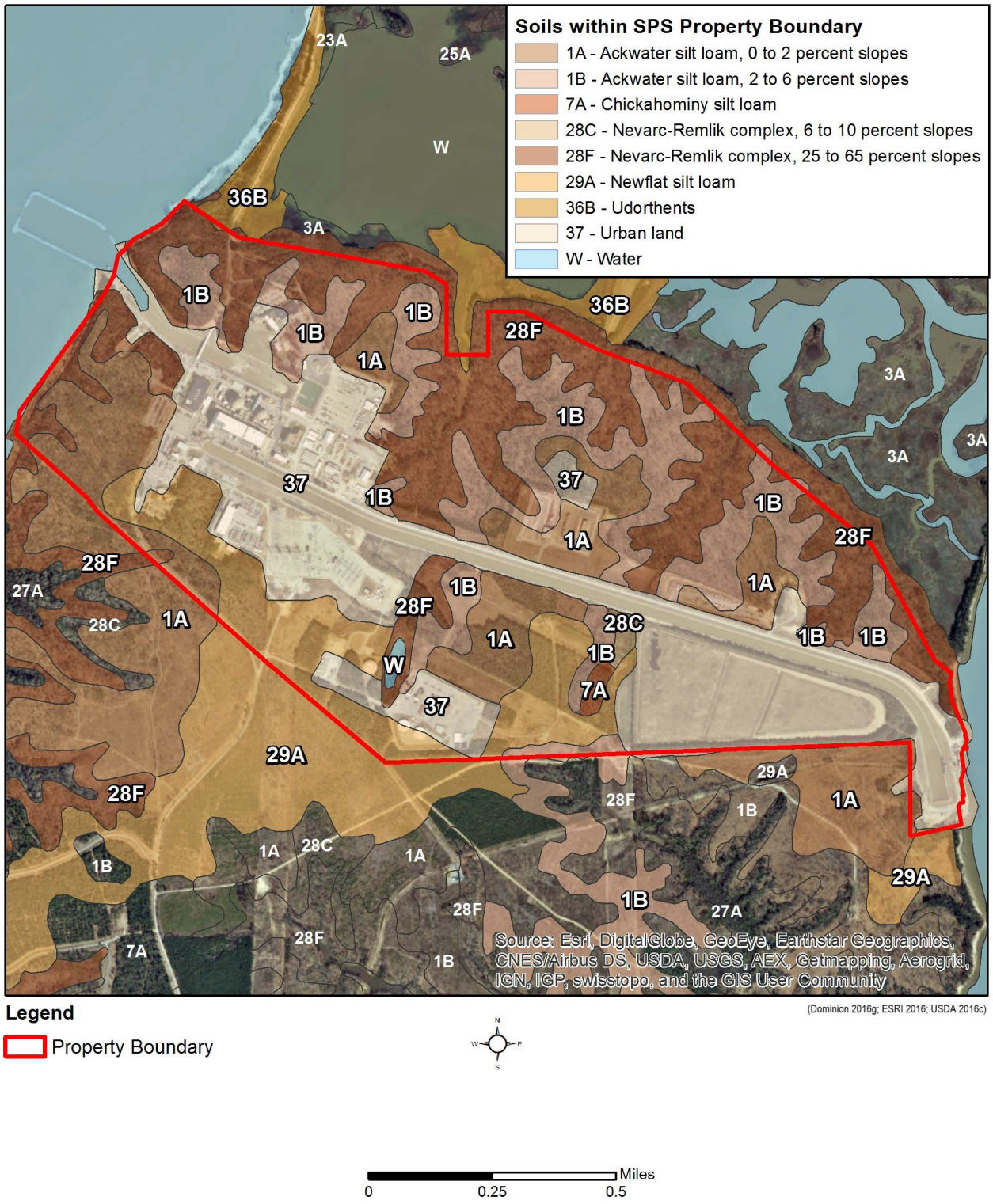
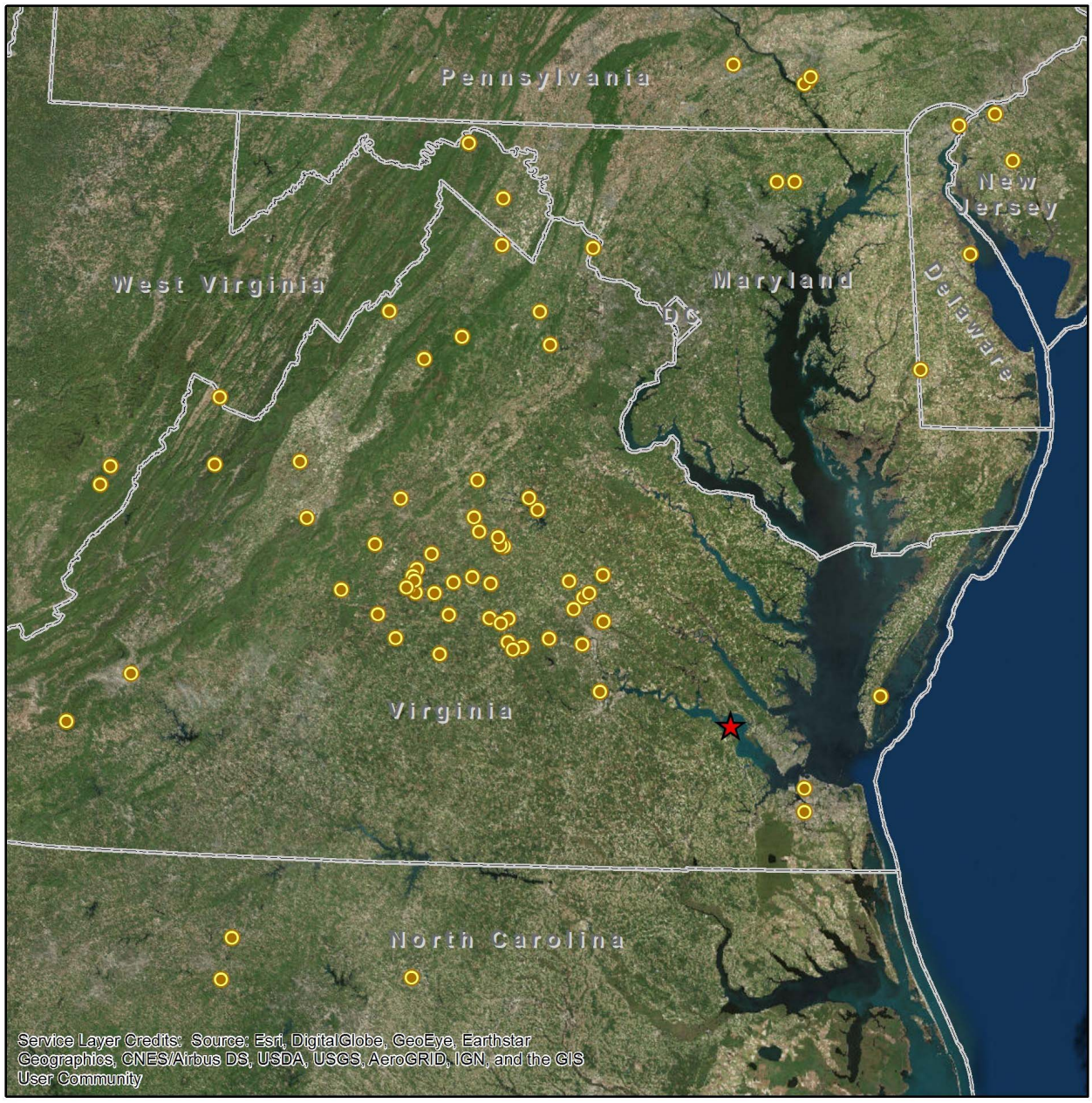


Figure E3.5-5 Historic Earthquakes, 1774 through 2016



(Dominion 2016e; ESRI 2016; SPS 2016a; USGS 2017a; USGS 2018)

E3.6 WATER RESOURCES

E3.6.1 SURFACE WATER RESOURCES

SPS is located on Dominion-owned property on the southern bank of the James River on the Gravel Neck Peninsula, approximately seven miles south of Colonial Williamsburg and eight miles east-northeast of the town of Surry (Figure E3.1-4). The Dominion property consists of approximately 840 acres with approximately 4,976 feet of river frontage on the eastern and western sides (Dominion. 2016g), and the James River is the primary hydrologic feature with which the plant interacts (Figure E3.6-1). Much of the region is characterized by marshes, extensive swamps, small streams, and pocosins. Water tables are very near the surface throughout the entire area, accounting for the large amount of surface waters. Drainage throughout the area is towards Hampton Roads, near the mouth of the Chesapeake Bay, and on to the Atlantic Ocean via the James River. (SPS. 2016a, Section 2.3.1.1)

The James River is Virginia's largest river, flowing across the entire state. It begins in the mountains at the confluence of the Cowpasture and Jackson rivers in Bath and Highland counties, and ends in Hampton Roads at Newport News, Virginia. The James River watershed encompasses approximately 10,000 square miles, which makes up almost 25% of the state. The watershed is comprised of three sections. The Upper James watershed begins in Alleghany County and travels through the Allegheny and Blue Ridge mountains until Lynchburg. The Middle James runs from Lynchburg to the fall line in Richmond, while the Lower James stretches from the fall line in Richmond to Hampton Roads. (JRA. 2016) Hampton Roads includes a large natural harbor incorporating the mouths of the Elizabeth and James rivers and emptying into the Chesapeake Bay (CBF. 2018).

The flow of water in the James River at the site consists of three components:

- Freshwater discharge from the James River watershed;
- Flow due to the oscillatory ebb and flood of the tide; and
- Flow due to the circulation pattern caused by intrusion of saline water within the estuary.

The drainage area of the James River above the station site is 9,517 square miles. The drainage area above the nearest gauge on the main stem of the James River near Richmond is 6,757 square miles. An additional 1,638 square miles of drainage area of tributaries between Richmond and the plant site is gauged, leaving 1,122 square miles ungauged. (SPS. 2016a, Section 2.3.1.1)

The 85-mile stretch of the James River between Richmond and the mouth of the river is subjected to tidal motion and is hence a tidal estuary. The site is located at river mile (RM) 25, in the transition region between the freshwater tidal river and the saline waters of the estuary proper. At a river discharge of about 10,000 cubic feet per second (cfs), the upstream portion of the site is in the freshwater river, and the salinity at the downstream side of the site is about one part per thousand. For river discharges less than 10,000 cfs (a condition occurring approximately 60% of the time), the water on both the upstream and downstream sides of the site will have varying concentrations of ocean-derived salts, depending on river discharge. (SPS. 2016a, Section 2.3.1.1)

The tide in the James River is a semi-diurnal tide, with two high waters and two low waters each lunar day of 24.84 hours. The oscillatory ebb and flood of this tide constitute the dominant motion in the waterway in the vicinity of the site. The net downstream flow required to discharge the fresh water seaward through any waterway cross section represents but a small fraction of the tidal flows. (SPS. 2016a, Section 2.3.1.1)

The USC&GS tidal current tables show that the ebb current is longer and stronger than the flood current at the site. The average of maximum ebb currents is 2.2 fps and the average of maximum flood currents is 1.9 fps. During spring tides, the ebb currents reach a maximum of 3.2 fps, and the flood currents a maximum of 2.8 fps. During the typical tidal period of 12 hours, 25 minutes, the current, on the average, will ebb for seven hours, five minutes, and flood for five hours, 20 minutes. It should be noted that the data used to compile the USC&GS tables are based on near-surface observations made during periods of normal river discharge, and therefore do not reflect meteorological effects. The predominance of ebb flow over flood flow will decrease with decreasing river discharge. (SPS. 2016a, Section 2.3.1.1)

Within the estuary proper, the salinity decreases in a more or less uniform manner from the mouth toward the head, and at any location increases with depth. Superimposed upon the oscillatory tide is a net non-tidal circulation in which the upper, less saline layers of water move seaward, while the deeper, more saline layers of water move up the estuary. The net non-tidal seaward-directed flow is stronger and, in the vicinity of the SPS site, extends to greater depths on the southern side of the estuary (looking downstream) than on the northern side. At times, the boundary between these two counterflows becomes strongly sloped so that the seaward flow extends to all depths on the southern side of the estuary, and the flow directed up the estuary occurs from bottom to surface on the northern side of the estuary. (SPS. 2016a, Section 2.3.1.1)

The volume rate of flow associated with this net non-tidal circulation pattern, while small compared to the oscillatory tidal flows, is several times larger than the volume rate of river discharge. In general, the higher the salinity, the larger the ratio of the volume rate of seaward flow in the surface layers to the freshwater discharge. Consequently, since the salinity at any given location increases with decreasing river discharge, the volume rate of flow associated with the net non-tidal circulation does not decrease directly with respect to the river discharge. (SPS. 2016a, Section 2.3.1.1)

There are no known or planned river control structures on the James River. Several small impoundments on tributaries in the upper reaches of the river do exist, but their size and location would preclude any effect or danger to the safety-related structures at the station. (SPS. 2016a, Section 2.3.1.1)

E3.6.1.1 Potential for Flooding

The sources of flooding in the James River at SPS are flood discharges due to watershed runoff and surge due to severe storms (SPS. 2016a, Section 2.3.1.2.1).

An analysis of the probable rise in mean water level at the site associated with the flood discharges indicates that even for a flood discharge recurrence interval of only once in 50 years, the water level at the site would rise no more than one foot above normal mean river level, if not accompanied by unusual meteorological tides (SPS. 2016a, Section 2.3.1.2.1).

SPS is located approximately 25 miles upstream of the point where the James River enters the Chesapeake Bay, and approximately 46 miles upstream from the mouth of Chesapeake Bay, where it enters the Atlantic Ocean. The probable maximum hurricane event is considered the most severe meteorological event at the SPS for modeling an open coast surge for severe storm flooding. Calculations show a minimum freeboard of greater than four feet is maintained between the canal water surface and the berm at elevation 36 AMSL during hurricane flooding of the river; therefore, no overtopping is anticipated, and there will be no effect on SPS. (SPS. 2016a, Section 2.3.1.2.2)

Based on Federal Emergency Management Agency (FEMA) data, the majority of the SPS property is located outside the 0.2% annual chance floodplain (100-year flood level). Small areas within drainage channels along the northern property line and the discharge canal have been designated as within the 0.2% annual chance floodplain with base flood elevations of 7-8 feet (NAVD88) (Figure E3.6-2). (FEMA. 2016)

The western and eastern property lines along the James River border designate coastal flood zones with base flood elevations between 10-19 feet (NAVD88) (Figure E3.6-2) (FEMA. 2016). FEMA has designated small areas of the shoreline and the northern SPS property boundary as the limit of moderate wave action during coastal flooding events. With the exception of a small section of the discharge canal adjacent to the shoreline, none of the designated limits of moderate wave action extend into the SPS property (Figure E3.6-2).

Class 1 structures at SPS are flood protected up to a minimum elevation of 26.5 feet AMSL, with the exception of the circulating water intake structure, which is protected to 24.0 feet AMSL (SPS. 2016a, Table 2.3-7).

E3.6.1.2 Surface Water Discharges

E3.6.1.2.1 VPDES-Permitted Outfalls

Chemical additives approved by the VDEQ are used to control pH, scale, and corrosion in the circulating water system, and to control biofouling of plant equipment. Process wastewaters are monitored and discharged to the James River via VPDES Outfall 001 in accordance with the SPS VPDES Permit No. VA0004090. The current VPDES permit authorizes discharges from 28 outfalls (one process water external outfall, five stormwater external outfalls, and 22 internal outfalls). The six external outfalls are depicted in Figure E3.6-3, and their associated effluent limits are listed in Table E3.6-1 (Attachment B).

Certain low-volume and chemical wastewaters from the SPS facility with no detectable radioactivity, as defined by the NRC plant effluent release limits, may be comingled and treated with similar waste and controlled under the terms of VPDES Permit No. VA0004090 (Attachment B). These discharges are treated, monitored, and directed to the discharge canal which drains via External Outfall 001 to the James River (SPS. 2016a). Potentially oil-contaminated stormwater runoff from GNCTS is pumped into the SPS settling basin, which is permitted to discharge to the James River via the SPS discharge canal (SPS. 2001, Section 3.5).

E3.6.1.2.2 Stormwater Runoff

Stormwater discharges associated with SPS industrial activities are regulated and controlled through VPDES Permit No.VA0004090 issued by the VDEQ. SPS collects stormwater runoff samples on a semiannual basis (when there is a flow) at VPDES Outfalls 050, 051, 052, and 053, which receives runoff from the entire industrial area, and analyzes the samples for pollutants as specified in the permit (Attachment B). These outfalls are surveilled for radioactivity. SPS also maintains and implements an SWPPP that identifies potential sources of pollution, such as erosion, that would reasonably be expected to affect the quality of stormwater, and identifies BMPs that will be used to prevent or reduce the pollutants in stormwater discharges. (SCS. 2016)

E3.6.1.2.3 Sanitary Wastewaters

SPS is equipped with its own sewage treatment plant. In addition, wastewater from GNCTS and the low-level restroom trailers at SPS is pumped and transported offsite for treatment. Sanitary wastewater from all other SPS locations is collected and treated in the sewage treatment plant, and is then discharged to Internal Outfall 101, which then discharges to the James River via Outfall 001 in accordance with SPS's VPDES Permit No. VA0004090 (Attachment B). Outfall 101 is also surveilled for radioactivity.

E3.6.1.2.4 Dredging

Historically, the U.S. Army Corps of Engineers (USACE) has dredged the main channel of the lower James River so that ocean-going vessels can proceed upriver as far as Hopewell, approximately 50 river miles above SPS (SPS. 2001, Section 2.2).

Dominion has dredged approximately 150,000 cubic yards from this channel every 3-4 years. During maintenance dredging within the existing channel on the James River (October 2016-January 2017), approximately 41,544 cubic yards were hydraulically dredged to a depth of 12 feet mean lower low water within a 2,000-foot long by 150-foot wide channel. The dredged material was placed at the existing onsite dredge material management pond (Figure E3.1-1) at SPS. The dredging project was conducted under the USACE Norfolk Regional District's Permit 02 (13-RP-02). To minimize impacts on anadromous fish and federally managed species, this permit does not authorize dredging between February 15 and June 30, of any year. (USACE. 2016)

As noted in Section E2.2.7.2, Dominion is developing an offsite DMMA, to be located on Hog Island Road, approximately four miles south of SPS (Figure E2.2-6), and is planned to be utilized once the onsite dredge material management pond reaches capacity. The offsite DMMA is currently undergoing permitting and evaluation processes, and construction has not yet been completed. (Dominion. 2016c) The offsite DMMA is being developed to support current operations and is not in scope for SLR.

E3.6.1.2.5 Compliance History

As presented in Chapter 9, over the six-year period 2012-2017, there have been no notices of violation or noncompliances associated with SPS wastewater discharges to receiving surface waters.

SPS received a warning letter from the VDEQ dated October 4, 2016, regarding elevated bi-monthly biochemical oxygen demand (BOD) results from Outfall 101 for the discharge of the sewage treatment plant. But because the effluent was consistently clear with no visible solids and the STP continued to operate within limits for other parameters, including pH and total suspended solids (TSS), SPS concluded there were no adverse impacts to state waters or endangerment of human health. Subsequent sampling showed reduced levels and the subsequent bimonthly sample from Outfall 101 was well below the permit limit with a BOD concentration of less than two milligrams per liter (mg/L). (VDEQ. 2016b)

One Enterococci bacteria sample exceeded previous reporting results in January 2017. A noncompliance report was provided to VDEQ. After decontaminating sampling instruments, reporting to expected results returned. An NOV was not issued.

E3.6.1.2.6 River Water Temperatures Reporting

River water temperature is measured by the USGS every 15 minutes at two stations on the James River. The closest station is located near Charles City, Virginia, which is approximately 23 miles upstream of SPS. Water temperature data for the James River has been collected since July 2014 for this station. An additional station located farther away from SPS near Cartersville, Virginia (85 miles upstream of SPS), has collected water temperature since October 2007. (USGS. 2016d; USGS. 2016e)

The raw data (measured every 15 minutes) were averaged for each month during the years data were available. The averaged values are plotted in Figures E3.6-6 and E3.6-7 (USGS. 2016d; USGS. 2016e)

E3.6.2 GROUNDWATER RESOURCES

E3.6.2.1 Groundwater Aquifers

The Virginia coastal plain aquifer system is a subdivision of the more extensive northern Atlantic coastal plain aquifer system (USGS. 2008). SPS is located within the Coastal Plain physiographic province. The coastal plain extends from the fall line in the west, to the Atlantic Ocean in the east, to the Maryland border in the north, and to the North Carolina border in the south. The surface of the coastal plain consists of a series of broad, gently sloping, highly dissected north-south trending terraces bounded by seaward-facing, ocean-cut escarpments. The subsurface is characterized by wedge-shaped, unconsolidated to partly consolidated sedimentary deposits that, in general, slope (dip) and thicken towards the east. These deposits consist of clay, silt, sand, and gravel, with variable amounts of shell material. In some localized areas, calcareous cementation of shell beds can form thin lithified strata. The unconsolidated sediments overlie a crystalline bedrock basement that also slopes gently to the east. Many different depositional environments existed during the formation of the coastal plain deposits, but in general, the stratigraphic section consists of a thick sequence of non-marine (fluvial and alluvial) sedimentary deposits overlain by a thinner sequence of marine (near shore beach, estuarine, and delta) sedimentary deposits. The ages of the sediments range from the Quaternary period to the Late Cretaceous period. (Malcolm Pirnie. 2009)

The groundwater flow system in the coastal plain of Virginia is a multi-aquifer system. In the area of investigation, there are five major water-bearing hydrogeologic units. Those units and the corresponding confining units include (from the deepest): Potomac aquifer, Potomac confining zone; Aquia aquifer, Nanjemoy-Marlboro confining unit; Piney Point aquifer, Calvert confining unit and Saint Marys confining unit; Yorktown-Eastover aquifer, Yorktown confining unit; and a surficial aquifer. A brief description of each unit is provided below. (Malcolm Pirnie. 2009)

The Potomac aquifer is the lowermost confined aquifer in Virginia's coastal plain hydrogeologic framework. It is characterized by thick, interbedded sequences of fluvial-deltaic coarse-grained quartz and feldspar sands and gravels and interbedded clay. The Potomac aquifer is continuous on a regional scale, but the lithologic heterogeneities make it discontinuous on a local scale. Production wells at SPS are screened in the uppermost section of the Potomac aquifer (i.e., upper Potomac aquifer). The upper Potomac aquifer is comprised of stratified sands and clays. The sands have been characterized as white micaceous, very fine to medium quartz with carbonaceous material. The interbedded clays are characteristically dark, silty, and highly micaceous, typically containing carbonaceous material. The uppermost section slopes to the east at approximately 15 feet per mile. (Malcolm Pirnie. 2009)

Of the five major water-bearing hydrogeologic units, the Potomac aquifer is the most heavily used, supplying water for major industries, towns and cities, and residential developments. This aquifer is capable of producing large quantities of good water suitable for most uses. Well yields in the central and southeastern parts of the aquifer range from 100-500 gpm with yields as high as 3,000 gpm in James City County. The majority of the aquifer is overlain by the Potomac confining zone with outcrops appearing in very limited and isolated areas. Recharge to the aquifer occurs as a result of leakage of groundwater through the confining layers. The transmissivity values range from 1,850 to 15,000 square feet per day, and storage coefficients range from 4.1 x 10-5 to 6.7 x 10-4 in the uppermost portion of the Potomac aquifer. (Malcolm Pirnie. 2009)

The Potomac confining zone is widespread and overlies the Potomac aquifer in most of Virginia's coastal plain except in a small area in the eastern section. This layer consists of clay interbedded with coarse-grained quartz and feldspar sands and gravels of the fluvial-deltaic Potomac Formation. The Potomac confining zone thickness ranges up to several tens of feet, and the unit approximates a transition zone to overlying units. On a regional scale, the Potomac confining zone is extensive, with relatively high leakage. On a local scale, the discontinuities in the fine-grained interbeds affect the amount of leakage into or out of this unit. (Malcolm Pirnie. 2009)

The sedimentary deposits of the Aquia aquifer are late Paleocene in age and consist of a continuous, elongate-lenticular sand body. The aquifer is present in much of Virginia's coastal plain except to the east and part of the fall zone. The Aquia aquifer is extensively exposed at the land surface in most major streams valleys in the western region of Virginia's coastal plain. Sediments are comprised of marine, medium to coarse-grained, glauconitic, and fossiliferous quartz sands. The aquifer is homogeneous, but is not commonly used as an aquifer because the deposits are much finer grained, commonly containing a limey-mud matrix and thin limestone beds. The Aquia aquifer overlies the Potomac confining zone. (Malcolm Pirnie. 2009)

The Nanjemoy-Marlboro confining unit is widespread and overlies the Aquia aquifer in most of Virginia's coastal plain except to the east and part of the fall zone. This layer primarily consists of marine, silty and clayey, fine-grained glauconitic quartz sands of the Nanjemoy Formation, and kaolinitic and micaceous Marlboro clay in the lower portion. The age of the Nanjemoy Formation is early Eocene, and late Paleocene to early Eocene for the Marlboro Clay. The Nanjemoy-Marlboro confining unit thickness ranges up to several tens of feet and thickens towards the northeast. (Malcolm Pirnie. 2009)

The sedimentary deposits of the Piney Point aquifer are middle Miocene to early Eocene in age and are present in much of Virginia's coastal plain except part of the fall zone. Sediments are generally comprised of marine, medium to coarse-grained, glauconitic, phosphatic, variably calcified, and fossiliferous quartz sands. The Piney Point aquifer is homogeneous and thickens towards the east and thins to nearly zero along its western limit. The aquifer supplies water for light industry, small municipalities, and domestic users. The Piney Point aquifer overlies the Nanjemoy-Marlboro confining unit in most areas. (Malcolm Pirnie. 2009)

The Calvert confining unit is characterized by marine, silty and clayey, fossiliferous fine-grained quartz sand with scattered shells and abundant foraminifera and diatoms. The sedimentary deposits of the Calvert confining unit are middle Miocene in age. The confining unit is widespread with a thickness ranging up to a few hundred feet. The Calvert confining unit predominantly overlies the Piney Point aquifer and the Nanjemoy-Marlboro confining unit to a lesser extent. This confining unit is wedged-shaped in cross section, sloping (dipping) and thickening to the east. (Malcolm Pirnie. 2009)

The Saint Marys confining unit is characterized by marine, fossiliferous, silty clay of the Saint Marys Formation and silty and clayey glauconitic and phosphatic, fine-grained quartz sands of the Eastover Formation. These sedimentary deposits are late Miocene in age. The confining unit predominantly overlies the Calvert confining unit and the Saint Marys aquifer and Piney Point aquifer in limited areas. The confining unit is widespread with a thickness ranging up to a few hundred feet. The Saint Marys confining unit is wedged-shaped in cross section and slopes and thickens to the east. (Malcolm Pirnie. 2009)

The sediments of the Yorktown-Eastover aquifer are characterized by interlayered, thick to massively bedded shelly sands separated by thinner clay beds. The sedimentary deposits are believed to be late Miocene to late Pliocene in age. The Yorktown-Eastover aquifer predominantly overlies the Saint Marys confining unit and the Nanjemoy-Marlboro confining unit or the Potomac confining zone in limited areas. The aquifer is widespread with a thickness ranging up to a few hundred feet. In cross section, the Yorktown-Eastover aquifer is wedge-shaped, sloping and thickening to the east. Of the five, it is the second most heavily used aquifer serving as public and private water supplies. (Malcolm Pirnie. 2009)

The Yorktown confining zone is characterized by blue-grey to green-grey clay interbedded with massive silty clay, fine sand, and calcareous shell fragments. The massive silty clay units are comprised of a series of coalescing clay layers that are not aerially continuous. The sedimentary deposits are believed to be late to early Pliocene in age. It overlies the Yorktown-Eastover aquifer throughout the central and eastern regions of the Virginia coastal plain and is overlain by the surficial aquifer in the eastern region. In cross section, the Yorktown confining unit is wedge-shaped, sloping and thickening eastward. (Malcolm Pirnie. 2009)

The surficial aquifer is the uppermost aquifer and is unconfined throughout its extent. This aquifer consists of the sandy surficial deposits above the Yorktown confining zone. These sedimentary deposits are late Pliocene to Holocene in age. This aquifer is characterized by interbedded very coarse gravel lag deposits that fine upwards into silts and clays. The surficial aquifer is used primarily for domestic water supplies, especially in the eastern region of Virginia's coastal plain. (Malcolm Pirnie. 2009)

E3.6.2.2 Hydraulic Properties

The hydrologic boundaries of the SPS site proper are the James River on the east and west, Hog Island Creek to the north, and Chippokes and Hunnicut creeks about one mile south (SPS. 2016a, Section 2.3.2).

A water budget analysis indicates that, of the total precipitation, 37% runs off and the remaining 63% is lost through evapotranspiration. Low soil permeability precludes significant groundwater recharge from local precipitation. (SPS. 2016a, Section 2.3.2)

The soils in the site area, as described in Section E3.5.3, consist of a series (50-80 feet thick) of lenticularly interbedded fine sands, clays, and silts. These clay and silt members are essentially impermeable, and the sand member showed field permeabilities on the order of 1 x 10^{-4}centimeters per second (cm/sec). (SPS. 2016a, Section 2.3.2)

The above deposits are underlain by 240-270 feet of tough, impermeable clay containing only occasional and limited sand members. At a depth of about 320 feet below the surface, Eocene and older sediments are encountered. The sand members of these sediments are excellent aquifers; many domestic wells and some industrial wells in the area obtain water supplies from this source. In general, yields range from 15-50 gpm, but a well 799 feet deep at Bacon's Castle, about five miles to the south, yielded under test 940 gpm with only 20.25 feet of drawdown. The closest offsite deep wells are located in the Hog Island WMA, about one mile north of SPS, and at Drewry Point, approximately 0.6 miles southwest. Both wells are approximately 340 feet deep and have a yield of about 35 gpm. The well at Drewry Point is not in full-time use as it serves a vacation cottage. (SPS. 2016a, Section 2.3.2)

In addition to the 340-foot deep well in the Hog Island WMA, which existed prior to station construction, there are five operating water wells on the SPS site that were constructed to serve several purposes. These wells are about 400-500 feet deep and obtain water from the Late Cretaceous sediments. Three of these wells yield 200 gpm each and are for makeup and domestic uses at the station. A separate well with a 100-gpm pump supplies the training center. (SPS. 2016a, Section 2.3.2) As presented in Section E3.6.3.2, two of these water wells are currently out of service and another well is not being used.

The hydraulic gradient is north, east, and west toward the James River. Both the deep well at Drewry Point and the shallow well south of the site are up-gradient from the site. The deep well in the Hog Island WMA is down-gradient from the site, but it is not affected by water flow from the site. Based on the results of borings, the general geology of the area and the location of the site, the coefficient of permeability of the soil mass in a horizontal direction is estimated to be several orders of magnitude greater than in the vertical direction. Water that does not enter the soil will move laterally to the east, north, or west, and discharge to the James River. There is no possibility of surface or near-surface water migrating downward to enter the aquifers in strata of Eocene or older ages, which supply deep wells. Various groundwater hydrology studies indicate that the operation of SPS causes no adverse effects to the water resources in the region. (SPS. 2016a, Section 2.3.2)

Due to the isolated location of the plant site (James River on the eastern and western sides, Hog Island WMA on the northern side, and additional WMA tracts to the south), no substantial industrial or residential development is anticipated in the vicinity of the SPS site. Therefore, no additional demand of a substantial nature upon the groundwater supply is expected. (SPS. 2016a, Section 2.3.2)

E3.6.2.3 Potentiometric Surfaces

A contour map of the shallow groundwater based on water level data collected in 2014 (as part of the Nuclear Energy Institute's (NEI) groundwater protection initiative [GPI] program) is provided as Figure E3.6-6. On a large-scale perspective, the groundwater flows from the west, south, and east towards SPS, with the intake and discharge canals bounding the groundwater. In between the intake canal and discharge canal, the groundwater flows from the southeastern portion of the intake canal (groundwater surface elevation of 25 feet AMSL) to the northwestern corner of the discharge canal (groundwater surface elevation of 2 feet AMSL). The subsurface drain pumps stabilize site water design elevation and prevent infiltration of groundwater into subsurface structures. At the center of SPS, the containment, fuel building, and alleyway subsurface drain pumps lower groundwater elevation. One groundwater model simulation shows an east-west groundwater divide in the immediate area of the boron recovery valve gallery. This divide shifts north and south depending on the relative elevation of the discharge canal to the surrounding groundwater elevation. (SPS. 2016b)

E3.6.2.4 Groundwater Protection Program

In May 2006, the NEI implemented the GPI, an industry-wide voluntary effort to enhance nuclear power plant operators' management of groundwater protection (NEI. 2007).

Industry implementation of the GPI identifies actions to improve licensee management and response to instances where the inadvertent release of radioactive substances may result in detectable levels of plant-related materials in subsurface soils and water, and also describes communication of those instances to external stakeholders. Aspects addressed by the initiative include site hydrology and geology, site risk assessment, onsite groundwater monitoring, and remediation. In August 2007, NEI published updated guidance on implementing the GPI as NEI 07-07, Industry Ground Water Protection Initiative-Final Guidance Document (NEI. 2007). The goal of the GPI is to identify leaks of licensed material as soon as possible.

In conjunction with the GPI, SPS performs groundwater monitoring from 35 of onsite locations to monitor for potential radioactive releases to groundwater in accordance with site procedures. Figure E3.6-7 shows locations of these groundwater monitoring wells with construction details presented in Table E3.6-2.

E3.6.2.5 Sole Source Aquifers

A sole source aquifer (SSA), as defined by the EPA, is an aquifer which supplies at least 50% of the drinking water consumed by the area overlying the aquifer, and there is no reasonably available alternative drinking water source should the aquifer become contaminated. The SSA program was created by the U.S. Congress as part of the Safe Drinking Water Act and allows for the protection of these resources. (EPA. 2016a)

SPS is located in EPA Region 3, which has oversight responsibilities for the public water supply in Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia. The EPA has designated six aquifers in EPA Region 3 as SSAs. Two of these SSAs (Columbia and Yorktown-Eastover multi-aquifer system and Prospect Hill aquifer) are located in the state of Virginia. The SSA closest to SPS is the Columbia and Yorktown-Eastover multi-aquifer system, which covers the eastern shore of Virginia. SPS's property is not situated over any of these designated SSAs. (EPA. 2016b)

E3.6.3 WATER USE

E3.6.3.1 Surface Water Use

The James River serves as a source of drinking water supply for millions of people along its 430 miles via water intakes for public water systems, including the City of Richmond, located approximately 50 miles upstream from SPS. The river is also a source of water to support industrial operations. While the drinking water supply for localities near downstream of SPS is not the James River, water quality parameters for various uses are monitored by permittees and the VDEQ.

SPS uses approximately 1,942 MGD of water from the James River for once-through cooling and the auxiliary cooling system. The water withdrawn from the James River represents about 3% of the tidal flow in the river near SPS. The water withdrawal is not subject to Virginia Water Protection Program permitting requirements because VA Code § 62.1-44.15:22.B exempts withdrawals established prior to July 1, 1989 from regulatory review. After passing through the condensers and the service water system, most of the water is returned to the James River. Less than 22,000 gpm is lost to evaporation, approximately 1% of the initial intake. (VDEQ. 2013a)

Approximately 99.98% of SPS's total water requirements associated with the once-through heat transfer system are met using water withdrawn from the James River. The remaining 0.02% of SPS's water demands are associated with supplemental domestic supply, laboratory grade water, and specialized processes that require water of a greater purity than James River water, particularly with respect to salinity. SPS reuses some of its water, but requires additional water as some losses occur due to consumption and evaporation and it is not cost effective to reuse all of the water, particularly for domestic supply. (SPS. 2010)

In Surry County, the James River is by far the dominant surface water supply. In 2010, surface water withdrawals were reported as 1,907.54 MGD, of which 1,907.10 MGD was used for power generation. (USGS. 2017b) Excluding power generation, surface water use for Surry County in 2015 was reported as 0.1 MGD. Surface water withdrawal by SPS in 2017 was reported as 735,026.76 MG and averaged 731,554.864 MG between 2013 and 2017 as shown in Table E3.6-6. (VDEQ. 2016c)

A summary of surface water use in Surry County and surrounding counties is presented in Table E3.6-3.

E3.6.3.2 Groundwater Use

In 2010, groundwater withdrawals were reported as 0.52 MGD with 0.35 MGD used for power generation. Public water supply use was the largest consumer of groundwater in Surry County, reported at 0.12 MGD in 2015. The remaining water use was for industrial and livestock supply purposes. (USGS. 2017b) A summary of groundwater use in Surry County and surrounding counties is presented in Table E3.6-4.

A list of registered groundwater wells (both active and out of service) within a two-mile band around the SPS property boundary is depicted in Figure E3.6-8 and presented in Table E3.3-5. These wells withdraw from the upper Potomac aquifer and are primarily used for non-domestic purposes. (USGS. 2016f; VDEQ. 2013a)

Currently, five groundwater wells (wells A, B, C, ER, and CS) serve SPS and another two wells (wells H and JR) serve the GNCTS. The VDEQ (Permit No. GW0003901) allows a maximum withdraw total of 154.7 million gallons of water per year (MGY). A monthly maximum of about 15.89 million gallons (MG) is authorized for use as domestic, process, and cooling water. (VDEQ. 2013a) Groundwater withdrawal by SPS in 2017 was reported as 115,477,500 MG and averaged 121,101,268 MG between 2013 and 2017 as shown in Table E3.3-6. Table E3.3-6 provides the groundwater withdrawals for these wells for the period 2013-2017. The amount of groundwater withdrawn is below the permitted monthly maximum. The majority of the water withdrawn is consumed by the different SPS uses described below.

Nine onsite wells are used (or described) as follows (SPS. 2015a):

- Well A is located at the low-level intake structure and provides water for the circulation water vacuum priming system, non-potable domestic water supply, and supply for emergency service water pumps to limit marine growth. The estimated maximum annual withdrawal for this well is 2,525,775 gallons per year (gpy), approximately 7,000 gallons per day (gpd).
- Wells B, C, and ER discharge into a common header that provides water to the two 300,000-gallon fire protection tanks (Well E was abandoned and replaced with Well ER in 2015). In addition to providing the fire protection system with water, the tanks also are used as a source of domestic water for the site and supplies groundwater to an onsite reverse osmosis (RO) trailer. The RO trailer and various cation/anion demineralizers can deliver 200 gpm of demineralized water for use at SPS. The demineralized water is stored in the two 300,000-gallon tanks and is used to provide high-purity make-up water for all primary and secondary systems throughout the plant. The estimated maximum annual withdrawal for these three wells is 136,842,303 gpy, approximately 375,000 gpd.
- Wells D and F, both located at the SPS training center, were permanently abandoned in 2015.
- Wells H and JR are on the GNCTS complex and do not interface with SPS. Well G was permanently abandoned, and Well J was abandoned and replaced with Well JR in 2015. The estimated maximum annual withdrawal for these two wells is 12,583,604 gpy, approximately 34,500 gpd, which is used as domestic, process, and cooling water. GNCTS fire protection is provided from SPS fire protection tanks and fire protection system.
- Well CS, located at the construction site parking lot, supplies domestic water and process water to the radwaste facility, the training center, and various fabrication and testing shops. The estimated maximum annual withdrawal is 2,748,319 gpy, approximately 7,530 gpd.

E3.6.4 WATER QUALITY

E3.6.4.1 Surface Water Quality

The quality of water sources in the vicinity of SPS was evaluated with respect to the suitability as alternative water supply sources for plant needs that are currently supplied by groundwater withdrawn from the Potomac aquifer. Surface water from the James River was given a low quality rating due to high levels of suspended and dissolved solids and organic matter. (SPS. 2010) SPS is located on segments 5D VAT-G11E_JMSO1A06 and 5D VAT-G11E_JMS01B08 of the James River. These segments cover 40.16 square miles from Gravel Neck Peninsula to the Pagan River and 3.85 square miles for the Hog Island area. The water quality in these segments of the river is included on VDEQ's draft 2016 CWA 303(d) impaired waters list for fish consumption due to PCBs in fish tissue and impairments to aquatic life due to estuarine bioassessments and chlorophyll-a (VDEQ. 2017a). Development of a total maximum daily load (TMDL) for PCBs is scheduled for 2018 (VDEQ. 2017a) and appears on the 2016-2022 priority list (VDEQ. 2016d). Impairments to aquatic life due to estuarine bioassessments are indicated to need a TMDL (VDEQ. 2017a), but this concern does not appear on the 2016-2022 priority list for Surry County's river segments (VDEQ. 2016d). Impairment to aquatic life due to chlorophyll-a is not pending development of a TMDL (VDEQ. 2017a). SPS is in compliance with its VPDES permit discussed in Section E3.6.1.2 and does not contribute to these impairments.

E3.6.4.2 Groundwater Quality

Groundwater from the confined aquifer (Potomac) is a low-quality source (in terms of dissolved solids), but has low suspended solids and organic matter content. An RO system is used to treat the Potomac groundwater with minimal pre-treatment. (SPS. 2010, Attachment E, Section 3.0) The monitoring of various wells is incorporated in the environmental sampling program for SPS. Water quality analyses at SPS show a chloride concentration ranging from 33-49 parts per million (ppm). In general, the quality of water from the lower aquifers is good except very near the coast or where the potentiometric levels have dropped significantly below mean sea level (msl). (SPS. 2016a, Section 2.3.2) Groundwater from the confined Potomac aquifer is currently the only practicable source of water that can simultaneously meet water quality and quantity requirements for the domestic water supply and certain industrial processes at SPS. (SPS. 2010, Attachment F, Section 6.0)

As part of the SPS radiological groundwater monitoring (and protection) program (GPP), groundwater samples are collected from selected onsite monitoring wells and analyzed for radionuclides to detect potential impacts to groundwater from inadvertent leaks or spills. Samples are collected on an annual, semi-annual, or quarterly basis based on contamination risk potential. As further discussed in Section E3.6.4.2.1, tritium concentrations have been detected in Piez-05, Piez-06, and Piez-29 since 2012. (SPS. 2013a) Tritium concentrations ranged from 1,330 to 8,340 picocuries per liter in 2016, with short-lived Co-58 detected once. One 2017 tritium sample from a later installed well (Piez-44) reported a concentration of 59,300 picocuries per liter. One 2018 follow-up sample for tritium reported a concentration of approximately 79,000 picocuries per liter.

Industrial practices at SPS that involve the use of chemicals are those activities typically associated with painting, cleaning of parts/equipment, refueling of onsite vehicles/generators, fuel oil and gasoline storage, and the storage and use of water treatment additives. The use and storage of chemicals at SPS are controlled in accordance with Dominion's fleet chemical control procedure and site-specific spill prevention plans. In addition, as presented in Section E2.2.7, nonradioactive waste is managed in accordance with Dominion's waste management procedure, which contains preparedness and prevention control measures.

E3.6.4.2.1 History of Radioactive Releases

In 2012, there were three onsite liquid radioactive releases estimated to be greater than 100 gallons each. On August 8, 2012, during an inspection of the east storm drain line, a six-inch hole was identified. This drain line hole provided a direct leakage pathway to the ground for a portion of the fluid passing through the line. The No. 3 turbine building sump was sampled for radioactivity because the sump discharges to the east storm drain line upstream of where the damaged line was identified. The sump discharge was redirected to prevent additional releases through the damaged storm drain line. Tritium was determined to be present in the sump water at a concentration of 1,250 picocuries per liter, and the leak was voluntarily reported to county and state officials, as well as the NRC. The exact volume of water that leaked through the storm drain could not be determined, but is estimated to be greater than 100 gallons. The damage to the drain line was related to the age of the line and the environmental conditions within the specified damaged area. (SPS. 2013a)

On September 17 and 23, 2012, the Unit 2 turbine building heating steam drain receiver tank overflowed to the damaged east storm drain line described above. A sample of the water in the tank confirmed the presence of tritium at a concentration of 1,450 picocuries per liter, and these leaks were subsequently reported to county and state officials and the NRC. The September 2012 overflow events occurred due to the failure of the tank discharge pump and to the failure of the tank discharge pump to the motor coupling, respectively. Each overflow was estimated to be greater than 100 gallons. (SPS. 2013a)

As stated above, the tritium concentration in these releases ranged from approximately 1,250-1,450 picocuries per liter.

In addition, tritium measured as part of the ongoing GPP (see Sections E3.6.2.4 and E3.6.4.2) is tracked and trended for reporting and corrective or improvement actions, such as remedial pumping and additional monitoring, e.g., via new wells or detection capabilities. A subject matter expert team has benchmarked the industry, and working toward zero-leakage goals has become an integrated component of the GPP.

E3.6.4.2.2 History of Nonradioactive Releases

Based on review of site records from 2012-2017, one inadvertent release of approximately eight gallons of glycol-based hydraulic fluid occurred during cleaning of the Unit 2 D service water intake bay. The release was reported to VDEQ and no NOV resulted.

Table E3.6-1 VPDES-Permitted Outfalls

Outfall	Description	Parameter	Permit Requirement
001	Once-through non-contact cooling water	Flow	No limitation; continuous monitoring and reporting required in MGD.
		pH	6.0–9.0 standard units (SU).
		Heat	12.6 x 10^9 Btu/hour daily maximum.
		Total residual chlorine	0.008 mg/L monthly average, maximum 0.016 mg/L.
		Total thallium	No limitation; annual monitoring and reporting required.
101	Sewage treatment plant	Flow	No limitation; continuous monitoring and reporting required in MGD.
		pH	6.0–9.0 SU
		BOD	30 mg/L monthly average, 45 mg/L daily maximum
		Total suspended solids	30 mg/L monthly average, 45 mg/L daily maximum
		Enterococci	35 geometric mean n/100 mL
		Fecal coliform	200 geometric mean n/100 mL
		Total phosphorous	No limitation; annual monitoring and reporting required.
		Total kjeldahl nitrogen	No limitation; annual monitoring and reporting required.
		Nitrite and nitrate	No limitation; annual monitoring and reporting required.
		Total nitrogen	No limitation; annual monitoring and reporting required.

Table E3.6-1 VPDES-Permitted Outfalls

Outfall	Description	Parameter	Permit Requirement
102 103 106	Turbine sump A Turbine sump B Turbine sump C	Flow	No limitation; semi-annual monitoring and reporting required in MGD.
		pH	No limitation; semi-annual monitoring and reporting required.
		Total suspended solids	30 mg/L monthly average, 100 mg/L maximum
		Oil & grease	15 mg/L monthly average, 15 mg/L monthly average, 20 mg/L maximum
		Total phosphorous	No limitation; annual monitoring and reporting required.
		Total kjeldahl nitrogen	No limitation; annual monitoring and reporting required.
		Nitrite & nitrate	No limitation; annual monitoring and reporting required.
		Total nitrogen	No limitation; annual monitoring and reporting required.

Table E3.6-1 VPDES-Permitted Outfalls

Outfall	Description	Parameter	Permit Requirement
104	Station RO reject and backwash	Flow	No limitation; semi-annual monitoring and reporting required in MGD.
107	Package boilers A and B	pH	No limitation; semi-annual monitoring and reporting required in SU.
109	Radwaste facility	Total suspended solids	30 mg/L monthly average, 100 mg/L maximum
110	Unit 1A waste neutralization sump	Oil and grease	15 mg/L monthly average, 20 mg/L maximum
111	Unit 1B waste neutralization sump	Total phosphorous	No limitation; annual monitoring and reporting required.
112	Unit 2A waste neutralization sump	Total kjeldahl nitrogen	No limitation; annual monitoring and reporting required.
113	Unit 2B waste neutralization sump	Nitrite & nitrate	No limitation; annual monitoring and reporting required.
114	Unit 1 steam generator blowdown	Total nitrogen	No limitation; annual monitoring and reporting required.
115	Unit 2 steam generator blowdown		
118	Unit 1 condenser hotwell drain		
119	Unit 2 condenser hotwell drain		
120	Low conductivity sump		
121	Unit 1 steam generator hydrolance		
122	Unit 2 steam generator hydrolance		

Table E3.6-1 VPDES-Permitted Outfalls

Outfall	Description	Parameter	Permit Requirement
105	Station oil storage tank dike	Flow	No limitation; semi-annual monitoring and reporting required in MGD.
		pH	No limitation; semi-annual monitoring and reporting required in SU.
		Total suspended solids	30 mg/L monthly average, 100 mg/L maximum
		Total petroleum hydrocarbons	No limitation; semi-annual monitoring and reporting required.
		Oil and grease	15 mg/L monthly average, 20 mg/L maximum
		Total phosphorous	No limitation; annual monitoring and reporting required.
		Total kjeldahl nitrogen	No limitation; annual monitoring and reporting required.
		Nitrite & nitrate	No limitation; annual monitoring and reporting required.
		Total nitrogen	No limitation; annual monitoring and reporting required.
108	Settling pond	Flow	No limitation; quarterly monitoring and reporting required in MGD.
		pH	No limitation; quarterly monitoring and reporting required in SU.
		Total suspended solids	30 mg/L monthly average, 100 mg/L maximum
		Total organic carbon	110 mg/L maximum
		Total petroleum hydrocarbons	No limitation; annual monitoring and reporting required.
		Oil and grease	15 mg/L monthly average, 20 mg/L maximum
		Total phosphorous	No limitation; annual monitoring and reporting required.
		Total kjeldahl nitrogen	No limitation; annual monitoring and reporting required.
		Nitrite & nitrate	No limitation; annual monitoring and reporting required.
		Total nitrogen	No limitation; annual monitoring and reporting required.

Table E3.6-1 VPDES-Permitted Outfalls

Outfall	Description	Parameter	Permit Requirement
116 117	Unit 1 recirculation spray heat exchanger Unit 2 recirculation spray heat exchanger	Flow	No limitation; semi-annual monitoring and reporting required in MGD.
		pH	No limitation; semi-annual monitoring and reporting required in SU.
		Total suspended solids	30 mg/L monthly average, 100 mg/L maximum
		Oil and grease	15 mg/L monthly average, 20 mg/L maximum
002	Gravel Neck gas turbine dike	Flow	No limitation; semi-annual monitoring and reporting required in MGD.
		Copper	No limitation; semi-annual monitoring and reporting in mg/L.
		Zinc	No limitation; semi-annual monitoring and reporting in mg/L.
		Total organic carbon	No limitation; semi-annual monitoring and reporting in mg/L.
		Total phosphorous	No limitation; semi-annual monitoring and reporting in mg/L.
		Total kjeldahl nitrogen	No limitation; semi-annual monitoring and reporting in mg/L.
		Nitrite & nitrate	No limitation; semi-annual monitoring and reporting in mg/L.
		Total nitrogen	No limitation; semi-annual monitoring and reporting in mg/L.
		Total suspended solids	No limitation; semi-annual monitoring and reporting in mg/L.
050	Central drainage area	Flow	No limitation; semi-annual monitoring and reporting required in MGD.
051	East central drainage area	Iron	No limitation; semi-annual monitoring and reporting in mg/L.
052	North side of intake drainage area	Total phosphorous	No limitation; semi-annual monitoring and reporting in mg/L.

Table E3.6-1 VPDES-Permitted Outfalls

Outfall	Description	Parameter	Permit Requirement
053	South side of intake drainage area	Total kjeldahl nitrogen	No limitation; semi-annual monitoring and reporting in mg/L.
		Nitrite & nitrate	No limitation; semi-annual monitoring and reporting in mg/L.
		Total nitrogen	No limitation; semi-annual monitoring and reporting in mg/L.
		Total suspended solids	No limitation; semi-annual monitoring and reporting in mg/L.

(SPS. 2016a)

Table E3.6-2 Onsite Well Construction Details

Well	Well Diameter[a]	Elevations (feet NGVD29)					
		Top of Casing	Top of Filter[b]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	Well Construction Material
PIEZ-01	2	27.34	-22	-20	-30.0	-30.5	Sch 40 PVC screen and riser
PIEZ -02	2	27.21	-17	-20	-25.0	-25.5	Sch 40 PVC screen and riser
PIEZ-03	2	27.16	-17	-20	-25	-25.5	Sch 40 PVC screen and riser
PIEZ-04	2	27.24	-27	-30	-35	-35.5	Sch 40 PVC screen and riser
PIEZ-05	2	26.99	-26	-30	-35	-35.5	Sch 40 PVC screen and riser
PIEZ-06	2	26.19	-25	-29	-34	-35.5	Sch 40 PVC screen and riser
PIEZ-07	2	27.17	-21	-29	-34	-35.5	Sch 40 PVC screen and riser
PIEZ-08	2	26.99	-27	-30	-35	-35.5	Sch 40 PVC screen and riser
PIEZ-09	2	30.58	-22	-25	-30	-30.5	Sch 40 PVC screen and riser
PIEZ-20	2	26.32			-35		Sch 40 PVC screen and riser
PIEZ-21	2	27.85			-35		Sch 40 PVC screen and riser
PIEZ-22	2	26.37			-35		Sch 40 PVC screen and riser
PIEZ-23	2	26.82			-30		
PIEZ-24	2	26.80			-35		
PIEZ-25	2	27.31			-35		
PIEZ-27	2	26.97			-35		
PIEZ-28	2	26.21			-35		
PIEZ-29	2	27.18			-40		
PIEZ-31	2	27.32			-29.5-		
PIEZ-32	2	28.96			-25		
PIEZ-33	2	27.44	-22	-24.5	-33.5	-35.5	Sch 40 PVC screen and riser
PIEZ-34	2	33.30	-24.5	-24.5	-34.5	40.5	Sch 40 PVC screen and riser
PIEZ-35	2	31.71	-21.5	-24	-34	-35.5	Sch 40 PVC screen and riser
PIEZ-36	2	29.37	-16	-18.5	-28.5	-30.5	Sch 40 PVC screen and riser

Table E3.6-2 Onsite Well Construction Details

Well	Well Diameter[a]	Elevations (feet NGVD29)					
		Top of Casing	Top of Filter[b]	Top of Screen[(b)]	Bottom of Screen[(b)]	Bottom of Filter[(b)]	Well Construction Material
PIEZ-37	2	36.79	-28	-30	--40	-40.5	Sch 40 PVC screen and riser
PIEZ-38	2	35.15	-14	-15.5	-25.5	-25.5	Sch 40 PVC screen and riser
PIEZ-39	2	29.91			-27		
PIEZ-40	2	25.30			-27		
PIEZ-41	2	23.36			-32		
PIEZ-42	2	26.25			-20		
PIEZ-43	2	26.86			-40		
PIEZ-44	2	27.10			-40		
PIEZ-45	2	26.54			-40		
PIEZ-46	2	28.16			-39.5		
PIEZ-47	2	26.33			-42		
PIEZ-48	2	26.44			-41		
PIEZ-49	2	26.99			-38.5		
PIEZ-50	6	26.31			-40		
PIEZ-51	6	30.21			-60		
PIEZ-52	2	29.47			-40		

a. Measured in inches. (FRI. 2007)
b. Approximate measurement.

Table E3.6-3 Surface Water Usage Summary in MGD, 2010

Category	Surry County	Isle of Wight County	James City County
Public supply	0.00	1.25	7.76
Industrial	0.00	0.00	0.00
Irrigation	0.24	0.58	0.57
Livestock	0.20	0.18	0.02
Aquaculture	0.00	4.81	0.00
Mining	0.00	0.32	0.33
Power generation	1907.10	0.00	0.00
Total	**1907.54**	**7.14**	**8.68**

(USGS. 2017b)

Table E3.6-4 Groundwater Usage Summary in MGD, 2010

Category	Surry County	Isle of Wight County	James City County
Public supply	0.12	1.93	4.75
Industrial	0.02	13.41	0.10
Irrigation	0.00	0.00	0.19
Livestock	0.03	0.07	0.00
Aquaculture	0.00	0.07	0.00
Mining	0.00	0.00	0.00
Power generation	0.35	0.00	0.00
Total	**0.52**	**15.48**	**5.04**

(USGS. 2017b)

Table E3.6-5 Registered Groundwater Wells, 2-Mile Band around SPS Property Boundary

Water Well Number	Distance[a]	Well Depth (feet)	Use Description	Aquifer Name
190-00050 (A)	1.6	418	Industrial	Upper Potomac
190-00051 (B)	0.1	418	Industrial/Potable	Upper Potomac
190-00052 (C)	0.2	420	Industrial/Potable	Upper Potomac
190-00103 (D) (new)[b]	0.2	400	Industrial - Abandoned	Upper Potomac
190-00071 (E)(b)	0.2	420	Industrial/Potable - Abandoned	Upper Potomac
190-00104 (F)(b)	0.2	396	Industrial - Abandoned	Upper Potomac
190-00105 (G)	0.5	400	Industrial - Abandoned	Upper Potomac
190-00106 (H)	--	410	Industrial	Upper Potomac
190-00028(CS (W))	0.2	415	Industrial	Upper Potomac
190-00110 (J)	0.6	417	Industrial - Abandoned	Upper Potomac
ER DEQ 190-137	0.2	475	Industrial/Potable	Upper Potomac
JR DEQ 190-138	0.6	459	Industrial	Upper Potomac
USGS 57F 16 SOW 087A	2.0	1,185	Observation	Upper Potomac
USGS 57F 24 SOW 087B	2.0	380	Observation	Upper Potomac

a. Distance is in miles from the SPS center point. Wells listed are limited to those wells within a two-mile band around the property boundary.
b. Well is permanently abandoned.

(USGS. 2016f; VDEQ. 2013a)

Table E3.6-6 Surface Water and Groundwater Withdrawals

Year	James River (MG)	Groundwater (gallons)
2013	716,708.66	105,532,800
2014	713,500.30	126,711,200
2015	677,491.40	127,793,200
2016	815,047.20	129,991,640
2017	735,252.04	115,477,500

Figure E3.6-1 Regional Hydrologic Features

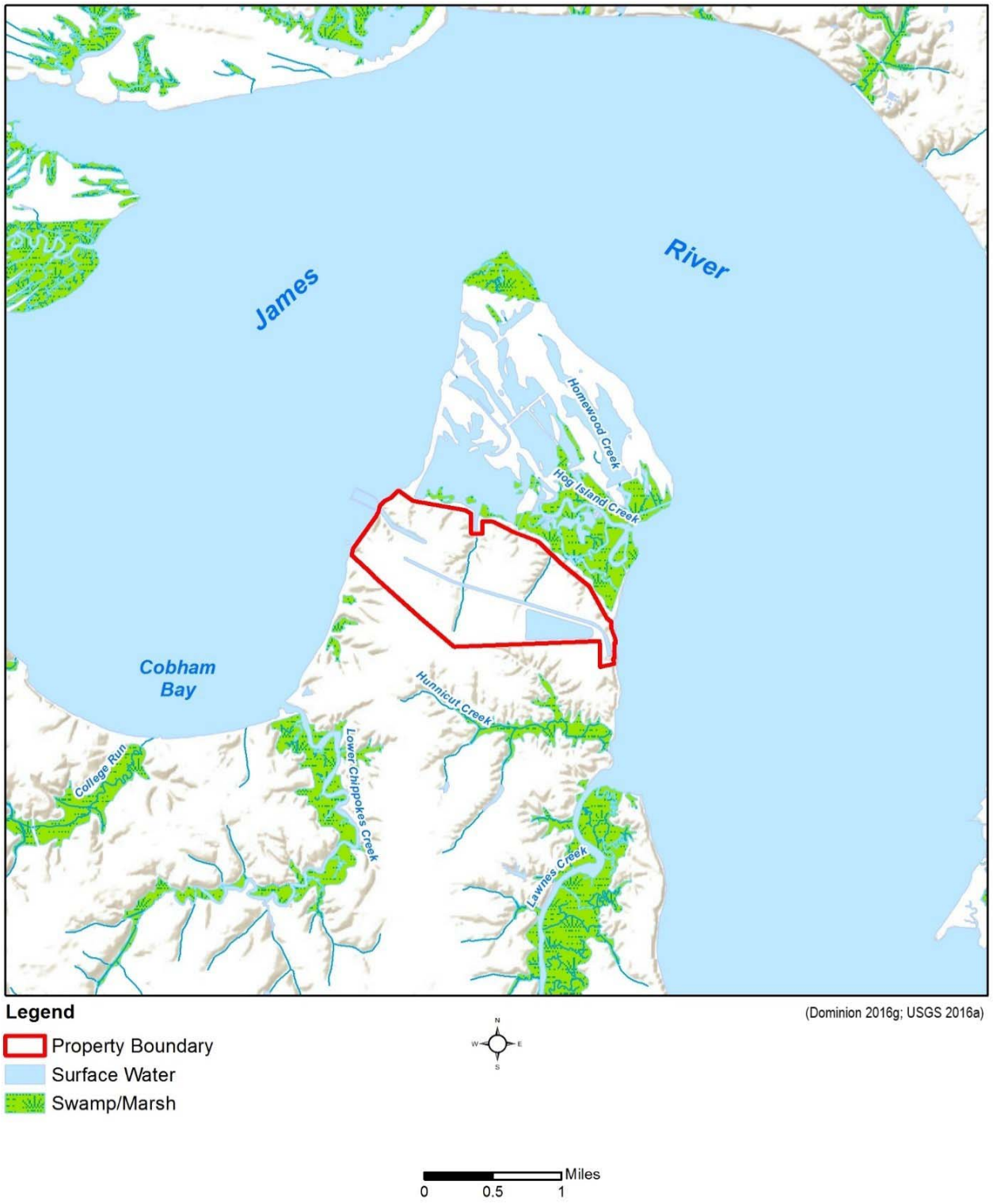


Figure E3.6-2 FEMA Flood Zones, SPS Site Property

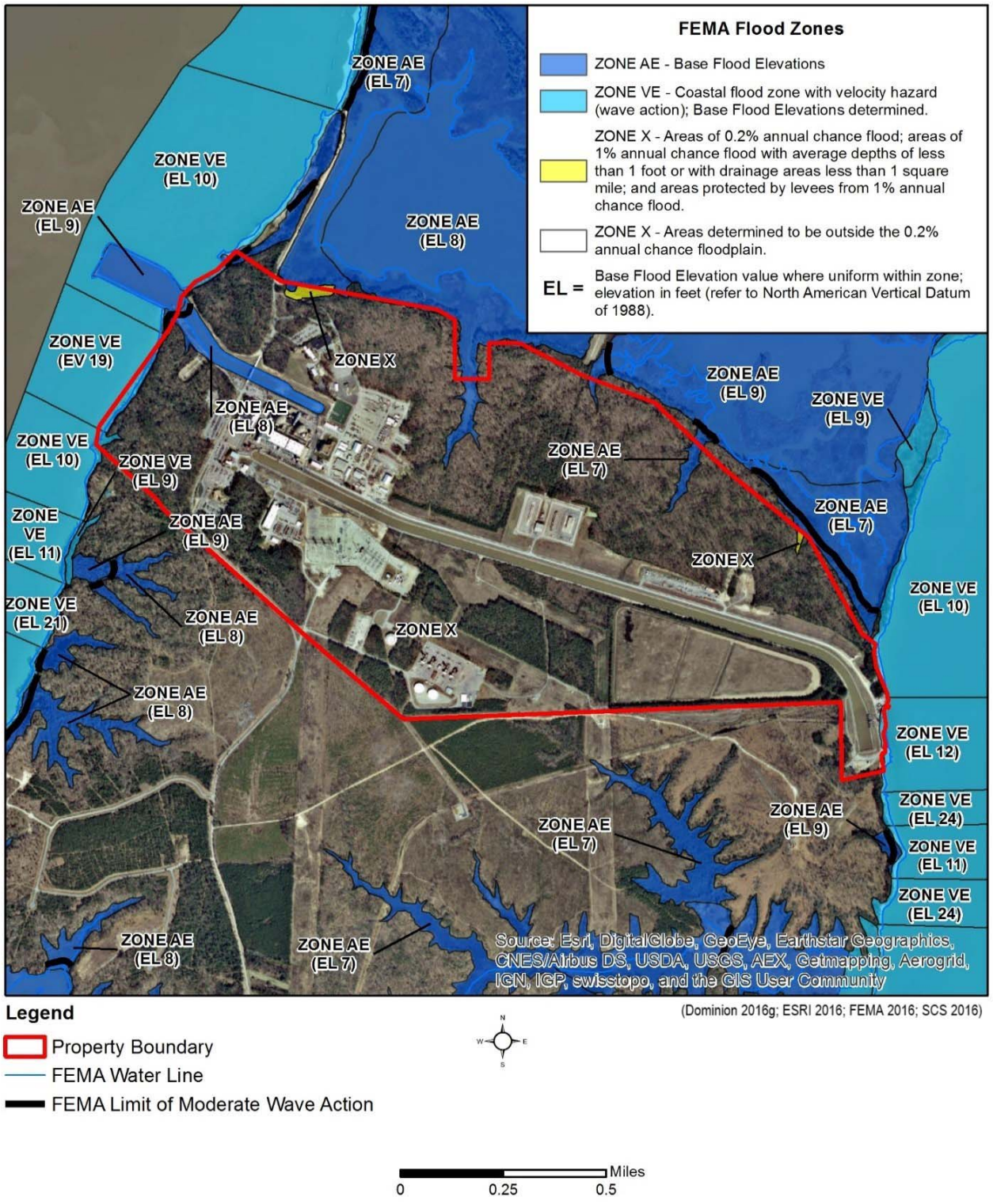


Figure E3.6-3 VPDES-Permitted Outfalls

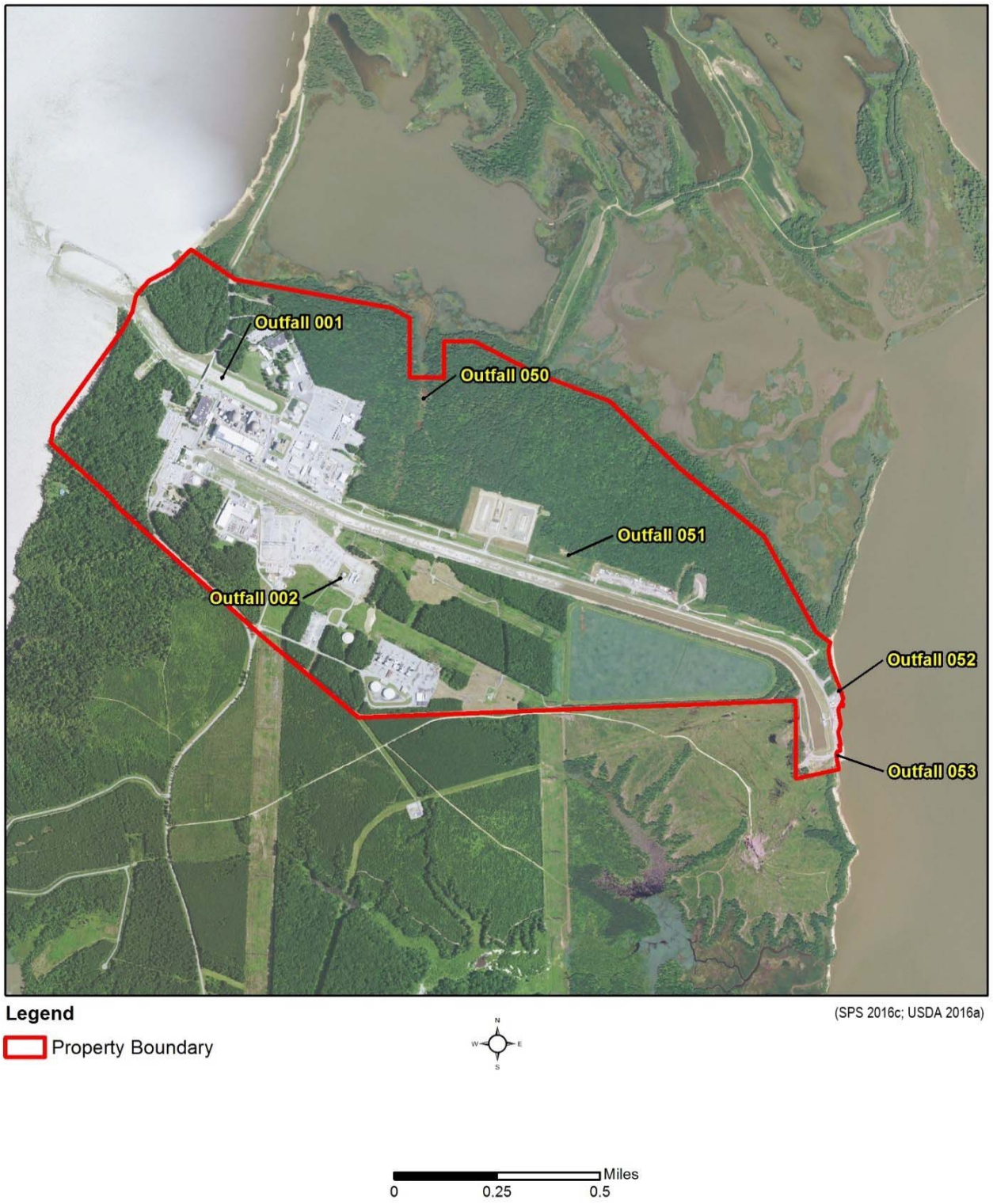


Figure E3.6-4 James River Average Temperatures Measured at Charles City, Virginia (Site #02042222), 2014-2016

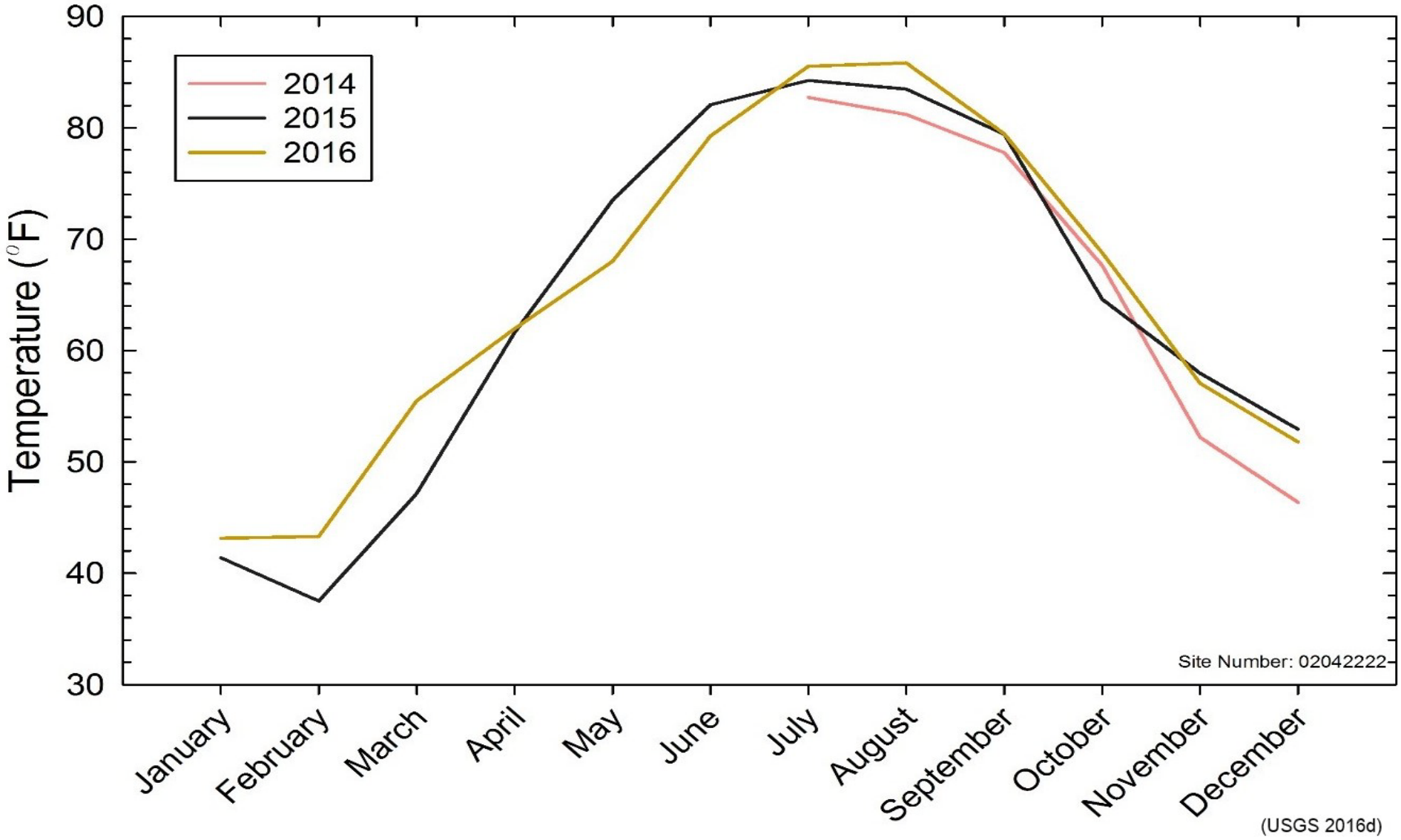


Figure E3.6-5 James River Average Temperatures Measured near Cartersville, Virginia (Site #02035000), 2008-2016

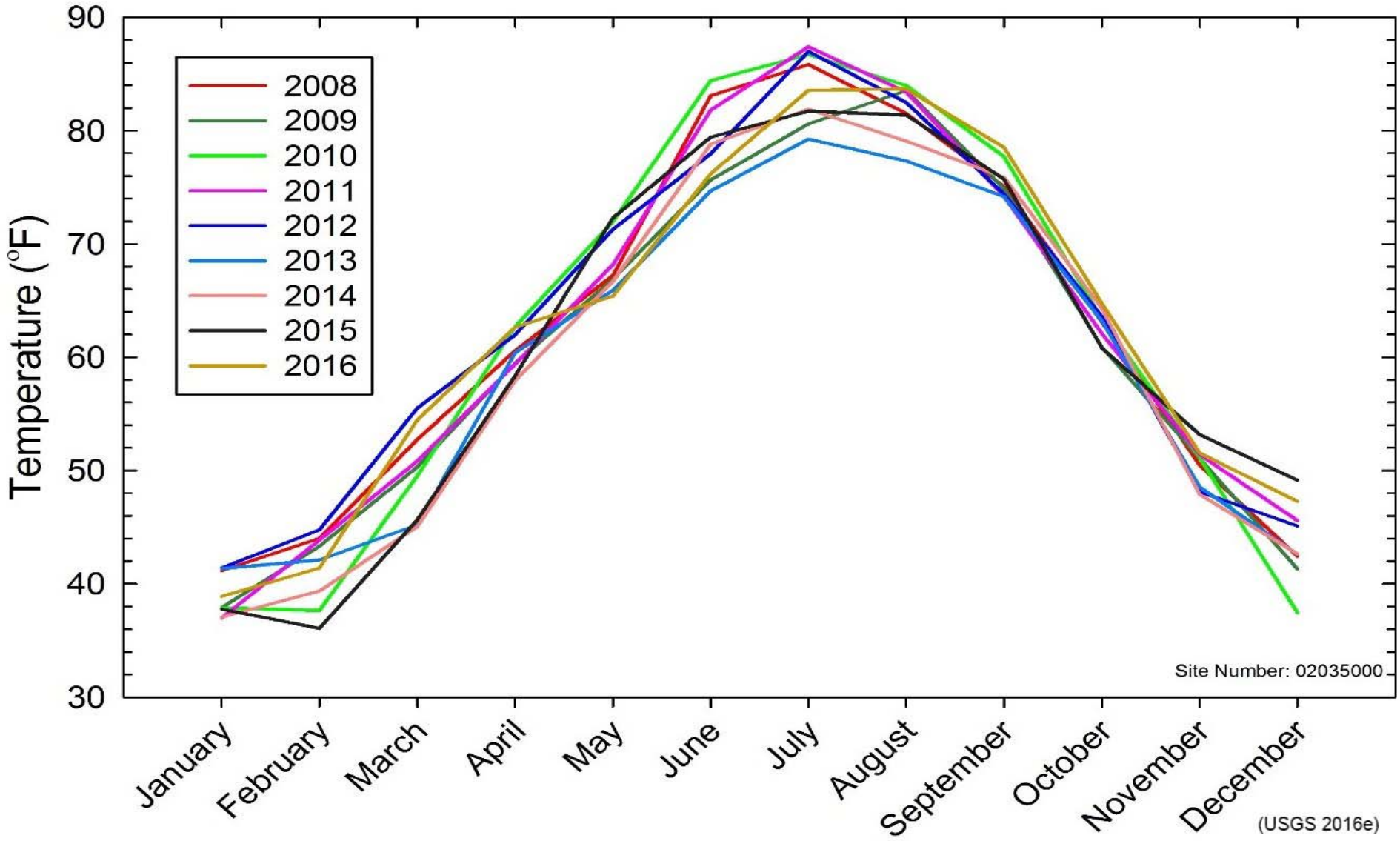


Figure E3.6-6 SPS Potentiometric Surface Map, Shallow Groundwater Elevation

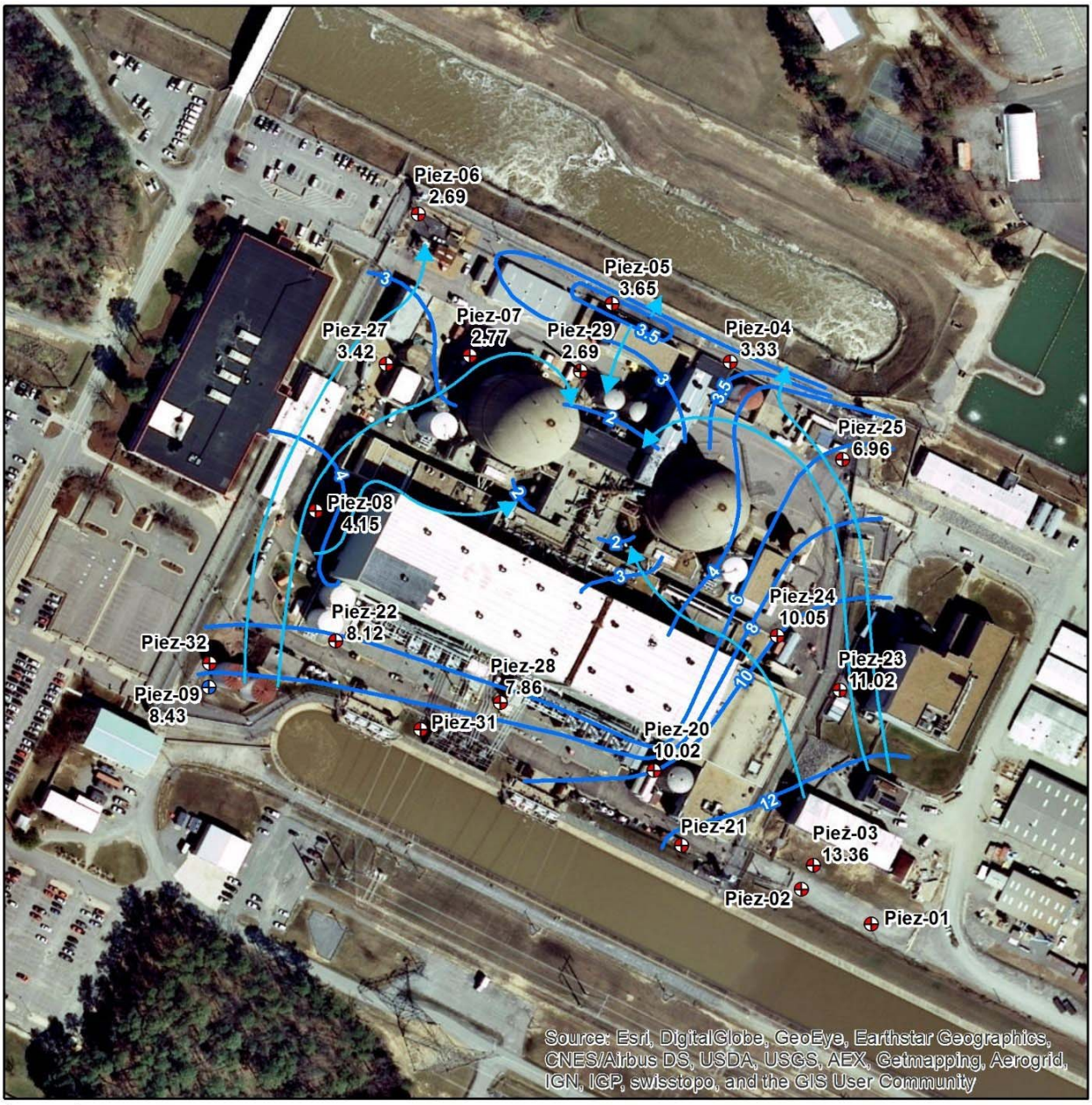


Figure E3.6-7 Onsite Groundwater Monitoring Wells

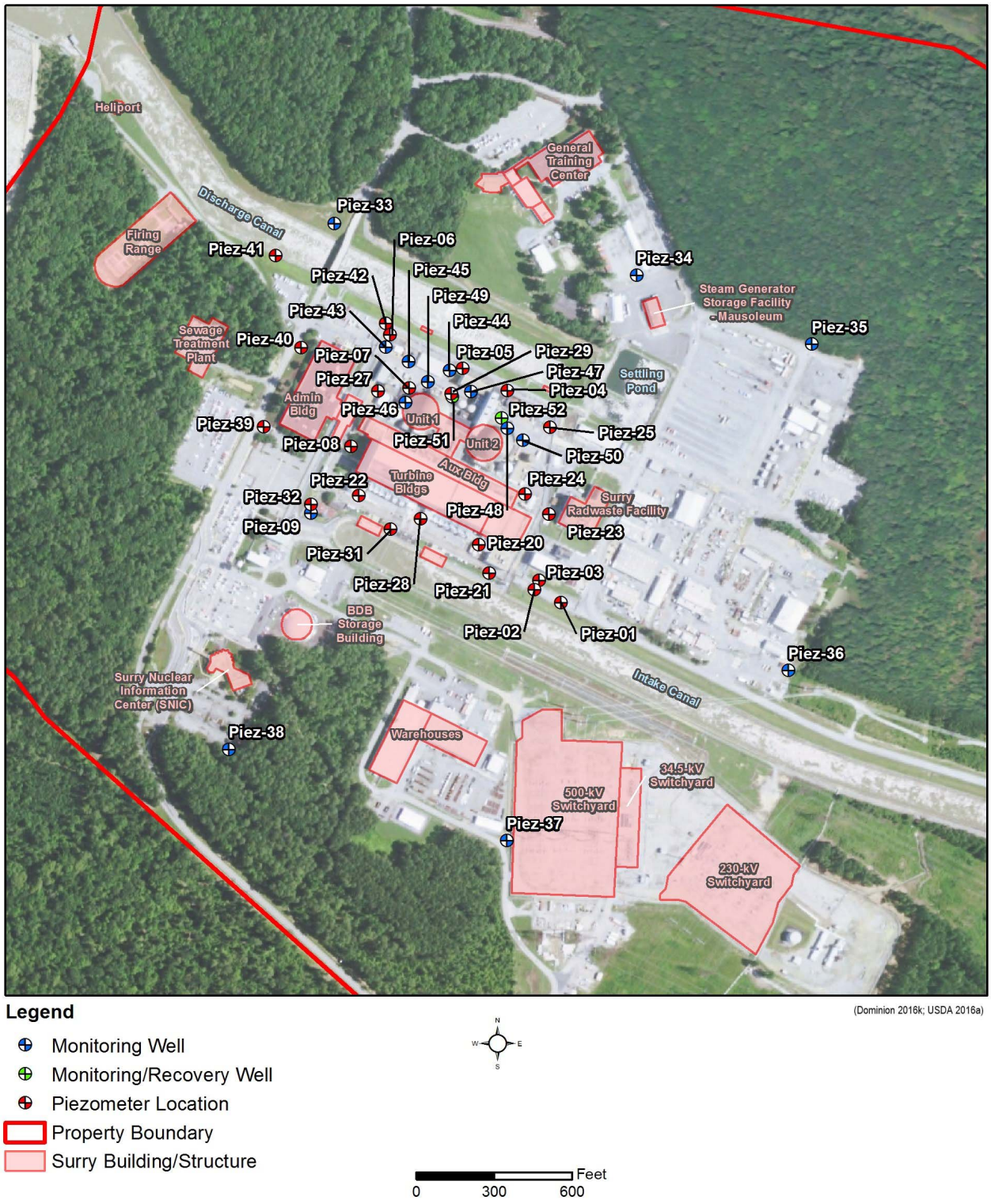
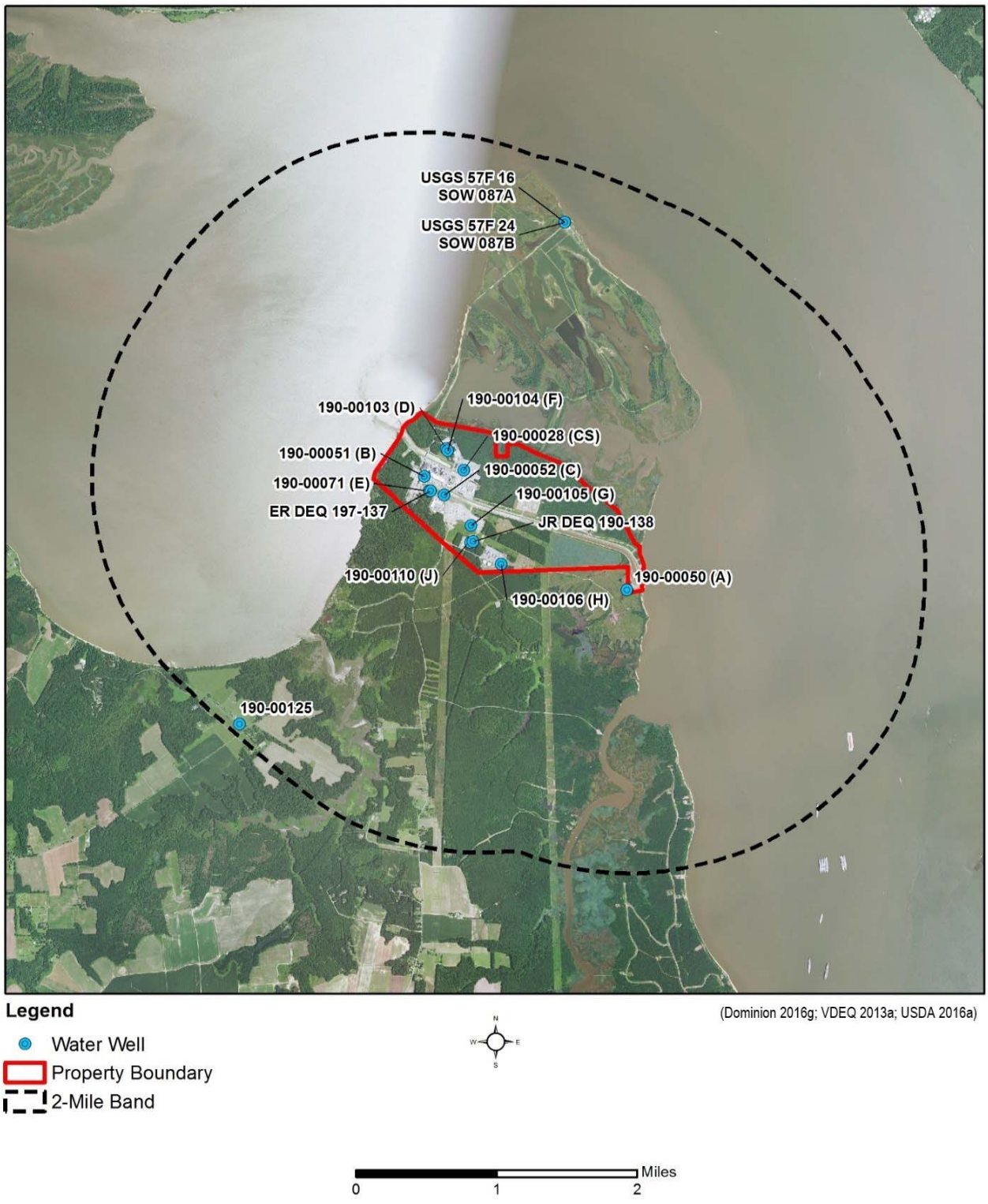


Figure E3.6-8 Registered Water Wells, 2-Mile Band around SPS Property Boundary



E3.7 ECOLOGICAL RESOURCES

Regional ecology is greatly influenced by the geomorphic and physiographic characteristics of the region. Soils determine the basic fertility of the region, which in turn determines the types of plants that may grow. The plants that are present greatly influence the types and number of animals that reside in the region. Soil types also greatly influence the basic fertility of aquatic ecosystems and the species present. Climatological factors, such as temperature, day length, and precipitation, further refine the plants and animals that may live in a locale.

E3.7.1 AQUATIC COMMUNITIES

The aquatic environment near the SPS site is associated with the James River. The James River rises in the Allegheny Mountains near the Virginia/West Virginia border and flows in a southeasterly direction to Hampton Roads, where it enters the Chesapeake Bay. The James River flows 430 miles from its headwaters (the confluence of the Cowpasture and Jackson rivers) to the Chesapeake Bay, crossing portions of the Blue Ridge, Valley and Ridge, Piedmont, and Coastal Plain physiographic provinces. The river drains an area of approximately 10,000 square miles, which is just over 25% of the total land area of Virginia. Overall, approximately 71% of the basin is forested, 23% is agricultural, and 6% is urban. The lower James River flows through the coastal plain of Virginia, which is virtually flat in tidewater areas, generally ranging from 0-100 feet AMSL. (NRC. 2006, Section 8.5.4)

E3.7.1.1 Chesapeake Bay

The Chesapeake Bay watershed is a drainage basin of 64,000 square miles, encompassing parts of the states of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the entire District of Columbia. Waters from this expansive landscape flow into the Chesapeake Bay, the nation's largest estuary. (USFWS. 2011a)

The Chesapeake Bay and its tributaries support more than 2,700 plant and animal species, including threatened and endangered species, waterfowl, raptors, neotropical migratory birds, anadromous fish, and commercially important fish and shellfish. Forested uplands are nesting and resting habitat for neotropical migratory birds and coastal wetlands provide valuable wintering grounds for waterfowl. The tributaries within the watershed are spawning grounds for anadromous fish species like striped bass (*Morone saxatilis*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), hickory shad *(Alosa mediocris*), and Atlantic

sturgeon (*Acipenser oxyrhynchus*). Shallow water areas support submerged aquatic vegetation, underwater plants that provide food and cover for waterfowl, blue crabs (*Callinectes sapidus*), and juvenile fish. The open water of the Chesapeake Bay supports striped bass, bluefish (*Pomatomus saltatrix*), weakfish (*Cynoscion regalis*), American shad, blueback herring, alewife, bay anchovy (*Anchoa mitchilli*), and Atlantic menhaden (*Brevoortia tyrannus*). Commercially valuable shellfish, like oysters and clams (*Bivalvia*), live along the bay's bottom. (USFWS. 2011a)

E3.7.1.2 Appomattox and Chickahominy Rivers

Two major tributaries enter the James River between Richmond and Hampton Roads. The Appomattox River enters the river from the south, in the stretch of river between Richmond and Petersburg. The Chickahominy River enters from the north, just west of Williamsburg. Although the James River downstream of Richmond was severely polluted for many years, the passage of the CWA in 1972 and implementation of associated regulations, such as the National Pollutant Discharge Elimination System (NPDES), have reduced the flow of point-source pollutants into the James River watershed. Pollution prevention measures and programs carried out by industrial entities in the area have further reduced chemical discharges to the James River. At present, nutrients from sewage treatment facilities, agricultural operations, and urban runoff and bacteria from combined sewer systems (those that combine stormwater and sewage) are considered the chief threats to the water quality of the lower James River. (Dominion. 2006, Section 8.6)

E3.7.1.3 James River

The lower James River supports a diverse assemblage of finfish species, ranging from exclusively marine species near the Chesapeake Bay to exclusively freshwater species at the fall line in Richmond. Approximately 80 fish species are known from the brackish portion of the James River downstream of SPS, with approximately 40 additional species recorded from the tidally influenced freshwater portion of the river upstream of the SPS site. Distributions and abundances of particular species vary between seasons and years, depending on salinity differences and natural fluctuations in fish populations. (NRC. 2006, Section 8.5)

Extensive surveys of James River aquatic biota were conducted by Dominion in the 1970s in conjunction with initial plant licensing. While preparing its ER for the North Anna Power Station (NAPS) early site permit (ESP) application in 2003, Dominion contacted the VIMS for more recent information. The following paragraphs describe the historic Dominion data and the more recent data collected by the VIMS. (NRC. 2006, Section 8.5)

From 1970-1978, Dominion collected 63 fish species in monthly haul seine surveys conducted to characterize fish populations of the shore zone in the vicinity of the SPS site. Five species made up more than 75% of fish collected. These were the Atlantic menhaden, blueback herring, inland silverside (*Menidia beryllina*), bay anchovy, and spottail shiner (*Notropis hudsonius*). Over the same period, 42 fish species were collected in otter trawl samples intended to characterize fish populations in deeper waters (the shelf zone) adjacent to the main river channel. Five species comprised more than 80% of fish collected in trawl samples: the hogchoker (*Trinectes maculatus*), spot (*Leiostomus xanthurus*), channel catfish (*Ictalurus punctatus*), Atlantic croaker (*Micropogonias undulatus*), and bay anchovy. (NRC. 2006, Section 8.5)

An ecological study of the James River adjacent to SPS was performed by the VIMS in 1975. This study catalogued the dominant phytoplankton and zooplankton communities in the James River. These species are shown in Table E3.7-1. This study remains the most comprehensive publicly available data regarding phytoplankton and zooplankton communities in the vicinity of SPS.

Between 1996 and 2000, VIMS conducted approximately 350 deep-water ichthyoplankton trawl surveys in the James River in the vicinity of Hog Island. In those collections, four species comprised more than 80% of the catch: hogchoker, white perch *(Morone americana)*, Atlantic croaker, and bay anchovy. Spot was the fifth most abundant species. Salinity appears to be the most important factor influencing the relative abundance of fish between the two sampling periods. (NRC. 2006, Section 8.5) Table E3.7-2 shows the species commonly found in the James River.

In addition to finfish, several invertebrate aquatic species were found in the vicinity of the SPS site. These include zooplankton (dominated by copepods), amphipods (notably the scud [*Gammarus spp.*]), and a variety of benthic organisms (e.g., polychaetes and shellfish). Shellfish formed the bulk of the benthic biomass from the transition zone in the vicinity of the SPS site to Chesapeake Bay. The brackish water clam *(Rangia cuneata)*, a species capable of tolerating a wide range of salinities, dominated the benthic community in the vicinity of the SPS site. Larval American oysters *(Crassostrea virginica)* occurred in the area as meroplankton, but adults were uncommon. The trawl survey collected American oysters, blue crabs, spider crabs *(Libinia emarginata)*, eight species of shrimp *(Penaeidae)*, and five species of clams. The diversity of benthic macroinvertebrate is usually low in a transition zone, increasing downstream to seawater and upstream (moderately) to fresh water. A combination of physical, chemical, and biological factors influences the distribution of benthic organisms, but as with the finfish, salinity appears to exert the greatest influence. (NRC. 2006, Section 8.5)

In August 2017, the National Marine Fisheries Service (NMFS) and the National Oceanic and Atmospheric Administration (NOAA) designated the James River, from Bosher Dam (above Richmond) all the way downstream 99 river miles to where the main stem river discharges into the Chesapeake Bay at Hampton Roads, as designated critical habitat (DCH) for the Atlantic sturgeon (82 FR 39160). Thus the James River adjacent to the SPS site is DCH for the Atlantic sturgeon. With that designation, Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies to ensure that any action they fund, authorize, or carry out is not likely to destroy or adversely modify that habitat [16 USC 1536(a)(2)]. This requirement is in addition to the Section 7(a)(2) requirement that federal agencies ensure that their actions are not likely to jeopardize the continued existence of ESA-listed species. Specifying the geographic location of critical habitat also facilitates implementation of Section 7(a)(1) of the ESA (81 FR 35701). No other DCH for endangered species exists in the James River (USFWS. 2017a).

In the 1970s, Dominion and its contractors conducted extensive surveys of fish and aquatic invertebrates in the lower James River in the vicinity of the SPS site. At the time of the initial LRA, no federally listed aquatic species were found in the lower James River. On Virginia's endangered species list, only one threatened or endangered fish species was identified in the entire James River drainage-the orangefin madtom *(Noturus gilberti)*, which occurs in the headwaters of the river, several hundred miles upstream of the SPS site. (NRC. 2006, Section 8.5)

Following the approval of the SPS LRA, the Chesapeake Bay population of the Atlantic sturgeon was federally listed as endangered in 2012 (USFWS. 2016a). The species was reported in the vicinity of the SPS site in the early 1970s, and was subsequently collected in research and monitoring studies conducted by Dominion and Dominion-funded entities in the mid-to-late 1970s (NRC. 2006, Section 8.5). This species is documented as occurring in the James River, as adults move from the Chesapeake Bay to spawning areas approximately 52 river miles upstream of the SPS site, and return to the Chesapeake Bay following spawning activities (Balazik, M. T., Garman, G. C., Eenennaam, J. P., Mohler, J., & Woods, L. C. 2012). This species is presented in greater detail in Section E3.7.8.

The blackbanded sunfish *(Enneacanthus chaetodon)* is listed as endangered by the Commonwealth of Virginia, and is reported to occur in Prince George, Surry, and Sussex counties west of the SPS site. This sunfish primarily inhabits thickly vegetated ponds, swamps, and pools, and is not reported to occur in the James River drainage. (NRC. 2006, Section 8.5)

The shortnose sturgeon *(Acipenser brevirostrum)* is federally listed as endangered, and a single specimen was recently collected from the James River upstream of SPS at RM 30 (SPS is at RM 25). (Balazik, M. 2017) indicated the fish was likely a stray that did not originate from the James River. The species occurs in major river systems north and south of the Chesapeake Bay, and is presumed to have spawned in the four major estuarine drainages of the Chesapeake Bay (including the James River) in Virginia as late as the 19th century. The Virginia Department of Conservation and Recreation (VDCR) lists the shortnose sturgeon as "LE," or "listed as endangered" in their Natural Heritage Program, Rare Animal Species. (NRC. 2006, Section 8.5)

The James River is utilized for recreational fishing. Common sportfish species in the James River include American shad, blue catfish *(Ictalurus furcatus)*, channel catfish, black crappie *(Pomoxis nigromaculatus)*, striped bass, and large-mouthed bass *(Micropterus salmoides)*. (VDGIF. 2016b) These species are included in Table E3.7-2.

While there is little commercial fishing on the James River in the vicinity of the SPS site, oyster beds located in the river to the north and east of the Gravel Neck Peninsula are leased for private oyster harvest by the Virginia Marine Resources Commission. Locations upstream of the SPS site are prohibited for shellfish harvest by the Virginia Department of Health (VDH). (VMRC. 2017)

E3.7.2 TERRESTRIAL AND WETLAND COMMUNITIES

Most of the SPS site consists of generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. The only terrestrial community at the site consists of remnants of mixed pine-hardwood forests used for timber production prior to acquisition by Dominion. Wildlife species found in the forested portions of SPS are those typically found in upland forests of coastal Virginia.

E3.7.2.1 Physiographic Province

The SPS site is located within the coastal plain physiographic province of Virginia. The coastal plain in Virginia extends inland from the coast about 110 miles to the fall line and passes roughly through Fairfax County, Fredericksburg, Richmond, Petersburg, and Emporia. The Coastal Plain Province is the only one in Virginia composed mostly of unconsolidated deposits, primarily alternating layers of sand, gravel, shell rock, silt, and clay. More groundwater is stored in these very permeable materials than in any other province in the state. The pollution potential in the uppermost unconfined aquifer here is high, however, because of the permeability coupled with the high population density and agricultural activities in the area. (VDGIF. 2016e)

South of the James River, the coastal plain is thought to have experienced frequent natural fires pre-settlement. Fire-maintained forests and woodlands, dominated by longleaf pine *(Pinus palustris)*, may have been widespread before European settlement, but little trace of them remains. The only remnants are associated with deep sandhill deposits along the Nottoway and Blackwater rivers in southeastern Virginia. In addition to longleaf pine, diagnostic species of the sandhill vegetation include a number of state-rare species and species reaching their northern or southern range limits, such as turkey oak *(Quercus laevis)*, sheep laurel *(Kalmia angustifolia)*, creeping blueberry *(Vaccinium crassifolium)*, common pyxie moss (*Pyxidanthera barbulata var. barbulata*), October flower *(Polygonella polygama var. polygama)*, golden pucoon *(Lithospermum caroliniense)*, hoary scufpea *(Pediomelum canescens)*, and pale grass-pink *(Calopogon pallidus)*. The primary area of longleaf pine development in Virginia may always have been in this sandhill belt, with the remainder of the southeastern coastal plain located in a transitional zone where longleaf pine originally occurred in mixtures with other pines and oaks. (VDCR. 2016a)

E3.7.2.2 Ecoregion

SPS is situated within the middle Atlantic coastal plain ecoregion. This ecoregion is a low, nearly flat plain, with many swampy or marshy areas that extends northeastward from Georgia to New Jersey. Forest cover in the region is predominantly loblolly shortleaf pine with patches of oak, gum, and cypress near major streams. Poorly drained soils are common especially in lowest areas. Elevations range from 0-100 feet, and local relief is less than 50 feet and often nearly level. This ecoregion has low terraces, marshes, dunes, beach ridges, barrier beaches, and beaches, which support natural vegetation of Appalachian oak forest, northern cordgrass prairie, southern floodplain forest, live oak-sea oats, and oak-hickory-pine forest. (EPA. 1999)

A brief description of regional ecosystems, including state-listed natural communities, is provided below.

E3.7.2.2.1 Coastal Plain Calcareous Seepage Swamp

The endemic coastal plain calcareous seepage swamp includes saturated deciduous forests occurring on moderately to highly base-rich substrates of the coastal plain and outer piedmont. Stands in the former province occur in the bottoms of ravines that have downcut into Tertiary shell deposits or limesands. These are naturally rare, small-patch communities known from the dissected inner coastal plain of Surry, Isle of Wight, York, James City, Gloucester, and Lancaster counties. Habitats consist of mucky, braided ravine bottoms saturated by constant groundwater seepage, and soils with high base status. Hummock-and-hollow microtopography is prevalent, and exposed shells are common in springs and rills. (VDCR. 2016b)

Green ash *(Fraxinus pennsylvanica)*, red maple *(Acer rubrum)*, and tulip poplar *(Liriodendron tulipifera)* are common overstory trees in most occurrences, but a subset of ravines on the south side of the James River features the unusual co-dominance of bald cypress *(Taxodium distichum)* or swamp tupelo *(Nyssa biflora)*. Small trees and shrubs include stiff dogwood *(Cornus stricta)*, spicebush (*Lindera benzoin var. benzoin* and *var. pubescens*), and wax myrtle *(Morella cerifera)*. A number of noteworthy mountain disjuncts have been documented in the herbaceous flora of these communities, including marsh marigold *(Caltha palustris)*, rigid sedge *(Carex tetanica)*, bog twayblade (*Liparis loeselii*; state-rare), swamp lousewort *(Pedicularis lanceolata)*, and American false hellebore *(Veratrum viride)*. Reaching their northern limits are the southern species Florida adder's-mouth *(Malaxis spicata)*, shadow witch orchid *(Ponthieva racemosa)*, and drooping bulrush *(Scirpus lineatus)*. Other characteristic herbs include lizard's tail *(Saururus cernuus)*, golden ragwort (*Packera aurea* = *Senecio aureus*), blackfruit clearweed *(Pilea fontana)*, smooth bur-marigold *(Bidens laevis)*, Carolina buttercup *(Ranunculus carolinianus)*, common brome sedge *(Carex bromoides spp. bromoides)*, and common wood reedgrass *(Cinna arundinacea)*. The damp, fertile habitats are particularly susceptible to invasion by the introduced Japanese stiltgrass *(Microstegium vimineum)*. The globally rare tidewater interstitial amphipod *(Stygobromus araeus)* appears to be closely associated with groundwater in shell marl deposits. The rare Kentucky lady's slipper *(Cypripedium kentuckiense)* occurs in a stand of this community type in Lancaster County. (VDCR. 2016b)

E3.7.2.2.2 Coastal Plain Depression Wetland

This diverse group of poorly drained basin wetlands is characteristic of flat coastal plain terraces with fluctuating, seasonally perched water tables. Similar wetlands are scattered throughout the mid-Atlantic coastal plain. The best documented examples of this group in Virginia are the Grafton Ponds, located on the peninsula in York County, but other sizeable complexes occur on coastal plain terraces in Dinwiddie, Surry, Isle of Wight, Gloucester, and Matthews counties. Also included are the seasonally exposed shores of Lake Drummond, a 3,180-acre natural basin in the Great Dismal Swamp. South of the James River, two community types in this group extend into the eastern piedmont, where they are associated with hardpan soils. Most of these wetlands are seasonally flooded and believed to be sinkhole features that formed through dissolution of underlying carbonate-rich, shell marl deposits. The marl deposits are too deep to influence soil or water chemistry of the depressions, which are strongly acidic in most examples. A few depressions in extreme southeastern Virginia appear to have originated from deep peat burn-outs. Although the term "vernal pond" has been applied to some of the communities in this group, that name is rather restrictive and is a poor descriptor of the more extensive occurrences. (VDCR. 2016b)

Vegetation in this group varies from nearly forested to entirely herbaceous, representing a sizeable number of distinct community types. Depth and duration of seasonal inundation are apparently the most important factors influencing community composition and the degree to which woody species become established. Dry season fires in adjacent uplands may spread into ponds and may be another factor limiting the invasion of woody species, although fire frequencies throughout the region have been much reduced in recent decades. Typical trees occurring in wooded ponds are red maple, sweetgum *(Liquidambar styraciflua)*, swamp tupelo, blackgum *(Nyssa sylvatica)*, willow oak *(Quercus phellos)*, overcup oak *(Quercus lyrata)*, and bald cypress. Shrubs that dominate some ponds include buttonbush *(Cephalanthus occidentalis)*, swamp loosestrife *(Decodon verticillatus)*, common persimmon *(Diospyros virginiana)*, and fetterbush *(Eubotrys racemosa)*. Herbs characteristic of these communities are well adapted to long periods of submersion. Included in these communities are: southern waxy sedge *(Carex glaucescens)*, cypress-swamp sedge *(Carex joorii)*, Walter's sedge *(Carex striata var. brevis)*, long-tubercled spikerush *(Eleocharis tuberculosa)*, square-stem spikerush *(Eleocharis quadrangulata)*, creeping rush *(Juncus repens)*, narrow-leaved seedbox *(Ludwigia linearis)*, globe-fruited seedbox *(Ludwigia sphaerocarpa)*, tall flat panic grass *(Coleataenia rigidula ssp. rigidula)*, warty panic grass *(Panicum verrucosum)*, mermaid-weeds (*Proserpinaca palustris* and *Proserpinaca pectinata*), short-bristled horned beaksedge *(Rhynchospora corniculata)*, narrow plumegrass *(Saccharum baldwinii)*, woolgrass *(Scirpus cyperinus)*, and pale mannagrass *(Torreyochloa pallida var. pallida)*. (VDCR. 2016b)

Coastal plain depression wetlands are relatively rare, small-patch communities that provide important habitat for the state-rare chicken turtle *(Deirochelys reticularia)* and three state-listed amphibians: Mabee's salamander *(Ambystoma mabeei)*, tiger salamander *(Ambystoma tigrinum)*, and barking tree frog *(Hyla gratiosa)*. In addition, the globally rare plants Harper's fimbristylis *(Fimbristylis perpusilla)* and pondspice *(Litsea aestivalis)* are confined to these habitats in Virginia. (VDCR. 2016b)

E3.7.2.2.3 Coastal Plain/Outer Piedmont Basic Mesic Forest

This natural community is represented by forests occurring in fertile, mesic, low-elevation habitats of the coastal plain, piedmont, and valleys of the central Appalachian region. Typical sites are deep ravines, sheltered north- or east-facing slopes subtending large streams and rivers, and occasionally well-drained floodplain terraces. Soils are usually weathered from carbonate or mafic bedrock, or from calcareous, shell-rich deposits in the coastal plain. The term "basic," as applied by VDCR Division of Natural Heritage (DNH) ecologists, refers to high levels of base cation saturation rather than soil pH, which analysis has proven to be a less reliable indicator of fertility and parent material. (VDCR. 2016b)

Dominant trees include chinquapin oak *(Quercus muehlenbergii)*, black maple *(Acer nigrum)*, southern sugar maple *(Acer floridanum)*, American beech *(Fagus grandifolia)*, bitternut hickory *(Carya cordiformis)*, and black walnut *(Juglans nigra)*. Shrub and herb layers contain a number of species that are atypical of mountain slopes, such as pawpaw *(Asimina triloba)*, painted buckeye *(Aesculus sylvatica)*, twinleaf *(Jeffersonia diphylla)*, harbinger-of-spring *(Erigenia bulbosa)*, lowland bladder fern *(Cystopteris protrusa)*, and toadshade *(Trillium sessile)*. Widespread herbs include species such as northern maidenhair fern *(Adiantum pedatum)*, hog-peanut *(Amphicarpaea bracteata)*, puttyroot *(Aplectrum hyemale)*, common jack-in-the-pulpit *(Arisaema triphyllum ssp. triphyllum)*, common wild ginger *(Asarum canadense)*, common black cohosh *(Actaea racemosa)*, large yellow lady's-slipper *(Cypripedium parviflorum var. pubescens)*, silvery spleenwort *(Deparia acrostichoides)*, squirrel corn *(Dicentra canadensis)*, Dutchman's breeches *(Dicentra cucullaria)*, showy orchis *(Galearis spectabilis)*, round-lobed hepatica *(Anemone americana)*, green violet *(Hybanthus concolor)*, pennywort *(Obolaria virginica)*, aniseroot *(Osmorhiza longistylis)*, broad beech fern *(Phegopteris hexagonoptera)*, mayapple *(Podophyllum peltatum)*, bloodroot *(Sanguinaria canadensis)*, small-flower baby-blue-eyes *(Nemophila aphylla)*, and heart-leaved foamflower *(Tiarella cordifolia)*. (VDCR. 2016b)

Five community types classified to date are segregated by geography and associated substrates. Slopes subtending streams cutting through limestone and other calcium-rich substrates of the mountain valleys and piedmont support a distinctive community type characterized by lush growth of twinleaf, dwarf larkspur *(Delphinium tricorne)*, broad-leaved waterleaf *(Hydrophyllum canadense)*, and other spring ephemerals. Coastal plain ravines that have downcut into Tertiary shell deposits in James City and York counties and the city of Suffolk support an endemic community type with abundant southern sugar maple and many noteworthy mountain disjuncts. (VDCR. 2016b)

Basic mesic forests are the low-elevation analogues of rich cove and slope forests. Excepting stands in the northwestern Virginia mountain valleys, they occur in non-montane settings and contain a substantial number of species that are confined to low elevations in Virginia. The extent and viability of basic mesic forests has been much reduced by repeated logging and invasive introduced weeds. (VDCR. 2016b)

E3.7.2.2.4 Northern Coastal Plain/Piedmont Mesic Mixed Hardwood Forest

These mixed hardwood forests are widespread in mesic to submesic, infertile habitats throughout the coastal plain and piedmont, and rarely at low elevations in the mountains. Forests in this group occupy mesic uplands, ravines, lower slopes, and well-drained "flatwoods" on deep acidic, relatively nutrient-poor soils. The most typical overstories contain mixtures of American beech, oaks (*Quercus spp.*, varying by region), tulip tree, and hickories (*Carya spp.*), but a wide variety of hardwood associates occur. American hornbeam (*Carpinus caroliniana ssp. caroliniana and ssp.*

virginiana), flowering dogwood *(Cornus florida)*, American strawberry-bush *(Euonymus americanus)* and, in eastern Virginia, American holly *(Ilex opaca var. opaca)* are prominent understory plants. In mesic "flatwoods" of the southeastern Virginia coastal plain, silky camellia *(Stewartia malacodendron)* and big-leaf snowbell *(Styrax grandifolius)* are characteristic small trees. These communities lack the lush herbaceous layers of basic mesic forests, although species such as Christmas fern *(Polystichum acrostichoides)*, New York fern *(Parathelypteris noveboracensis)*, and white wood aster (*Eurybia divaricata* = *Aster divaricatus*) may form moderately dense populations. Along with Christmas fern, downy rattlesnake-plantain *(Goodyera pubescens)*, Virginia heartleaf *(Hexastylis virginica)*, and partridge-berry *(Mitchella repens)* are frequent evergreen herbs in mesic mixed hardwood forests. The name "southern mixed hardwood forest" has been applied to some coastal plain representatives of this group. Although mesic mixed hardwood forests still cover sizable areas east of the mountains in Virginia, their extent and compositional integrity have been reduced by repeated logging. (VDCR. 2016b)

E3.7.2.2.5 Coastal Plain Dry Calcareous Forest

This is a group of rare, deciduous (rarely mixed) forests and woodlands of subxeric to xeric, fertile habitats over unconsolidated, calcareous deposits. Similar forests are scattered in the mid-Atlantic coastal plain from Maryland to South Carolina. In Virginia, occurrences are small and highly localized in two environmental situations: 1) steep, convex, south-facing slopes of dissected ravine systems and river-fronting bluffs of the inner coastal plain from southeastern Virginia north to Stafford County; and 2) steeply cut slopes bordering estuaries on the outer coastal plain. In the first setting, slopes have downcut into Tertiary shell deposits or limesands, producing circumneutral to slightly alkaline soils. In the estuarine settings, shell middens may provide the primary source of substrate calcium. Calcium levels in soil samples collected from these habitats are among the highest documented in Virginia, ranging to > 11,000 ppm. The majority of documented stands are on the peninsula near Williamsburg (James City and York counties). (VDCR. 2016b)

Tree canopies range from semi-closed to very open. Chinquapin oak is the most characteristic tree; southern sugar maple, white oak *(Quercus alba)*, northern red oak *(Quercus rubra)*, bitternut hickory, American beech, and white ash *(Fraxinus americana)* are common associates. In the stands bordering tidal streams, hackberries *(Celtis occidentalis* and *Celtis laevigata)* are characteristic components. The understory includes eastern red cedar *(Juniperus virginiana var. virginiana)*, eastern redbud *(Cercis canadensis var. canadensis)*, American holly, buckthorn bumelia *(Sideroxylon lycioides)*, and flowering dogwood. (VDCR. 2016b)

Although not lush, the herb layer contains a diversity of species, including several long-range mountain disjuncts. Particularly abundant or noteworthy herbaceous species include robin's-plantain *(Erigeron pulchellus var. pulchellus)*, Bosc's panic-grass *(Dichanthelium boscii)*, bearded shorthusk *(Brachyelytrum erectum)*, white crownbeard *(Verbesina virginica var. virginica)*, American bellflower *(Campanula americana)*, hairy leafcup *(Smallanthus uvedalius)*, whorled rosin weed *(Silphium asteriscus var. trifoliatum)*, few-flowered tick-trefoil *(Hylodesmum pauciflorum)*, crested coralroot *(Hexalectris spicata var. spicata)*, hairy wild rye *(Elymus villosus)*, and eastern needlegrass *(Piptochaetium avenaceum)*. Compared to the basic mesic forests of the coastal plain, these dry calcareous forests have a larger component of oaks (particularly chinquapin oak) in the overstory and have a much less lush herb layer. The single Virginia community in this group is considered globally rare and is threatened by logging and development. (VDCR. 2016b)

E3.7.2.2.6 Bald Cypress-Water Tupelo Brownwater Swamp

Forests in this group occupy seasonally to semi-permanently flooded backswamps, sloughs, and poorly drained first bottoms of coastal plain rivers and streams. They are generally distributed throughout southeastern Virginia, north to Dragon Swamp (Gloucester, King and Queen, and Middlesex counties), with small-stream swamp tupelo swamps extending somewhat further north. Habitats are deeply flooded (up to 4.2 feet) for part of the year; many retain at least some standing water throughout the growing season. Microtopography is often pronounced with small channels, swales, tree-base hummocks, and numerous bald cypress "knees." Overstory composition varies from mixed stands of bald cypress, water tupelo *(Nyssa aquatica)*, and/or swamp tupelo to nearly pure stands of one species or another. The three dominants have complex competitive and successional relationships. As a rule, the two tupelos are less shade tolerant than bald cypress and regenerate more readily by sprouting in cut-over stands. Thus, tupelos tend to become dominant when bald cypress stands are heavily logged. In addition, swamp tupelo appears to be most abundant in organic swamp soils, while water tupelo appears to prefer mineral soils with high silt content. (VDCR. 2016b)

Stands dominated primarily or exclusively by swamp tupelo typically occur in the most acidic soils with highest organic content, usually in the smaller swamps along headwater streams of the inner coastal plain (VDCR. 2016b).

E3.7.2.2.7 Tidal Bald Cypress Woodland (Shoreline Sedge Type)

This region consists of coniferous or mixed swamp forests and woodlands dominated by bald cypress, and is known only from the upper tidal reaches of rivers in Maryland, southeastern Virginia and North Carolina. Examples are documented in Virginia from the lunar-tidal Dragon Swamp/Piankatank River (Gloucester, King and Queen, and Middlesex counties), Chickahominy River (Charles City, James City, and New Kent counties), and James River (Isle of Wight and Surry counties), and the wind-tidal Northwest and North Landing rivers (City of Chesapeake and Virginia Beach). At some sites, these communities occur in ecotones between tidal marshes and non-tidal backswamps or uplands. (VDCR. 2016b)

In lunar-tidal stands, bald cypress dominates an open to very open overstory, with or without hardwood associates such as swamp tupelo, water tupelo, and green ash. Stand structure and canopy cover range from closed forest to very open woodland. Shrub and herb layers are variable, but generally contain a mixture of species characteristic of both marshes and swamps. Some well-developed tidal bald cypress forests appear floristically similar to palustrine bald cypress-tupelo swamps. Other stands have a nearly monospecific herb dominance by shoreline sedge *(Carex hyalinolepis)*. In a unique, possibly fire-influenced, savanna-like stand on the Northwest River, the herbaceous dominants, in rough seasonal order, are silvery sedge *(Carex canescens var. disjuncta)*, spikerushes *(Eleocharis fallax* and *Eleocharis rostellata)*, rattlesnake-master *(Eryngium aquaticum var. aquaticum)*, and wild rice *(Zizania aquatica var. aquatica)*. (VDCR. 2016b)

A distinctive mixed tidal swamp forest in extreme southeastern Virginia is subject to irregular wind-tidal flooding. As currently defined, this community type appears to be a globally rare endemic of the embayed region of southeastern Virginia and northeastern North Carolina; similar communities, occur occasionally further north on the irregularly flooded edges of lunar-tidal systems. In Virginia, stands occur primarily along the North Landing and Northwest rivers (cities of Virginia Beach and Chesapeake), and in the estuarine tributaries of Currituck Sound. Although these systems are no longer influenced by lunar tides because of inlet closures, they are subject to wind-driven currents that produce as much as three feet of variation in water levels and contribute to a salinity regime that fluctuates between completely fresh and about five parts per thousand. This forest borders the wind-tidal marshes along the lower portions of the two rivers, extending well upstream of the limit of marshes in narrowing channel-side belts. It appears to represent a long-term seral stage in succession from marsh to swamp forest. Habitats have a pronounced hummock-and-hollow microtopography, with an average flooding depth 16 inches above the hollow bottoms. Soils are coarse, fibric peats that appear indistinguishable from adjacent marsh peats.

Bald cypress, swamp tupelo, and loblolly pine *(Pinus taeda)* are the dominant overstory trees in variable combinations. Spanish moss *(Tillandsia usneoides)* is locally abundant, festooning the trees in some stands. Sweetbay magnolia *(Magnolia virginiana)* and red bay *(Persea palustris)* are scattered understory trees, while wax myrtle dominates the shrub layer. The herb layer is diverse, containing species characteristic of both marshes and swamps, but royal fern *(Osmunda spectabilis)* often dominates. (VDCR. 2016b)

E3.7.2.3 Wetlands

Wetlands are defined as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (USACE. 1999)

Thirteen functions and values typically considered by regulatory and conservation agencies when evaluating wetlands are used as part of the New England method. These include: groundwater recharge/discharge; floodflow alteration; fish and shellfish habitat; sediment/toxicant/pathogen retention; nutrient removal/retention/transformation; production export (nutrient); sediment/shoreline stabilization; wildlife habitat; recreation (consumptive and nonconsumptive); educational/scientific value; uniqueness/heritage; visual quality/aesthetics; and threatened or endangered species habitat. (USACE. 1999)

The USFWS maintains the National Wetlands Inventory (NWI), which integrates digital map data along with other resource information to produce current information on the status, extent, characteristics, and functions of wetland, riparian, and deepwater habitats in the United States.

Based on a review of USFWS NWI maps of the site (USFWS. 2016b), there are approximately 37,445 acres of wetlands within a six-mile radius of SPS, composed of the following types (Figure E3.7-1):

- Estuarine and marine deepwater habitat covering approximately 19,344 acres (51.66% of total wetland habitat)
- Estuarine and marine wetlands covering approximately 2,182 acres (5.83% of total wetland habitat)
- Freshwater emergent wetlands covering approximately 2,611 acres (6.97% of total wetland habitat)
- Freshwater forested/scrub shrub wetlands covering approximately 2,338 acres (6.24% of total wetland habitat)
- Freshwater pond covering approximately 304 acres (0.81% of total wetland habitat)
- Lake covering approximately 541 acres (1.44% of total wetland habitat)
- Riverine covering approximately 10,124 acres (27.04% of total wetland habitat)

The SPS property is roughly rectangular in shape and is bounded by the James River on the eastern and western property boundaries. Based on the NWI data (USFWS. 2016b), a total of 48 acres of wetland, lake, and riverine waters are located on the SPS site (Figure E3.7-2). A total of 22.6 acres of the area identified by NWI as "lake" is the intake canal, and 8.91 acres of the areas identified as "riverine" are the discharge canal. Two mapped drainages transverse the SPS site, flowing northward to the wetland areas located in the Hog Island WMA. Several freshwater emergent and freshwater forested/shrub wetlands are mapped as occurring along these drainages.

Based on the NWI data, the following wetland and water types are located on the SPS site:

- Estuarine and marine wetlands covering approximately 0.46 acres (0.67% of total wetland habitat)
- Freshwater emergent wetlands covering approximately 6.07 acres (12.7% of total wetland habitat)
- Freshwater/forested wetlands covering approximately 2.66 acres (5.57% of total wetland habitat)
- Freshwater pond covering approximately 3.03 acres (6.35% of total wetland habitat)
- Lake covering approximately 22.6 acres (47.33% of total wetland habitat)
- Riverine covering approximately 12.93 acres (27.07% of total wetland habitat)

E3.7.2.4 Terrestrial Animal Communities

The terrestrial community at SPS consists of remnants of mixed pine-hardwood forests interspersed with early successional fields and developed areas. Wildlife species, found primarily in the forested portions of the site, are those typically found in upland forests of coastal Virginia. Terrestrial species that are federally and/or state-listed as endangered or threatened known to occur in the vicinity of SPS are discussed in detail in Section E3.7.8. The barking tree frog, state-listed as threatened, is believed to be in the general vicinity, but has not been observed at the SPS site. Table E3.7-3 includes all terrestrial species identified by the Virginia Department of Game and Fisheries (VDGIF) that are likely to be observed in Surry County and in the counties located within a six-mile radius of the SPS site. Dominion does not routinely perform species assessment surveys.

Mammals commonly seen on and in the vicinity of SPS or animals suited to the habitat surrounding the site include the white-tailed deer *(Odocoileus virginianus)*, the Virginia opossum *(Didelphis virginiana virginiana)*, the eastern gray squirrel *(Sciurus carolinensis carolinensis)*, bobcat *(Lynx rufus rufus)*, and the raccoon *(Procyon lotor lotor)*. None of the mammal species observed or reported at the site are unusual for the region (Table E3.7-3).

Reptiles and amphibians likely to inhabit the SPS site and its surrounding areas include the northern black racer *(Coluber constrictor constrictor)*, eastern worm snake *(Carphophis amoenus amoenus)*, the common fine-lined skink *(Plestiodon fasciatus)*, the eastern fence lizard *(Sceloporus undulates)*, and the eastern woodland box turtle *(Terrapene carolina Carolina)*. Reptile and amphibian populations are likely representative of what would be found in the region (Table E3.7-3).

Bird populations on the SPS site include year-round residents, seasonal residents, and transients (birds stopping briefly during migration). While there are resident bird populations, the region serves as a pass-through area for semi-annual migrations of neotropical birds that may range between South America and Canada, as well as seasonal migrations of waterfowl. Common migrants through Virginia include: wood thrush *(Hylocichla mustelina)*, red-eyed vireo *(Vireo olivaceus)*, American redstart *(Setophaga ruticilla)*, black-throated green warbler *(Setophaga virens)*, ovenbird *(Seiurus aurocapilla)*, and scarlet tanager *(Piranga olivacea)*. Less common migrants are yellow-bellied flycatcher *(Empidonax flaviventris)*, gray-cheeked thrush *(Catharus minimus)*, yellow-throated vireo *(Vireo flavifrons)*, prothonotary warbler *(Protonotaria citrea)*, rose-breasted grosbeak *(Pheucticus ludovicianus)*, and orchard oriole *(Icterus spurius)*. Bird populations on the SPS site are representative of those found in the region (Table E3.7-3).

The SPS site is located in the Atlantic flyway, a major migratory route for birds during the fall and spring. The Atlantic flyway extends along the east coast of the United States from the Gulf of Mexico to Canada. Migrants often fly these routes at night, and land to rest early in the morning. Before dawn they seek out suitable habitat, called stopovers, in which to feed and avoid predators. Large natural barriers such as mountains, deserts, or large bodies of water create especially crowded stopovers. These stopovers are very important because flight over the barrier will mean a long stretch without any opportunity to stop for food, rest, or cover. Along the Atlantic flyway, two major barriers are the Delaware and the Chesapeake bays. Flocks of birds traveling down the peninsulas of Cape May and the eastern shore become bottle-necked as they approach the tips, making them especially important for conservation of migratory songbirds. It is here that migrants seek out habitat that allows them to rest and feed before resuming their perilous journeys. (VDCR. 2016c)

E3.7.2.5 Transmission Lines

Physical features (e.g., length, width, route) of each of the in-scope transmission lines are described in Section E2.2.5. The transmission corridors are situated within the coastal plain physiographic province. All in-scope transmission lines are located completely within the Dominion EAB, as shown in Figure E2.2-5.

Although the James River adjacent to the SPS site is DCH for the Atlantic sturgeon, the in-scope transmission lines do not cross the DCH area. No other DCH areas for endangered species exist at SPS or adjacent to associated transmission lines (USFWS. 2017a). The transmission corridors do not cross any state or federal parks or Was (NRC. 2002a). Except in unusual circumstances, transmission corridors are maintained on a three-year cycle. Mechanical mowing and selective herbicide application are the predominate methods for corridor maintenance. In areas where mowing is impractical or undesirable (e.g., wetlands and densely vegetated areas), handcutting and/or non-restricted-use herbicides are employed. Selective handcutting is sometimes used in sensitive areas such as wetlands. For example, herbicides are not used on the corridor within the Great Dismal Swamp National Wildlife Refuge or in the Ragged Island WMA. Instead, trees are controlled by selective handcutting. Locations of rare or sensitive plant species are maintained in cutting sketches and a geospatial database that Dominion maintains for all its transmission lines. These data, along with specifications regarding herbicide use and brush control, are provided to corridor maintenance contractors so adverse impacts on rare and sensitive species and habitats can be avoided. Further, Dominion coordinates with the VDCR-DNH to ensure that all practices and procedures are consistent with agency guidelines and directives. (NRC. 2013c)

E3.7.2.6 Dredge Material Placement

The current onsite dredge material management pond, which has been utilized for disposal of dredged material removed from the 2,000-foot long intake channel, is approaching capacity. As noted in Section E2.2.7.2, Dominion is developing a new DMMA, to be located on Hog Island Road, approximately four miles south of SPS (Figure E2.2-6), and is planned to be utilized once the onsite dredge material management pond reaches capacity. The offsite DMMA is currently undergoing permitting and evaluation processes, and construction has not yet been completed. (Dominion. 2016c) The majority of the offsite DMMA site is agricultural field. Two significant natural drainage features are located to the north and south of the DMMA. These drainage features discharge to Lawnes Creek to the east. The area between the proposed Lawnes Creek and the DMMA is primarily wooded. Only a small quantity of trees around the perimeter of the agricultural field would be cleared to support construction of the DMMA. (Dominion. 2016c) The offsite DMMA is being developed to support current station operations and is not in scope for SLR.

E3.7.3 POTENTIALLY AFFECTED WATER BODIES

The major water resource in the vicinity of SPS is the James River. Water from the river is used for once-through cooling water. The SPS site contains several intermittent and ephemeral streams in the undeveloped portions of the SPS property, but no other significant water bodies are on the SPS site. The James River watershed occupies the central portion of Virginia and covers approximately 10,000 square miles, or almost 25% of the Commonwealth's total land area. It is Virginia's largest river basin and is made up of the upper, middle, and lower James River sub-basins as well as the Appomattox River sub-basin. (VDEQ. 2015) The SPS site is located at RM 25 on the James River in the lower James River watershed (hydrologic unit code [HUC] 02080206).

The topography of the James River basin varies throughout the four physiographic provinces that it spans. The Valley and Ridge Province extends from the Appalachian Plateau in West Virginia to the Blue Ridge Province. The Blue Ridge Province, a remnant of a former highland, differs from the Valley and Ridge Province. It is a province of rugged terrain with steep slopes and narrow ridges in the north and broad moderate slopes in the south. The Piedmont Province extends to the fall line and has scattered hills and small mountains, gradually turning into gently rolling slopes and lower elevation in the eastern portion of the province. The fall zone separates the Coastal Plain Province from the Piedmont Province. The fall zone is a three-mile stretch of river running through Richmond where the river descends 84 feet as it flows from the resistant rocks of the Piedmont Province to the softer sediments of the Coastal Plain Province. (VDEQ. 2015)

In the vicinity of the SPS site, the James River is approximately 2.5 miles wide. Cobham Bay lies west (just upstream) of the Gravel Neck Peninsula and represents the approximate limit of saltwater incursion, effectively dividing the James River into a tidally influenced freshwater river upstream (to the fall line at Richmond) and an estuary downstream. The USACE historically has dredged the main channel of the lower James River so ocean-going vessels can proceed upriver as far as Hopewell, approximately 50 river miles northwest of the SPS site. (NRC. 2006, Section 8.5.4)

Water elevations at SPS are affected by tides with a mean low tide water level of elevation -1.0 foot and a high tide level of elevation 1.1 feet, resulting in a mean tidal range of 2.1 feet and a mean spring tidal range of 2.5 feet. The average water depth in front of the SPS intakes is 26 feet. The average maximum ebb and flood tidal currents at SPS are 2.23 fps and 1.90 fps, respectively. The maximum James River flow at the site is approximately 420,000 cfs, with a monthly mean range of 857-39,778 cfs. (HDR. 2016a)

A navigation channel is maintained at 24.9 feet and generally courses through the middle of the river. In the vicinity of the SPS low-level intake structure, the river has an abbreviated littoral or shoreline zone as a result of steep bank elevations and the channelized river bottom. The river bed in the vicinity of SPS is composed of soft mud, clay, sand, and pebbles, with no single bottom type predominating. (HDR. 2016a)

As presented in Section E3.6.4.1, the water of the James River is considered poor quality in the vicinity of the SPS. SPS uses water from the James River for once-through cooling and the auxiliary cooling system. The water withdrawn from the James River represents about 3% of the tidal flow in the James River in the vicinity of SPS. After passing through the condensers and service water system, most of the water is returned to the James River. Less than 22,000 gpm is lost to evaporation (approximately 1% of the initial intake). (VDEQ. 2013a)

As presented in Section E3.6.3.1, the James River serves as a source of drinking water supply via water intakes for public water systems, including the city of Richmond, located approximately 50 miles upstream from SPS. The river is also a source of water to support industrial operations. (SPS. 2010)

As presented in Section E3.7.1.3, sport fishing is a common activity on the James River. While there is little commercial fishing on the James River in the vicinity of the SPS site, oyster beds in the river to the north and east of Gravel Neck Peninsula are leased for private oyster harvest by the VMRC.

SPS Units 1 and 2 employ a once-through heat dissipation system designed to remove waste heat from the plant. Water is removed from the James River, pumped through the plant condenser, and returned to the river about six miles upriver from the withdrawal point. Cooling water travels through a channel dredged in the bottom of the river between the main river channel and the eastern shore of Gravel Neck Peninsula and then into the low-level intake structure with eight reinforced concrete bays. The low-level intake structure is equipped with continuously rotating Ristroph traveling water screens. A low-pressure spray washes impinged fish from the screens into a return sluice, through which fish return to the river. (NMFS. 2012)

When both units are operating at full power, eight pumps (one for each bay) pump a total of 1.68 million gpm into the 1.8-mile intake canal, which transports water by gravity flow from the low-level intake structure to the high-level intake structure. Cooling water then moves into two high-level structures (each of which has four bays) and passes through the turbine steam condensers. After passing through the condensers, the cooling water flows through a tunnel into the head of an 875-yard discharge canal, and from the canal, returns to the James River. A rock-filled jetty extends from the discharge canal about 372 yards into the river. (NMFS. 2012)

SPS cannot operate without the intake and discharge of cooling water. The NRC is responsible for authorizing the operation of nuclear facilities, as well as approving any extension of an initial operating license through the license renewal process. Intake and discharge of water through the cooling water system would not occur but for the operation of the facility pursuant to a renewed license; therefore, the effects of the cooling water system on listed species and any DCH are effects of the proposed action. (NMFS. 2012)

Pursuant to the NRC's regulations, operating licenses are conditioned upon compliance with all applicable laws, including, but not limited to, CWA and NPDES permits. The effects of the proposed federal action-the continued operation of SPS, which necessarily involves the removal and discharge of water from the James River-are therefore shaped by the NPDES permit issued to the plant. (NMFS. 2012) The VPDES permit for this facility was effective as of March 1, 2016 (Attachment B).

Dominion regularly performs maintenance dredging of the intake channel. Dredging occurs as needed and is permitted under a USACE 13-RP-02 Regional Permit 2 authorizing the dredging of a 2,000-foot long by 150-foot wide channel. Dredge material is placed in the dredge material management pond on the SPS site. Compliance with permit terms and conditions requires that dredging does not occur between February 15 and June 30 of any year, and that dredging activities comply with state 401 water quality restrictions. Regulation of dredging activities under USACE permits ensures that these activities will not contribute to the degradation of water quality or impacts to threatened and endangered species. (USACE. 2016)

E3.7.4 PLACES AND ENTITIES OF SPECIAL ECOLOGICAL INTEREST

This section contains a description of the occurrence, location, and description of communities and habitats of special ecological interest in the plant vicinity, such as natural heritage areas and other areas of public or scientific interest, or areas that may be particularly sensitive or susceptible either directly or indirectly to the effects of continued plant operations and refurbishment.

E3.7.4.1 Hog Island Wildlife Management Area

The Hog Island WMA comprises two separate tracts of land, the Hog Island tract and the Carlisle and Stewart tracts (Figure E3.1-5).

The Hog Island tract of the Hog Island WMA is adjacent to the northern boundary of SPS at the tip of Gravel Neck Peninsula. The 2,900 acres of the Hog Island tract are primarily tidal marshes and diked impoundments interspersed with pine forests, which provide habitat for numerous amphibians, reptiles, mammals, waterfowl, and upland game birds. (NRC. 2002a)

The Carlisle and Stewart tracts of the Hog Island WMA, approximately 1,000 acres in extent, are southeast of SPS. These parcels are primarily upland forested areas, but also contain tidal marshes along Lawnes Creek. All three tracts of the Hog Island WMA are owned by the VDGIF and support a rich variety of wildlife. The tidal flats and marshes provide habitat for large numbers and numerous species of migratory shore birds, wading birds, and waterfowl. (NRC. 2002a)

E3.7.5 INVASIVE SPECIES

This section contains the occurrences of aquatic and terrestrial invasive species in the plant vicinity, and management activities undertaken by the plant to control such species. The VDCR maintains an inventory of invasive species known to have significant economic impacts on agricultural ecosystems, public infrastructure, or natural resources, or are recognized by ecologists to degrade natural ecosystems, negatively affect native species, or have the potential to have deleterious effects on human health (VDCR. 2014). Dominion maintains guidance documents with policies and procedures for invasive species management. For instance, in the case of phragmites, Dominion employs both mechanical and chemical treatments for control and has a "phragmites vigilance" permit requirement stipulating that Dominion must control the invasive plant species that occur in a constructed electric transmission right-of-way. (Dominion. 2016l)

E3.7.5.1 Aquatic Plants

E3.7.5.1.1 Alligator Weed *(Alternanthera philoxeroides)*

Alligator weed is a perennial with prostrate, sprawling, floating hollow stems, often in a dense tangled mass, rooted in shallow water or growing from the shoreline, occasionally free-floating. The hollow stems provide considerable buoyancy of the mat. (Thayer, D. D. and I.A. Pfingsten. 2016)

While recognized as a major pest in aquatic environments where it has been introduced, alligator weed may also grow terrestrially in moist cultivated soils. Alligator weed can form dense floating mats, and with the subsequent build-up of organic detritus in the mat, can create an environment that supports the growth of emergent aquatic and terrestrial species, including woody species such as willow (*Salix spp.*) and buttonbush. These floating islands (also referred to as tussocks, sudds, and flotants), accelerate succession and create concern for quality aquatic habitat, navigation, and infrastructure. (Thayer, D. D. and I.A. Pfingsten. 2016)

After its introduction into the United States in the late 1800s, alligator weed quickly spread throughout the southeast, creating problems similar to those described for water hyacinth *(Eichhornia crassipes)*. Following the development of the herbicide 2,4-D in the 1940s, aggressive herbicide spraying initiated against water hyacinth allowed for alligator weed, which was more resistant to the herbicide, to replace the niche formerly occupied by water hyacinth. By 1963, an estimated 65,700 hectares of waters throughout the southeast were infested. As a result, in 1959, the USACE, under the expanded project for aquatic plant control authorized by Public Law 85-500, requested the Agricultural Research Service of the USDA to begin surveys for natural enemies of alligator weed in South America. In 1964, the USDA began releasing imported insects from South America as a biocontrol for this pest. (Thayer, D. D. and I.A. Pfingsten. 2016)

E3.7.5.1.2 Curly-Leaf Pondweed *(Potamogeton crispus)*

Curly-leaf pondweed grows entirely as a submersed aquatic plant with no floating leaves. This species can survive and grow at very low light levels (less than 1% of the surface irradiance) and low water temperatures (34-39°F). As such, the plant thrives in polluted waters with low light penetration. Curly-leaf pondweed is often found growing in the deepest vascular plant zone and, in waters with higher light penetration, can be found in 16-23-foot depth contours. This species survives under the ice throughout the winter. When springtime water temperatures rise above 50°F, it exhibits a growth rate of 3-4 inches per day, which allows curly-leaf pondweed to exploit the warming waters before other aquatic plants begin to grow. (Thayer, D. D., I.A. Pfingsten, L. Cao, and L. Berent. 2016)

The species has spread across much of the United States, presumably by migrating waterfowl, intentional planting for waterfowl and wildlife habitat, and possibly even as a contaminant in water used to transport fish and fish eggs to hatcheries. Curly-leaf pondweed can also spread by plant fragments attached to boats and equipment that are not properly cleaned. (Thayer, D. D. and I.A. Pfingsten. 2016)

Large infestations of curly-leaf pondweed can impede water flow and cause stagnant water conditions. A large amount of phosphorus is released during decomposition, which can lead to eutrophication and algal blooms, and oxygen concentration in the water can drop significantly, impacting fish. (Thayer, D. D. and I.A. Pfingsten. 2016)

E3.7.5.1.3 Phragmites *(Phragmites australis)*

Phragmites is a tall grass species found in many parts of the world with regional genetic variations. At least one variation, or genotype, was introduced into the United States and has become an aggressive invader of brackish wetlands in eastern and midwestern states. Phragmites overwhelms other marsh plant species from above and below with tall stems that may be 15 feet in height and fast-growing rhizomes (underground stems) which form new shoots and a thick, tangled root mat. By forming tall, dense stands which allow few other plant species, phragmites creates a homogeneous habitat that lacks value to wildlife. Once established, it is very difficult and expensive to control. The VDCR recently mapped over 1,200 acres of phragmites that has invaded wetlands on the seaside and barrier islands of Virginia's eastern shore. (VISC. 2005)

E3.7.5.2 Aquatic Animals

E3.7.5.2.1 Asian Clam *(Corbicula fluminea)*

The Asian clam is a filter feeder that removes particles from the water column. It can be found at the sediment surface or slightly buried. This species persists in temperatures ranging from 36-86°F. Its ability to reproduce rapidly, coupled with low tolerance of cold temperatures, can produce wild swings in population size from year to year in northern water bodies. Furthermore, the Asian clam is able to reproduce by self-fertilization at different ploidy levels. The life span is about one to seven years. (Foster, et.al. 2016)

Since the introduction of the Asian clam to the United States in 1938, it has spread into many of the country's major waterways. The most prominent effect of the introduction of the Asian clam into the United States has been biofouling, especially of complex power plant and industrial water systems. It has also been documented to cause problems in irrigation canals, pipes, and drinking water supplies. The Asian clam also alters benthic substrates and competes with native species for limited resources. (Foster, et.al. 2016)

In the United States, the Asian clam has caused millions of dollars' worth of damage to intake pipes used in the power and water industries. Large numbers, either dead or alive, clog water intake pipes, and the cost of removing them is estimated at approximately one billion U.S. dollars each year. Juvenile Asian clams are carried by water currents into condensers of electrical generating facilities where they attach themselves to the walls via byssus threads, growing and ultimately obstructing the flow of water. Several U.S. nuclear reactors have had to be closed down temporarily for the removal of the Asian clam from the cooling systems. In Ohio and Tennessee, where river beds are dredged for sand and gravel for use as aggregation material in cement, high densities of the Asian clam have incorporated themselves into the cement, burrowing to the surface as the cement starts to set, thereby weakening the structure. (Foster, et.al. 2016)

Factors that may affect population density and distribution of Asian clams include excessively high or low temperatures, salinity, drying, low pH, silt, hypoxia, pollution, bacterial, viral and parasitic infections, inter- and intraspecific competition, predators, and genetic changes (Foster, et.al. 2016).

E3.7.5.3 Terrestrial Plants

E3.7.5.3.1 Kudzu *(Pueraria montana)*

Kudzu is a well-known invasive plant. Intentionally introduced to the United States from its native Japan for use in soil stabilization, kudzu became the "vine that ate the Agricola due to its habit of growing rapidly up and over all other vegetation, creating a dense canopy with its large leaves. It starves other plant species of sunlight and quickly reduces complex natural communities to tangled stands of kudzu. Currently, seven million acres of land are infested with kudzu. Although used as forage, it produces low yields. Annual costs to power companies in the southeast for kudzu control have been estimated at 1.5 million dollars. (VISC. 2005)

E3.7.5.3.2 Japanese Stiltgrass *(Microstegium vimineum)*

Japanese stiltgrass is especially well adapted to low light conditions. It threatens native plants and natural habitats in open-to-shady, moist-to-dry locations. Stiltgrass spreads to form extensive patches, displacing native species unable to compete with it. Where white-tail deer *(Odocoileus virginianus)* are overabundant, they may facilitate its invasion by feeding on native plant species and avoiding stiltgrass. Japanese stiltgrass may impact other plants by changing soil chemistry and shading other plants. (Swearingen, J.M. and S. Adams. 2008)

Stiltgrass occurs in a wide variety of habitats including moist ground of open woods, floodplain forests, wetlands, uplands, fields, thickets, paths, clearings, roadsides, ditches, utility corridors, and gardens. It readily invades areas subject to regular mowing, tilling, foot traffic, and other soil-disturbing activities, as well as natural disturbances such as the scouring associated with flooding. Stiltgrass appears to prefer moist, acidic-to-neutral soils that are high in nitrogen. (Swearingen, J.M. and S. Adams. 2008)

A variety of control methods are available for stiltgrass, depending on the extent of the infestation, the type of habitat, and the availability of labor and other resources. Preventing the introduction of stiltgrass from infested to non-infested areas should be a priority. Early control of new infestations will also reduce the likelihood of establishment and expansion. Manual removal of plants results in unavoidable disturbance to the soil, which can result in additional germination of stiltgrass seed. Using an herbicide leaves the plants and soil in place, thus minimizing that likelihood. (Swearingen, J.M. and S. Adams. 2008)

E3.7.5.4 Terrestrial Animals

E3.7.5.4.1 Emerald Ash Borer *(Agrilus planipennis)*

The emerald ash borer is a small beetle discovered in Michigan in 2002. A native of China, Korea, Taiwan, and Japan, its larvae have killed 8-10 million ash trees (*Fraxinus spp.*) in Michigan, Ohio, and Indiana. Evidence suggests the beetle has been established in Michigan for as long as 6-10 years. Michigan, Ohio, and Indiana state agencies and the U.S. Forest Service (USFS) are conducting coordinated programs of research, eradication by means of tree removal, and quarantines to prevent further infestations. Several occurrences of emerald ash borer have been discovered in Maryland, all associated with ornamental trees originating from one nursery. This same nursery sold 16 infested ash trees to Fairfax County Public Schools in Virginia. The infested trees and all ash trees within a 0.5-mile radius were removed and incinerated by Fairfax County Forest Pest Section and the Virginia Department of Agriculture and Consumer Services. Monitoring for emerald ash borer in Virginia continues. (VISC. 2005)

E3.7.5.5 Diseases and Vectors

E3.7.5.5.1 Chestnut Blight Fungus *(Cryphonectria parasitica)*

Less than 100 years ago, the American chestnut was a dominant tree species in the Appalachian Mountains from Maine to Mississippi. It was a valued timber tree and produced a bounty of edible nuts. Chestnut blight fungus was first noted on trees in New York City in 1904. The blight, introduced from Asia, kills the above-ground part of the chestnut tree. By 1926, the chestnut blight had spread throughout the range of the American chestnut. Surviving trees were reduced to shrubby stems that rarely reproduced. Industries dependent on American chestnut disappeared. (VISC. 2005)

E3.7.5.5.2 Sudden Oak Death *(Phytophthora ramorum)*

Phytophthora ramorum, a fungal pathogen of unknown origin, causes damage to trees and shrubs. It is responsible for "sudden oak death" in California and Oregon, killing tanoak *(Lithocarpus densiflorus)*, coast live oak *(Quercus agrifolia)*, and Californian black oak (Q. kellogii). The fungus causes a wide range of symptoms on oak and rhododendron species, including many horticultural species. It has been detected in an ever-increasing number of nurseries in the United States and Europe, but so far has not been found in native forests in the eastern U.S. Nevertheless, sudden oak death remains a very high concern for foresters and the nursery industry. The only control methods known at this time are quarantine or burning host plants. (VISC. 2005)

E3.7.5.5.3 West Nile Virus (Flavivirus)

Detected in the United States in 1999, West Nile virus is a disease-causing virus that affects birds and mammals, including humans. It was first identified in Uganda in 1937. Since it was discovered in North America, it has spread at an astonishing rate. By 2004, West Nile virus had spread west to California, north into Canada, and south into Central America and the Caribbean. (VISC. 2005)

West Nile virus is transmitted by mosquitoes and can cause West Nile fever (a mild flu-like condition), meningitis, encephalitis or even a polio-like paralysis and death. Since 1999, over 16,000 cases of West Nile virus disease have been reported, with 666 resulting in death. Most people infected with the virus never get sick, while some experience only mild, flu-like symptoms. (VISC. 2005)

West Nile virus also affects many wild and captive bird species, which are the primary means of dispersal. Certain species, such as crows and jays, are particularly vulnerable and experience high rates of mortality. Some bird species are better reservoirs of the virus than others. (VISC. 2005)

The virus is transmitted from birds to humans by mosquitoes. Recent research also suggests it may be transmitted by blood transfusion, organ transplants, and breast milk. The most likely pathway for the virus into the United States is via birds in zoos, or commercial and pet trade, although this has not been proven. There are many different possible pathways by which the virus could have arrived in this country. (VISC. 2005)

E3.7.6 PROCEDURES AND PROTOCOLS

Dominion relies on administrative controls and other regulatory programs to ensure that habitats and wildlife are protected as a result of a change in plant operations (i.e., water withdrawal increase, new NPDES discharge point, wastewater discharge increase, air emissions increase), or prior to ground-disturbing activities. The administrative controls, as presented in Section E9.5, involve reviewing the change, identifying effects, if any, on the environmental resource area (i.e., habitat and wildlife), establishing BMPs, modifying existing permits, or acquiring new permits as needed to minimize impacts. Existing regulatory programs that the site is subject to, as presented in Chapter 9, also ensure that habitats and wildlife are protected. These are related to programs such as the following: stormwater management for controlling the runoff of pollution sources such as sediment, metals, or chemicals; spill prevention to ensure that BMPs and structural controls are in place to minimize the potential for a chemical release to the environment; USACE permitting programs to minimize dredging impacts; and management of herbicide applications to ensure that the intended use will not adversely affect the environment.

E3.7.7 STUDIES AND MONITORING

E3.7.7.1 Entrainment and Impingement Monitoring

In accordance with the statutory guidelines set forth in the VPDES permit issued to Dominion for SPS, and to maintain compliance under Section 316(b) of the CWA, ongoing monitoring of entrainment and impingement of fish and aquatic species is conducted to verify that SPS is utilizing the best technologies available to prevent entrainment and impingement.

E3.7.7.1.1 Entrainment Monitoring

Entrainment data were collected at SPS from June 2005-May 2006 as a part of a series of studies conducted to meet the requirements of the §316(b) Phase II Rule. Entrainment samples were collected in front of the SPS low-level intake structure using paired conical plankton nets deployed from a boat. Samples were collected at three depths: near surface, mid-depth, and near the bottom of the water column. A total of 46 ichthyoplankton taxa were identified in the 24 entrainment samples. The studies were conducted bimonthly and included four sample periods in 24 hours. (HDR. 2016a)

Young life stages of invertebrates comprised approximately 97% of the total entrainment, while finfish comprised approximately 3% of the total entrainment. The finfish component of the entrainment data was represented primarily by goby sp. larvae, bay anchovy egg, naked goby larvae, bay anchovy juvenile/adult, naked goby juvenile, Atlantic croaker juvenile, and Atlantic silverside larvae, which accounted for approximately 91% of the finfish component and approximately 3% of the entrainment total. The entrained ichthyoplankton was largely comprised of bay anchovy eggs and goby sp. larvae, which were most often entrained from May to July. (HDR. 2016a)

Ambient ichthyoplankton sampling conducted on a bimonthly basis June 2005-May 2006 provided additional information on larval fish and pelagic invertebrates. The James River upstream, downstream, and adjacent to the intake was sampled at 0400, 1000, 1600, and 2200 hours on a bi-weekly basis. These samples were collected with a single 20-inch diameter plankton net consisting of 505 micrometer (µm) mesh netting and a General Oceanic 2030R flowmeter affixed in the net mouth. Stepped-oblique tows were made at mid-depth for 4.5 minutes against the prevailing tide. (HDR. 2016a)

Only six taxa were collected in ambient ichthyoplankton samples conducted during the June 2005-May 2006 sampling period. These were, in order of abundance: bay anchovy eggs, naked goby larvae/adults, bay anchovy larvae/juvenile/adults, Atlantic croaker juveniles, Atlantic silverside larvae/juvenile/adults, and blue crab megalopae. Higher densities of most ichthyoplankton species were found in the entrainment samples rather than ambient river samples, with the exception of bay anchovy eggs, dominant in June 2005. The reason for the higher abundance of entrainment numbers versus ambient numbers is not known, but may be related to a patchy distribution of organisms. (HDR. 2016a)

To meet the requirements of the new rule (August 15, 2014), entrainment sampling surveys were conducted twice per month over a 24-month interval from August 1, 2015-July 31, 2017. Each sample collection event was conducted over a 24-hour period with sample sets collected every six hours. The sample frequency selected for this entrainment study provided finfish and invertebrate (shellfish) taxa, density distribution and seasonal/diel variation data over a two-year period. Shellfish, for the purposes of this study, included shrimp, crabs (including horseshoe), lobsters, crayfish, and motile stages of bivalves and gastropods. (HDR. 2016a)

This methodology includes the following significant changes relative to the June 2005-May 2006 entrainment study (HDR. 2016a):

- Use of a pump to collect samples directly in front of the bar racks rather than a streamed net approximately 100 feet in front of the bar racks.
- Use of 335-µm mesh targeted for the current study rather than 505-µm mesh.
- Collection of detailed morphometric data is included to support alternative technology evaluations.
- Inclusion of methods and evaluations to maximize resolution of the taxonomic identifications with regard to Atlantic sturgeon and other species.
- Collection of 24 months of entrainment data rather than 12 months.

E3.7.7.1.2 Impingement Monitoring

Dominion collected impingement monitoring data from May 1974-May 1983. The impingement monitoring data consist of discrete fish samples (identified by species and size groups) extrapolated to daily, weekly, and annual estimates of impingement and fish survival. Seasonal trends in impingement exist for many of the fish species. Seasonal impingement rates varied among the top ten species, with spot and menhaden occurring in the samples primarily in summer and early fall. In contrast, white perch, blueback herring, and threadfin shad were infrequently impinged during these months, primarily found in the samples during the late fall and winter months. Bay anchovy were dominant only in the spring. (HDR. 2016b)

Two of the top six dominant impinged species, spot and white perch, represent game fish species. Other game fish species impinged, in order of numerical dominance, included Atlantic croaker, white catfish *(Ameiurus catus)*, brown bullhead *(Ameiurus nebulosus)*, and channel catfish. Of these species, the catfish were impinged at a relatively constant level throughout the year. Atlantic croaker showed highest impingement rates between March and May. (HDR. 2016b)

Ambient juvenile and adult fish sampling collections were conducted quarterly along with entrainment studies during the June 2005-May 2006 sampling period, discussed in Section 2.7.7.1.1, and sampled at three stations by otter trawl and beach haul seines: one upstream, one downstream, and one near the high-level intakes. At each station, 100 feet of shoreline were seined and one otter trawl was conducted for a 10-minute period. Larger fish were identified, measured, and weighed in the field, and smaller fish were preserved and subsequently processed in the laboratory. (HDR. 2016b)

The fish and shellfish collected in 2005 and 2006 were considered representative for that year. Twenty-four species of finfish and one shellfish (blue crab) were collected. Blue catfish, bay anchovy, Atlantic silverside, spot, hogchoker, inland silverside, and white perch were the most abundant species collected, accounting for 90% of the total catch. With regards to the catfish, results are consistent with studies that have documented the increasing abundance of blue catfish following their successful introduction as a sport fish in the James, Rappahannock, and Mattaponi rivers from 1974-1989, and decreasing abundance of white and channel catfish. (HDR. 2016b)

SPS performed additional impingement monitoring twice per month over a 12-month study period between August 1, 2015, and July 31, 2016. Impingement sample collections were conducted by diverting the screenwash water into the fish holding pen located in the existing housing designated for impingement study (i.e., impingement building hereafter). Impingement sampling was conducted every four hours over a 24-hour period. The targeted sample duration was approximately 30 minutes within each four-hour period, or 15 minutes if more than 400 fish and shellfish were collected in the same sampling time slot of the prior sampling event. The sample duration and frequency selected for the 2015-2016 impingement study was designed to provide finfish and invertebrate (shellfish) taxonomic identifications, seasonal impingement density distributions, diel variation, and initial impingement survival. (HDR. 2017)

Initial impingement survival data were collected for only the first 10 minutes of sample processing during each hourly sampling. Field crews selected fish for processing at random across species and size classes present in the screenwash sample. Each fish and macroinvertebrate was classified according to the following condition criteria and enumerated by category (HDR. 2017):

- Live, undamaged - live with no apparent damage
- Live, damaged - live with evidence or indication of abrasion or laceration
- Fresh dead - no vital signs, no body or opercular movement, clear eyes, red gills, and no obvious signs of decay
- Dead decaying - no vital signs, cloudy eyes, soft flesh, pale gills, other obvious signs of decay

For each four-hour sampling period, up to 15 randomly selected live and fresh dead fish from each taxon collected were measured for total length, maximum body width, and maximum body depth to the nearest millimeter and weighed to the nearest gram. No more than 100 measurements of each species were required within a 24-hour impingement sampling event. Additionally, up to 10 randomly selected live and/or fresh dead blue crabs were measured for greatest body (carapace) length, width, and depth. (HDR. 2017)

During the 2015-2016 study, a total of 316,163 organisms, comprised of 285,868 fish distributed among 61 distinct taxa, and 30,295 shellfish distributed among six distinct taxa were collected during sampling. Bay anchovy was the most common taxon in the samples accounting for 75% of all organisms collected during the study. Atlantic croaker and white perch, the second and third most common taxa collected, respectively, each represented 4% of the total. Each of the remaining taxa contributed less than 3% to the total. Shellfish were led by grass shrimp that were not reliably identifiable beyond the genus level Palaemonetes. The fishery targeted blue crab contributed 2% to the collected total. Overall, collection densities were high in October 2015, which was followed by some of the lowest densities in November and December. By mid-January 2016, the average density was above average, but progressively declined with time through July 2016. Impingement was highest at night and lowest during the day, especially during the afternoon. (HDR. 2017)

The total number of finfish and shellfish estimated to be impinged under design intake flows was 6,973,535 and 4,969,657, respectively. Based on 2015-2016 actual intake flows, and after accounting for impingement survival, the estimated impingement mortality of finfish and shellfish was 1,125,574 and 439,202, respectively. Impingement mortality primarily involves blue crab, Atlantic menhaden, Atlantic croaker, white perch, and gizzard shad, accounting for 83% of total impingement mortality (finfish and shellfish combined). Based on these estimates, the SPS Ristroph traveling water screens, fish return system, and flow reduction measures reduce impingement and associated mortality at the facility by 84% for finfish, 91% for shellfish, and 87% overall. (HDR. 2017)

E3.7.7.1.3 Avian Monitoring

The Center for Conservation Biology (CCB) at the College of William and Mary conducts annual aerial surveys for rookeries and eagle and osprey nests. These data are made publicly available in an online mapping tool. Breeding eagles have been surveyed annually in the lower Chesapeake Bay since 1956. Each year, CCB biologists fly a nest survey in February and March to map eagle nests and determine the activity status of each nest. This survey is followed in late April and May by a productivity survey in which chicks are counted in each nest. The survey covers all tributaries of the lower Chesapeake Bay, as well as other prominent bodies of water, and requires more than 100 hours of flight time in a high-wing Cessna. Biologists survey all known nest structures to determine the activity status of each, and search for newly established nests. (CCB. 2016) These data are utilized by SPS when coordinating with state and federal agencies to ensure compliance with Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA).

According to the CCB data, there are three bald eagle nests located on the SPS site. One nest (Nest Code SU0901) is identified as occurring on the eastern portion of the SPS site. Nest Code SU1703 and Nest Code SU1704 are located on the northern portion of the SPS property. The CCB identified all nests as active in 2017. (CCB. 2017)

E3.7.7.1.4 Rare and Endangered Plant Monitoring

Monitoring of rare and endangered plant species along transmission line right-of-ways (ROWs) generally occurs on a three-year cycle, unless otherwise directed by the VDCR-DNH. Locations of rare or sensitive plant species are maintained in cutting sketches and a geospatial database that Dominion maintains for all its transmission lines. These data, along with specifications regarding herbicide use and brush control, are provided to corridor maintenance contractors so adverse impacts on rare and sensitive species and habitats can be avoided. Further, Dominion coordinates with the VDCR-DNH to ensure all practices and procedures are consistent with agency guidelines and directives. (Dominion. 2013c)

E3.7.7.1.5 As-Needed Monitoring

Studies and monitoring at SPS occur as needed to comply with federal, state, and local regulatory requirements, as directed by the agencies, generally prior to new projects. Any monitoring that occurs is consistent with agency policies and procedures, and performed under the guidance of the agency under which coordination is occurring.

E3.7.8 THREATENED, ENDANGERED, AND PROTECTED SPECIES, AND ESSENTIAL FISH HABITAT

The USFWS maintains current lists of threatened or endangered species on its website (USFWS. 2016c). The VDGIF and the VDCR-NHP also maintain lists of state-protected species on their websites (VaFWIS. 2016; VDCR. 2016d). In 2015, the VDGIF finalized the updated state wildlife action plan (WAP), identifying species in the Commonwealth of Virginia that are critically imperiled or in decline, and exploring strategies to conserve and restore these species. The Virginia WAP designates a conservation status listing for each identified species. (VDGIF. 2015)

Species located onsite or potentially occurring near the SPS site, or within counties occurring within a six-mile radius of the site, that are listed as threatened or endangered by these agencies as well as the WAP conservation status for each species (if one is assigned) are listed in Table E3.7-3. Species with no recorded county occurrences are included in Table E3.7-3 if they could occur in the vicinity of SPS or along associated transmission lines, based on habitat and known geographic range. Consultation letters with state and federal agencies are included in Attachment C.

E3.7.8.1 Federally Listed Species

A total of 13 species in Surry County and its adjacent counties are listed as federally endangered, threatened, delisted, or identified as in recovery. The bald eagle *(Haliaeetus leucocephalus)*, rufa red knot *(Calidris canutus rufa)*, red-cockaded woodpecker *(Picoides borealis)*, peregrine falcon *(Falco peregrinus)*, Atlantic sturgeon, northern long-eared bat *(Myotis septentrionalis)*, and the sensitive joint-vetch *(Aeschynomene virginica)* are listed as potentially occurring in Surry County. The Kemp's Ridley sea turtle *(Lepidochelys kempii)*, loggerhead sea turtle *(Caretta caretta)*, leatherback sea turtle *(Dermochelys coriacea)*, piping plover *(Charadrius melodus)*, roseate tern *(Sterna dougallii dougalli)*, and the small whorled pogonia *(Isotria medeoloides)* are not listed as occurring in Surry County, but are listed in adjacent counties (VaFWIS. 2016; USFWS. 2016c; VDCR. 2016d). The ecological requirements for these species are summarized below. With the exception of the bald eagle, no other federally and/or state-listed endangered, threatened, candidate, or delisted terrestrial animals are known to exist at the SPS site or along the transmission line ROWs.

Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by Dominion for the licensed life of the SPS facility.

Adherence to these controls, as well as compliance with applicable laws and regulations should prevent potentially negative impacts to any special status and protected species.

E3.7.8.1.1 Bald Eagle

In July 2007, the bald eagle was removed from the federal list of threatened and endangered species; in January 2013, it was removed from Virginia's list of endangered and threatened species. The bald eagle is still afforded special protection as a federal species of concern through the BGEPA and the MBTA. The bald eagle currently is globally secure, is imperiled to uncommon as a breeding species, and is rare to uncommon as a non-breeder in Virginia. (VDGIF. 2015)

Distinguished by a white head and white tail feathers, mature bald eagles are powerful brown raptors that may weigh 14 pounds and have a wingspan of eight feet. Male eagles are smaller, weighing as much as 10 pounds and having a wingspan of six feet. Sometimes confused with golden eagles, bald eagles are mostly dark brown until they are four to five years old, when they acquire their characteristic coloring. There is a distinction between the two species, though, even during the early years. Only the tops of the bald eagle's legs have feathers. The legs of golden eagles are feathered all the way down. (USFWS. 2015a)

Bald eagles live near rivers, lakes, and marshes where they can find fish, their staple food. Bald eagles will also feed on waterfowl, turtles, rabbits, snakes, and other small animals and carrion. This species requires a reliable food base, perching areas, and nesting sites. Its habitat includes estuaries, large lakes, reservoirs, rivers, and some seacoasts. In winter, the birds congregate near open water in tall trees for spotting prey and night roosts for sheltering. (USFWS. 2015a)

Bald eagles mate for life, choosing the tops of large trees to build nests, which they typically use and enlarge each year. Nests may reach 10 feet across and weigh a half ton. Bald eagles may also have one or more alternate nests within their breeding territory. In treeless regions, they may nest in cliffs or on the ground. The birds travel great distances, but usually return to breeding grounds within 100 miles of the place where they were raised. Bald eagles may live 15 to 25 years in the wild, longer in captivity. (USFWS. 2015a)

Breeding bald eagles typically lay one to three eggs once a year, which hatch after about 35 days. The young eagles are flying within three months and are on their own about a month later. Disease, lack of food, bad weather, or human interference kill many eaglets. Recent studies show that approximately 70% survive their first year of life. (USFWS. 2015a)

Shortly after World War II, dichlorodiphenyltrichloroethane (DDT) was hailed as a new pesticide to control mosquitoes and other insects. Unfortunately, DDT and its residues washed into nearby waterways, where aquatic plants and fish absorbed it. Bald eagles, in turn, ingested DDT upon eating contaminated fish. The chemical interfered with the ability of the birds to produce strong eggshells. As a result, their eggs had shells so thin that they often broke during incubation or otherwise failed to hatch. DDT also affected other species such as peregrine falcons and brown pelicans. (USFWS. 2015a)

By 1963, with only 487 nesting pairs of bald eagles remaining, the species was in danger of extinction. Loss of habitat, human predation, and DDT poisoning contributed to the near demise of this species. In 1967, the Secretary of the Interior listed bald eagles south of the 40th parallel under the Endangered Species Preservation Act of 1966. In 1972, the EPA banned the use of DDT in the United States. Following enactment of the ESA (an expansion of the Endangered Species Preservation Act) in 1973, the USFWS listed the species in 1978 as endangered throughout the lower 48 states except in Michigan, Minnesota, Oregon, Washington, and Wisconsin, where it was designated as threatened. (USFWS. 2015a)

In July 1999, the USFWS proposed removing the bald eagle from the list of threatened and endangered species. Since then, the USFWS has reviewed comments received on that proposal along with new data and information to determine the best ways to manage the species once it is removed from the protections of the ESA. In 2006, the USFWS re-opened the public comment period due to new information on the proposal to delist. Data gathered during this comment period were factored into a final decision on the status of the species. (USFWS. 2015a)

Bald eagle populations have rebounded and recovered to the point that they no longer need the protection of the ESA. Therefore, on June 28, 2007, the USFWS announced the recovery of the bald eagle and its removal from the list of threatened and endangered species. (USFWS. 2015a)

Activities on the SPS site are evaluated to ensure compliance under the BGEPA and MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. There are currently no MBTA permitting requirements associated with SPS site operations or in-scope transmission lines that are under the scope of the SPS SLRA. An eagle disturbance application has been submitted to the USFWS in association with construction of the Surry-Skiffs Creek project, an out-of-scope transmission line. Compliance with all regulatory requirements associated with this species will continue to be an administrative control practiced by Dominion for the licensed life of the SPS facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to bald eagles.

E3.7.8.1.2 Peregrine Falcon

The peregrine falcon has been federally delisted and is classified by the USFWS as in recovery. This species is still listed as threatened by the Commonwealth of Virginia and designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

Peregrines are medium-sized raptors with long, pointed wings and a long, narrow tail. They are easily recognizable through a characteristic dark crown and nape, and dark "sideburns" which are features of all plumages. Adults have blue-gray to brown-gray upperparts and barred bellies and legs. Underparts vary from bright white to buff. Young birds have dark brown upperparts, a buffy breast and belly, and dark, vertical streaking across the breast and belly. (VDGIF. 2016c)

In the wild, peregrines prefer high cliffs overlooking rivers, oceans, and valleys when they build their nests. The nest is called a "scrape," which is often just a small depression in some gravel. Within the last 20 years, peregrines have increasingly nested on tall bridges, buildings, towers, and other man-made structures in urban and coastal areas of the eastern United States. (NPS. 2016d)

Peregrines are skilled hunters that fly high above their quarry and often dive on their prey at very high speeds. They generally strike their prey with partially closed talons and then seize the immobilized bird out of the air. They are also capable of overtaking prey in level flight before grabbing them from the air. Peregrine diet varies with season and location. In coastal Virginia, they feed primarily on shorebirds during spring and fall. In urban areas, they feed on pigeons, starlings, grackles, and other medium-sized birds. In the Appalachians, some of their prey includes flickers, blue jays, towhees, juncos, and mourning doves. A mature peregrine consumes about 2.5 ounces of food each day, which is equivalent to two medium-sized birds. (NPS. 2016d)

The American peregrine falcon was once found throughout the Appalachian Mountains of the eastern United States. In 1942, the known nesting population east of the Mississippi was estimated at around 350 pairs. Nesting in Virginia was known from 24 sites in the Allegheny and Blue Ridge mountains and from two sites along the coast, in tree nests made by other birds. (VDGIF. 2016c)

After World War II, the widespread use of organochlorine pesticides such as DDT, in conjunction with human disturbance, contributed to abrupt and widespread population declines of the falcon. DDT led to the bioaccumulation of toxic residues in prey species, in turn contaminating the falcons and reducing the viability of their eggs. This resulted in the falcon's probable extirpation as a nesting species from Virginia and the eastern United States by the mid-1960s. The American and Arctic peregrine falcon subspecies were listed as endangered by the USFWS in 1970. (VDGIF. 2016c)

Between 1975 and 1979, an eastern peregrine falcon recovery team appointed by the USFWS developed a federal recovery plan whose main objective was "to restore a new self-sustaining population of peregrine falcons in the eastern United States." The plan called for protecting and managing essential nesting, wintering, and migration habitat; eliminating the environmental pollutants that originally caused most of the population declines; protecting peregrines through law enforcement; implementing an education program to build public support for and understanding of peregrines; and releasing falcons bred in captivity into the wild. (VDGIF. 2016c)

An evaluation of the VDGIF's Virginia Fish and Wildlife Information Service (VaFWIS) species observation data yielded the result of three recorded observations of this species within six miles of the SPS site. Observation numbers 608471 (May 13, 2010), 330021 (May 21, 2009), and 775 (January 1, 1900) were each recorded over the James River, in Newport News City and/or Isle of Wight County. (VaFWIS. 2016)

Activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. (Dominion. 2009a) Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by Dominion for the licensed life of the SPS facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to any special status and protected species.

E3.7.8.1.3 Piping Plover

This species is federally and state-listed as threatened. It has been designated as Tier II, very high conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

Piping plovers are small shorebirds approximately seven inches long with sand-colored plumage on their backs and crown and white underparts. Breeding birds have a single black breastband, a black bar across the forehead, bright orange legs and bill, and a black tip on the bill. During winter, the birds lose the black bands, the legs fade to pale yellow, and the bill becomes mostly black. (USFWS. 2016d)

Piping plovers breed in North America in three geographic regions: the Atlantic coast, the northern Great Plains, and the Great Lakes. Atlantic coast plovers nest on coastal beaches, sandflats at the ends of sand spits and barrier islands, gently sloped foredunes, sparsely vegetated dunes, and washover areas cut into or between dunes. (USFWS. 2016d)

Piping plover populations were federally listed as threatened and endangered in 1986. The northern Great Plains and Atlantic coast populations are threatened, and the Great Lakes population is endangered. Piping plovers are considered threatened throughout their wintering range. According to the last breeding census in 1996, the northern Great Plains population is the largest of the three breeding populations, numbering approximately 1,398 breeding pairs. The Atlantic coast population consists of 1,372 breeding pairs, and the Great Lakes population has only 32 breeding pairs. The highest concentration of birds reported in winter censuses are found in Texas, Louisiana, and Florida. Only 63% of the breeding birds counted in 1991 were reported during the winter census, suggesting that important wintering areas are still unknown. (USFWS. 2016d)

Plovers arrive on the breeding grounds during mid-March through mid-May and remain for three to four months per year. They lay three to four eggs in shallow scraped depressions lined with light colored pebbles and shell fragments. The eggs are well camouflaged and blend extremely well with their surroundings. Both sexes incubate the eggs, which hatch within 30 days, and both sexes feed the young until they can fly, about 30 days after hatching. Plovers depart for the wintering grounds from mid-July through late October. Breeding and wintering plovers feed on exposed wet sand in wash zones; intertidal ocean beach; wrack lines; washover passes; mud, sand, and algal flats; and shorelines of streams, ephemeral ponds, lagoons, and salt marshes by probing for invertebrates at or just below the surface. They use beaches adjacent to foraging areas for roosting and preening. Small sand dunes, debris, and sparse vegetation within adjacent beaches provide shelter from wind and extreme temperatures. (USFWS. 2016d)

In recent decades, piping plover populations have declined drastically, especially in the Great Lakes. Breeding habitat has been replaced with shoreline development and recreation. Availability of quality foraging and roosting habitat in the wintering grounds is necessary to ensure that an adequate number of adults survive to migrate back to breeding sites and nest successfully. (USFWS. 2016d)

An evaluation of the VaFWIS species observation yielded a result of no observations for this species within six miles of the SPS site (VaFWIS. 2016). This species is not documented to occur in Surry County, and suitable habitat for this species is not located on the Gravel Neck Peninsula. Furthermore, activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. (Dominion. 2009a)

E3.7.8.1.4 Rufa Red Knot

This species is federally and state-listed as threatened. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The rufa red knot migrates annually between its breeding grounds in the Canadian Arctic and several wintering regions, including the southeastern United States, the northwest Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. During both the northbound (spring) and southbound (fall) migrations, groups of a few individuals to thousands of rufa red knots can be found anywhere along the coastal and inland United States migration corridors from Argentina to Canada. In the spring, well-known staging and stopover areas include Patagonia, Argentina; eastern and northern Brazil; the southeastern United States; the Virginia barrier islands; and Delaware Bay. In the fall, well-known migration stopovers include Hudson Bay, James Bay, St. Lawrence River, Mingan Archipelago and Bay of Fundy in Canada; Massachusetts and New Jersey coasts; Altamaha River in Georgia; the Caribbean; and the northern coast of South America from Brazil to Guyana. Throughout the range, rufa red knots occur primarily along the coasts, but also migrate across areas of open ocean as well as over land. (USFWS. 2012)

In the United States, rufa red knots use both coastal and interior routes during migration, including the central, Mississippi, and Atlantic flyways. Most records in the interior states show small numbers (fewer than 10) of rufa red knots, but there are multiple records in every inland state included in this listing. Although several thousand rufa red knots migrate through inland areas each year, scientists are just beginning to discover where these birds are stopping to rest and feed along the way. For example, geolocator information shows rufa red knots using stopovers in North Dakota and in Montana, and there are clusters of sightings records along the tributaries to the Mississippi River and along the Great Lakes. (USFWS. 2012)

Threats to food resources from climate change and other causes occur throughout the rufa red knot's range. The best available data suggest reduced horseshoe crab populations in Delaware Bay due to commercial harvest were an important factor in rufa red knot population declines. Since 2000, the Atlantic States Marine Fisheries Commission has restricted harvest, and in 2012, it implemented an adaptive management framework that explicitly ties crab harvest levels to rufa red knot populations. Though crab numbers have not yet fully rebounded, the full implementation and monitoring of this framework should lead to increased crab populations and help rufa red knot recovery. Outside Delaware Bay, the rufa red knot feeds mainly on small clams and mussels, except in its Arctic breeding grounds, where it feeds mainly on insects. The effects of climate change have begun affecting both types of prey. Oceans become more acidic as carbon dioxide emitted into the atmosphere dissolves in the ocean; this has been shown to interfere with the ability of clams and mussels to form their shells. Clams and mussels also are sensitive to warming water temperatures, and changes in their geographic distribution or timing of spawning are likely to affect rufa red knot food supplies during important stopover periods. For example, the range of blue mussels, the young (called spat) of which are an important prey species for rufa red knots, has already shrunk due to warming ocean temperatures, and the mussel soon may not be available as a food resource for migrating rufa red knots in the Virginia stopover area. In the Arctic breeding grounds, insects are hatching earlier in the spring due to warming temperatures. This change in timing could cause rufa red knot chicks to miss the peak window for feeding and rapid growth before their long southward migration. (USFWS. 2012)

Additionally, sand placement projects and off-road vehicle (ORV) use are known to bury or crush animals that the rufa red knots eat. The negative effects to prey resources from these activities are typically short term, though repeated renourishing may prolong the adverse effects to the invertebrate community on which rufa red knots rely for food. (USFWS. 2012)

Incidental occurrences of migrating rufa red knots may occur at the SPS site. The primary migratory route for this species, and the location of its preferred habitat, however, is approximately 40 miles to the east of the site, on the Virginia barrier islands (USFWS. 2012). Furthermore, activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. (Dominion. 2009a)

E3.7.8.1.5 Red-cockaded Woodpecker

This species is federally and state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

About the size of the common cardinal, the red-cockaded woodpecker is approximately seven inches long, with a wingspan of about 15 inches. Its back is barred with black and white horizontal stripes. The red-cockaded woodpecker's most distinguishing feature is a black cap and nape that encircle large white cheek patches. (USFWS. 2016e)

Rarely visible, except perhaps during the breeding season and periods of territorial defense, the male has a small red streak on each side of its black cap called a cockade, hence its name. The common name came into use during the early 1800s when "cockade" was regularly used to refer to a ribbon or other ornament worn on a hat. Female red-cockaded woodpeckers lack the red cockade. Juvenile males have a red patch in the center of their black crown. This patch disappears during the fall of their first year at which time their red-cockades appear. (USFWS. 2016e)

Red-cockaded woodpeckers were once considered common throughout the longleaf pine ecosystem, which covered approximately 90 million acres before European settlement. Historical population estimates are 1-1.6 million groups, the family unit of red-cockaded woodpeckers. The birds inhabited the open pine forests of the southeast from New Jersey, Maryland, and Virginia to Florida, west to Texas and north to portions of Oklahoma, Missouri, Tennessee, and Kentucky. (USFWS. 2016e)

The longleaf pine ecosystem initially disappeared from much of its original range because of early (1700s) European settlement, widespread commercial timber harvesting, and the naval stores/turpentine industry (1800s). Early to mid-1900 commercial tree farming, urbanization, and agriculture contributed to further declines. Much of the current habitat is also very different in quality from historical pine forests in which red-cockaded woodpeckers evolved. Today, many southern pine forests are young, and the absence of fire has created a dense pine/hardwood forest. (USFWS. 2016e)

The red-cockaded woodpecker is a territorial, non-migratory species with a more complex social system than most species of birds. Individuals live in groups normally consisting of a breeding pair and zero to four male (rarely female) offspring from previous years. These offspring, known as helpers, assist in incubating eggs and brooding and feeding nestlings produced by the breeding pair. The red-cockaded woodpecker social system is referred to as a cooperative breeding system, that is, the breeding pair receives assistance from offspring in the raising of young. (USFWS. 2016e)

In mid-April, the female red-cockaded woodpecker usually lays a clutch of three to five white eggs in the breeding male's roost cavity. Eggs hatch after 10-12 days of incubation (among the shortest incubation in birds) and nestlings fledge from the nest cavity 24-27 days after hatching. The nestlings are altricial, that is, they do not have feathers when hatched and their eyes are not open. They require a lot of care from parents and helpers who will feed the nestlings and clean the cavity of waste during the nestling period. (USFWS. 2016e)

After fledging, the young birds continue to be fed by adults for up to six months, at which time the majority of fledglings disperse from the territory where they hatched. Mortality is high (68%) for female fledglings as they disperse to search for breeding vacancies. Male fledglings either disperse or remain on their natal territory to become helpers. Annual mortality is also high (57%) for male fledglings. (USFWS. 2016e)

Although re-nesting may occur if a clutch or brood is lost, red-cockaded woodpeckers typically have only one successful nesting attempt annually. Double brooding (two successful nests in one breeding season) has been documented, but is extremely rare. (USFWS. 2016e)

The diet of red-cockaded woodpeckers consists mostly of insects in the egg, larvae, and adult stages. These include beetles, ants, roaches, spiders, and other insects found in or on pine trees. Fruits and seeds make up a small portion of the overall diet. Methods of foraging include flaking away bark and probing under the bark using their specialized forked tongue to extract insects. Large, older trees are preferred for foraging. In general, males forage on the limbs and upper trunk while females forage on the trunk below the crown. This division of foraging area is most noticeable in winter when insect numbers are at their lowest and their activity slows due to cold weather, making it harder for red-cockaded woodpeckers to detect prey. Differences in the foraging behavior of males and females may help to reduce competition between them when food is scarce. (USFWS. 2016e)

The red-cockaded woodpecker makes its home in mature pine forests. Longleaf pines are most commonly preferred, but other species of southern pine are also acceptable. While other woodpeckers bore out cavities in dead trees where the wood is rotten and soft, the red-cockaded woodpecker is the only one which excavates cavities exclusively in living pine trees. Cavities are excavated in mature pines, generally over 80 years old. The older pines favored by the red-cockaded woodpecker often suffer from a fungus called red heart disease which attacks the center of the trunk, causing the inner wood, the heartwood, to become soft. Cavity excavation takes one to six years. (USFWS. 2016e)

The aggregate of cavity trees is called a cluster and may include one to 20 or more cavity trees on 3-60 acres. The average cluster is about 10 acres. Cavity trees that are being actively used have numerous, small resin wells which exude sap. The birds keep the sap flowing apparently as a cavity defense mechanism against rat snakes and possibly other predators. The typical territory for a group ranges from about 125-200 acres, but observers have reported territories running from a low of around 60 acres, to an upper extreme of more than 600 acres. The size of a territory is related to both habitat suitability and population density. (USFWS. 2016e)

The red-cockaded woodpecker plays a vital role in the intricate web of life of the southern pine forests. Red-cockaded woodpeckers are primary cavity nesters, meaning they are responsible for the construction of cavities. In the southern pine ecosystem there are many secondary cavity users that benefit from the red-cockaded woodpecker's work. Red-cockaded woodpeckers are considered a keystone species because use of their cavities by these animals contributes to the species richness of the pine forest. (USFWS. 2016e)

Only one breeding population of red-cockaded woodpeckers is documented in the Commonwealth of Virginia. This population is located at the Piney Grove Preserve in Wakefield, Virginia, approximately 20 miles south of the SPS site. The SPS site lacks old growth pine forest and a suitable fire regime required by this species as suitable habitat.

E3.7.8.1.6 Roseate Tern

This species is federally and state-listed as endangered. It is not identified as in need of protection in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The roseate tern is a medium-sized, gull-like tern about 15 inches long. It is primarily found in the northern hemisphere on the northeastern coast of North America, extending from Nova Scotia to the southern tip of Florida, as well as several islands in the Caribbean. It is also found in northwestern Europe, southern and western Africa, and western Australia. (USFWS. 2011b)

The roseate tern is divided into four subspecies based on small differences in size and bill color. The North American subspecies is divided into two separate breeding populations: one in the northeastern United States and Nova Scotia, and another in the southeastern United States and the Caribbean. Roseate terns are most common in the central portion of this range, from Massachusetts to Long Island, N.Y. Populations in the northeastern United States greatly declined in the late 19th century due to hunting for the millinery, or hat, trade. In the 1930s, protected under the MBTA, the population reached a high of about 8,500, but since then, population numbers have declined and stayed in the low range of 2,500-3,300. The species was listed in 1987 as endangered in the northeastern United States. Populations in Florida, Georgia, North Carolina, Puerto Rico, South Carolina, and the Virgin Islands are listed as threatened. (USFWS. 2011b)

When not in breeding season, the roseate tern has a black bill, black legs, white forehead and most of the crown, and a long, deeply forked tail. During this time, the roseate tern is often difficult to distinguish from common terns, among which it nests in the northeast. During breeding season, it is paler than other terns, with most of its plumage turning silver-gray above and creamy white below a rosy-pink chest and a black cap. It also develops long white tail-streamers that it loses after the breeding season. In the northeastern birds, the black bill becomes orange-red at the base and the black legs also turn orange-red. The roseate tern is a specialist feeder, eating almost exclusively small fish, primarily the American sand lance in northeastern populations. It captures food mainly by plunge diving, completely submerging its body underwater to catch prey, but it also feeds in shallow waters and even steals food from common terns. (USFWS. 2011b)

Roseate terns nest on small barrier islands, often at ends or breaks. They nest in hollows or under dense vegetation, debris, or rocks hidden from predators. Roseate terns in northeastern North America almost always nest in colonies with common terns. Roseate terns begin arriving to breeding areas at the end of April, and begin laying eggs as early as the third or fourth week of May. They lay one to two eggs, rarely three, and rely on the more aggressive Arctic and common terns in the surrounding colony to defend them. In the winter, roseate terns migrate south in late August to early September. They migrate from the northeastern United States to the waters off Trinidad and northern South America from the Pacific coast of Colombia to eastern Brazil. (USFWS. 2011b)

Habitat for northeastern North American populations has been greatly reduced by human activity and development on barrier islands, predation, and competition from expanding numbers of large gulls. Roseate terns are highly sensitive to disturbances and will desert a whole colony if they feel threatened. The move to less desirable, often inadequate areas exposes the roseate tern to high predation and affects its ability to reproduce. Roseate terns often desert their colonies and eggs at night when they become subject to predation, leaving eggs and young exposed and vulnerable to predatory mammals such as foxes, skunks, and brown rats. Predatory birds, such as the great horned owl and black-crowned night heron, pose a greater threat because they can fly to the more protected island nesting sites. Roseate terns are quick to abandon a nesting site when predators

are active. An increase in great-blacked gull and herring populations has displaced roseate terns from their traditional nesting colonies in the northeast. Roseate terns compete with gulls for nesting sites and food; the aggressiveness and larger size of the gulls give them an advantage. Gulls also compete for habitat with terns by nesting before the terns do, leading the roseate terns to retreat and abandon their historical sites. The loss of habitat from erosion, a possible result of rising sea levels, is another major factor contributing to the decline of roseate tern populations. The spit-a narrow land comprised of gravel and sand extending into the ocean-on Falkner Island, in the Long Island Sound, is home to one of the largest tern populations in the northeastern U.S. It is estimated that Falkner Island is losing about 800-900 square feet per year due to erosion, and in the next two to five years, the spit will be in a tidal zone, leaving roseate terns without their prime habitat. (USFWS. 2011b)

An evaluation of the VaFWIS species observation yielded a result of no observations of this species within six miles of the SPS site (VaFWIS. 2016).

This species is not listed by VDGIF as occurring in Surry County, and optimal habitat for this species is not located on Gravel Neck Peninsula. Furthermore, activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. (Dominion. 2009a)

E3.7.8.1.7 Atlantic Sturgeon

This species is federally and state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The Atlantic sturgeon is a long-lived, estuarine dependent, anadromous fish. Atlantic sturgeon can grow to approximately 14 feet long and can weigh up to 800 pounds. They are bluish-black or olive brown dorsally with paler sides and a white belly, and they have five major rows of dermal scutes. Atlantic sturgeon are benthic feeders and typically forage on benthic invertebrates such as crustaceans, worms, and mollusks. (NOAA. 2015)

Atlantic sturgeon are similar in appearance to shortnose sturgeon, but can be distinguished by their larger size, smaller mouth, different snout shape, and scutes. Atlantic sturgeon have been aged to 60 years. There is generally faster growth and earlier age at maturation in more southern populations. (NOAA. 2015)

Spawning adults migrate upriver in spring, beginning in February-March in the south, April-May in the mid-Atlantic, and May-June in Canadian waters. In some areas, a small spawning migration may also occur in the fall. Spawning occurs in flowing water between the salt front and fall line of large rivers. Atlantic sturgeon spawning intervals range from 1-5 years for males and 2-5 years for females. Fecundity of female Atlantic sturgeon is correlated with age and body size and ranges from 400,000-8,000,000 eggs. The average age at which 50% of maximum lifetime egg production is achieved is estimated to be 29 years, which is approximately 3-10 times older than for other bony fish species. (NOAA. 2015)

Atlantic sturgeon are anadromous; adults spawn in fresh water in the spring and early summer, and migrate into estuarine and marine waters where they spend most of their lives. In some southern rivers, a fall spawning migration may also occur. They spawn in moderately flowing water (18-30 inches per second) in deep parts of large rivers. Sturgeon eggs are highly adhesive and are deposited on bottom substrate, usually on hard surfaces (e.g., cobble). It is likely that cold, clean water is important for proper larval development. Once larvae begin migrating downstream, they use benthic structure (especially gravel matrices) as refuges. Juveniles usually reside in estuarine waters for months to years. (NOAA. 2015)

Following spawning, males may remain in the river or lower estuary until the fall; females typically exit the rivers within four to six weeks. Juveniles move downstream and inhabit brackish waters for a few months and, when they reach a size of about 30-36 inches, they move into nearshore coastal waters. These immature Atlantic sturgeon travel widely once they emigrate from their natal rivers. Sub-adults and adults live in coastal waters and estuaries when not spawning, generally in shallow (33-164 feet) nearshore areas dominated by gravel and sand substrates. Long-distance migrations away from spawning rivers are common. (NOAA. 2015)

Studies have consistently found populations to be genetically diverse and indicate that there are about 10 populations that can be statistically differentiated. However, there is some disagreement among studies, and results do not include samples from all rivers inhabited by Atlantic sturgeon. (NOAA. 2015)

Historically, threats to Atlantic sturgeon included overharvesting (which led to widespread declines in Atlantic sturgeon abundance) and commercial fishing from the 1950s to the 1990s. Current threats include bycatch of sturgeon in fisheries targeting other species; habitat degradation and loss from various human activities such as dredging, dams, water withdrawals, and other development; habitat impediments including locks and dams; and ship strikes. Although there are no known diseases threatening Atlantic sturgeon populations, there is concern that non-indigenous sturgeon pathogens could be introduced through aquaculture operations. (NOAA. 2015)

Section 316(b) of the CWA requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts [33 USC 1326]. The EPA regulates impingement and entrainment under Section 316(b) of the CWA through the NPDES permit process. VDEQ administers Section 316(b) in Virginia through the VPDES program, and SPS is subject to 316(b) requirements. Pursuant to NRC's regulations, operating licenses are conditioned upon compliance with all applicable law, including, but not limited to, CWA and VPDES permits. Facilities with NPDES permits, such as SPS, are subject to §316(b), which requires the location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts.

SPS is subject to the existing facility rule and based on its current configuration and operation is anticipated to be required to develop and submit each of the §122.21(r)(2)-(13) submittal requirements with its next permit renewal in accordance with the rule's technical and schedule requirements.

Based on what is known about Atlantic sturgeon distribution in the James River, it is expected that yearlings, sub-adult, and adult Atlantic sturgeon would be present in the James River adjacent to SPS. The SPS site is located at RM 25, and transient Atlantic sturgeon will move past the SPS site as they traverse the James River during spawning runs. Adult sturgeon appear to be absent from the James River in the vicinity of SPS for most of the summer until late August, when tagged fish are once again have been detected in the river. During the late summer-early fall residency (August-October), fish ascend the river rapidly and congregate in upriver sites between RM 77 and the fall line near Richmond, Virginia. As temperature declines in late September or early October, adults disperse through downriver sites and begin to move out of the river. By November, adults occupy only lower river sites. By December, adults are presumed to be out of the river. Yearlings are known to occur in the vicinity of the plant site and overwinter in deep water areas near RM 25. (NMFS. 2012)

Entrainment occurs when small aquatic life forms are carried into and through the cooling system during water withdrawals, and primarily affects organisms with limited swimming ability that can pass through the screen mesh used on the intake systems. Fish egg and larval entrainment studies were conducted by the VIMS from April 1975 through December 1978. Entrainment studies were conducted again between August 2005 and June 2006. More recently, entrainment studies occurred from August 1, 2015-July 31, 2017. No Atlantic sturgeon have been documented during entrainment studies at SPS in the past, including the most recent studies conducted from 2015-2016. (NMFS. 2012)

Atlantic sturgeon spawn in the James River, but the spawning grounds are approximately 52 miles upstream of the SPS low-level intake. A second area with seemingly suitable habitat is located approximately 25 miles upstream of the low-level intake. Eggs are adhesive and demersal and occur only on the spawning grounds. Larval Atlantic sturgeon tend to remain in the main channels of their freshwater habitats. Given these are miles upstream of the SPS intakes, and the intake is located along a shallow shoreline, it is unlikely Atlantic sturgeon larvae would be susceptible to entrainment. Similarly, as the larvae grow their swimming ability increases, and the combination of larger size and increased swimming ability make it unlikely to entrain young Atlantic sturgeon. Therefore, no entrainment of Atlantic sturgeon is expected at SPS. (NMFS. 2012)

Impingement occurs when organisms are trapped against cooling water intake screens or racks by the force of moving water. Impingement happens when aquatic species cannot escape from the screen or rack and become stuck. As presented in Section E3.7.7.1.2, impingement monitoring occurs at SPS. The impingement studies indicated that approximately 94% of all finfishes impinged on the Ristroph traveling screens were returned alive to the James River. No impinged Atlantic sturgeon have been documented at SPS. (NMFS. 2012)

Impingement only occurs when a fish cannot swim fast enough to escape the intake (e.g., the fish's swimming ability is overtaken by the velocity of water being sucked into the intake). The approach velocity at the SPS trash racks is 0.98 fps, with a through-rack velocity of 1.12 fps. For impingement to happen, a fish must be overcome by the intake or through-screen velocity. (NMFS. 2012)

Young of the year (yearling), juvenile, and adult Atlantic sturgeon occur in the vicinity. Previous studies have concluded that juvenile and adult shortnose sturgeon (body lengths greater than 23 inches) can avoid impingent and entrainment at intakes with velocities as high as 3.0 fps. Shortnose sturgeon with body lengths greater than 11 inches have been demonstrated to avoid impingement at intakes with velocities of 1.0 fps. It has also been determined that yearling and older shortnose sturgeon are easily able to avoid approach velocities of approximately 1.0 fps. (NMFS. 2012)

Assuming that Atlantic sturgeon have swimming capabilities at least equal to shortnose sturgeon, Atlantic sturgeon in the vicinity should also be able to avoid becoming impinged on the trash bars and intake screens. This is a reasonable assumption given that the Atlantic sturgeon that would be present in the vicinity are at least of a similar size to the juvenile and adult shortnose sturgeon tested in other studies and because these species have similar body forms. Therefore, the impingement or entrainment of any Atlantic sturgeon is extremely unlikely to occur. (NMFS. 2012)

E3.7.8.1.8 Northern Long-Eared Bat

This species is federally and state-listed as threatened. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The northern long-eared bat is a medium-sized bat with a body length of 3-3.7 inches, but a wingspan of 9-10 inches. Its fur color can be medium to dark brown on the back and tawny to pale-brown on the underside. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, Myotis.

Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible. (USFWS. 2015b)

During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds. (USFWS. 2015b)

Breeding begins in late summer or early fall when males begin to swarm near hibernacula. After copulation, females store sperm during hibernation until spring. In spring, they emerge from their hibernacula, ovulate and the stored sperm fertilizes an egg. This strategy is called delayed fertilization. (USFWS. 2015b)

After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies of females and young generally have 30-60 bats at the beginning of the summer, although larger maternity colonies have also been seen. Numbers of individuals in roosts, typically decreases from pregnancy to post-lactation. Most bats within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18-21 days after birth. Maximum lifespan for the northern long-eared bat is estimated to be up to 18.5 years. (USFWS. 2015b)

Like most bats, northern long-eared bats emerge at dusk to feed. They primarily fly through the understory of forested areas feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation. (USFWS. 2015b)

No other threat is as severe and immediate as white-nose syndrome (WNS). If this disease had not emerged, it is unlikely the northern long-eared bat would be experiencing such a dramatic population decline. Since symptoms were first observed in New York in 2006, WNS has spread rapidly from the northeast to the midwest and southeast, an area that includes the core of the northern long-eared bat's range where it was most common before this disease. Numbers of northern long-eared bats (from hibernacula counts) have declined by up to 99% in the northeast. Although there is uncertainty about the rate at which WNS will spread throughout the species' range, it is expected to spread throughout the United States in the foreseeable future. (USFWS. 2015b)

Preferred habitat for the northern long-eared bat is not located on the portions of the SPS site utilized for energy production. Substandard habitat for this species may be located on the forested, unutilized portions of the site. The VDGIF maintains an interactive map depicting the locations of northern long-eared bat maternity roosts (summer habitat) and hibernaculums. The closest known site to SPS is located approximately 44.6 miles southeast of SPS. (VDGIF. 2016d)

A review of the VaFWIS species observation data yielded one documented occurrence of this species within six miles of the SPS site. This occurrence (Observation ID 624285, dated August 3, 2014), was in York County, approximately six miles north of the SPS site (VaFWIS. 2016). Coordination with USFWS in 2015 confirms that there are no documented hiberlacula or roost trees in Surry County (USFWS. 2015c). Actions requiring the removal of trees by Dominion would require adherence to the USFWS 4(d) Rule which sets guidelines for incidental take, and consultation with federal wildlife agencies to ensure that impacts to this species from any future activities would be minimized and/or mitigated.

E3.7.8.1.9 Kemp's Ridley Sea Turtle

This species is federally and state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP (VDGIF. 2015; VaFWIS. 2016).

This species is the smallest of the sea turtles. The beak is parrot-like and the color ranges from light gray to grayish-brown or even an olive green. The plastron is white or yellowish. The adult male's tail extends beyond the rear edge of the shell while the adult female's tail barely extends beyond this edge. The weight of this species is 77-108 pounds and the length 22-31 inches. The carapace is heart-shaped and keeled. The hatchlings are all black. Hatchlings measure 1.5-2 inches carapace length and weigh 0.5-0.75 ounces. Breeding does not occur in Virginia. With few exceptions, breeding occurs only on 15 miles of beach in Tamaulipas, Mexico. In that area, the breeding season is from April-June. There is one breeding season per year, and the females nest three times per season. There are about 110 eggs per clutch. A sand beach in which the back berm and foredunes are well above high tide levels is necessary for egg laying. The incubation period is from 45-70 days. (VDGIF. 2016e)

The Kemp's Ridley is found along Virginia's Atlantic coast and throughout the Chesapeake Bay from the Potomac River south. This species nests on dunes, islands, sandy reefs, atolls, and lagoons. Neither berm nor dune vegetation appear to hinder them. On the Atlantic coast, this species appears to be both oceanic and estuarine, and adult turtles are rarely found. (VDGIF. 2016e)

This species feeds on shallow water benthic invertebrates, with a preference for crustaceans. It also consumes small mollusks, including snails and clams. On the nesting grounds, the diet of this species changes to more active prey including squid, jellyfish, and fish, as well as some vegetation. (VDGIF. 2016e)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site. This species is not documented as occurring in Surry County (VaFWIS. 2016). No habitat for this species is located on SPS or in its surrounding waters. Occurrences of this species near SPS are unlikely and would be incidental. Implementation of 316(b) practices by SPS are designed to prevent entrainment or impingement of this species as the result of facility operations.

E3.7.8.1.10 Leatherback Sea Turtle

This species is federally and state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The leatherback sea turtle is the largest marine turtle. The carapace length can be as great as 96 inches, with an average of 60 inches. It has a weight of 640-1,300 pounds. The carapace is teardrop-shaped and covered with leathery skin, as opposed to horny plates. Hatchlings are black to dark brown, and the keels on the carapace and the margins of the flippers are white to yellow. Leatherbacks can probably exchange gases through their skin as indicated by sphincter muscles in the pulmonary arteries that can divert blood from the lungs to the skin. The oil found within both the skeleton and flesh of this species may lessen decompression problems during rapid diving and resurfacing. Leatherbacks can dive to a depth of around 1,500 feet, nearly the depth attained by the bottle-nosed dolphin. The leatherback is able to maintain its body temperature several degrees higher than in surrounding waters. This explains its ability to migrate into cold waters in upper latitudes, where it feeds on the abundant cold-water jellyfish. The preponderance of clear plastic debris in the oceans has had a negative impact on the survival of leatherbacks. These turtles consume plastic bags, jugs, and sheets because they look like jellyfish. This leads to intestinal blockage and starvation. (VDGIF. 2016f)

Only sub-adults and adults are seen in coastal waters; juveniles are seldom seen anywhere. Leatherbacks are the most pelagic of sea turtles. They forage in coastal and offshore waters, but occasionally wander close to shore and into estuaries. They occur in Virginia's coastal waters during the warmer months and stay longer than other species. Breeding is not likely to occur in Virginia. This species prefers water deeper than 15 feet. (VDGIF. 2016f)

The diet of this species consists of soft-bodied animals such as jellyfish and tunicates, together with associated juvenile fishes, amphipods, and other organisms. Although they are not agile enough to catch fish on their own, they will forage from gill and pound nets. In Virginia, leatherbacks feed primarily on the moon jellyfish and sea nettle. (VDGIF. 2016f)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site. This species is not documented as occurring in Surry County (VaFWIS. 2016). No habitat for this species is located on SPS, or in its surrounding waters. Occurrences of this species near SPS are unlikely and would be incidental. Implementation of 316(b) practices by SPS are designed to prevent entrainment or impingement of this species at the result of facility operations.

E3.7.8.1.11 Loggerhead Sea Turtle

This species is federally and state-listed as threatened. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The loggerhead sea turtle is a large sea turtle that grows to lengths of 84 inches. The carapace is heart shaped, without striations on the surface, and brown to reddish brown in color. The plastron (lower shell) is hingeless, smaller than the carapace (upper shell), and cream to yellowish in color. Star-shaped light and dark streaks may be present on the carapace. The top of the head, the neck, and the front of the fore-flippers are reddish brown. The snout is short and the upper jaw is yellowish brown. The entire undersurface, side of the neck, and parts of the flippers are cream to yellow. The fore-flippers are large, about half the length of the carapace; the hind-flippers are short and paddle-like. Each flipper bears one or two claws. Hatchling and juvenile loggerheads have a brown carapace with three dorsal keels. The breeding season is from April to August. Incubation takes 55-70 days, and there are two to three nestings per year, with an average clutch size of about 119 eggs. (VDGIF. 2016g)

The loggerhead is the most abundant sea turtle in Virginia's coastal waters. It is found only in salt water, in the Chesapeake Bay from Baltimore south, in all the major rivers along Virginia's coast, and into channels between barrier islands. The Chesapeake Bay is an important summer foraging area for sub-adults between the ages of five and 15 years. Nearly all nesting sites are on barrier islands in the United States. Nesting habitat is a sand beach that is high enough that it is not inundated by high tides nor soaked by groundwater rising from below. (VDGIF. 2016g)

The loggerhead forages in the bay and its estuaries primarily for horseshoe crabs. It will also consume other crustaceans, sea grasses, sponges, fish, mollusks, and snails. (VDGIF. 2016g)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site. This species is not documented as occurring in Surry County (VaFWIS. 2016). No habitat for this species is located on SPS, or in its surrounding waters. Occurrences of this species near SPS are unlikely and would be incidental. Implementation of 316(b) practices by SPS are designed to prevent entrainment or impingement of this species at the result of facility operations.

E3.7.8.1.12 Sensitive Joint-Vetch

The sensitive joint-vetch is federally and state-listed as threatened (USFWS. 2016c; USFWS. 2016d). This species is an annual legume native to the eastern United States. Populations currently exist in Maryland, New Jersey, North Carolina, and Virginia. The historical range for the species extended to Delaware and Pennsylvania. In Virginia, populations are found along the Potomac, Mattaponi, Pamunkey, Rappahannock, Chickahominy, and James rivers and their tributaries. This plant usually attains a height of 3-6 feet in a single growing season, but may grow as tall as eight feet. The flowers are yellow, streaked with red, and the fruit is a pod, turning dark brown when ripe. (USFWS. 2010)

The joint-vetch occurs in fresh to slightly brackish tidal river systems, within the intertidal zone where populations are flooded twice daily. It typically occurs at the outer fringe of marshes or shores; its presence in marsh interiors may be a result of nutrient deficiencies, ice scouring, or muskrat herbivory. The sensitive joint-vetch is found in localities where plant diversity is high and annual species are prevalent. Bare to sparsely vegetated substrates appear to be a habitat feature of critical importance for establishment and growth of this species. Plants flower from July through September and into October in some years. Fruits are produced from July through late October, concurrent with flowering. (USFWS. 2010)

Occurrences of this species would be restricted to tidally-influenced fringes of the peninsula, and is not likely to occur in to portions of the SPS site utilized for plant operations. This species has not been recorded to occur at the SPS site.

E3.7.8.1.13 Small Whorled Pogonia

A member of the orchid family, this species is federally listed as threatened and state-listed as endangered (USFWS. 2016c). It usually has a single grayish-green stem that grows about 10 inches tall when in flower and about 14 inches when bearing fruit. The plant is named for the whorl of five or six leaves near the top of the stem and beneath the flower. The leaves are grayish-green, somewhat oblong and 1-3.5 inches long. The single or paired greenish-yellow flowers are about 0.5-1 inches long and appear in May or June. The fruit, an upright ellipsoid capsule, appears later in the year. (USFWS. 2016f)

Although widely distributed, the small whorled pogonia is rare. It is found in 18 eastern states and Ontario, Canada. Populations are typically small with less than 20 plants. It has been extirpated from Missouri, Vermont, and Maryland. (USFWS. 2016f)

This orchid grows in older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory. Sometimes it grows in stands of softwoods such as hemlock. It prefers acidic soils with a thick layer of dead leaves, often on slopes near small streams. (USFWS. 2016f)

This pogonia flowers from mid-May to mid-June, with the flowers lasting only a few days to a week. It may not flower every year but when it does flower, one or two flowers are produced per plant. If pollinated, a capsule forms that contains several thousand minute seeds. The pogonia appears to self-pollinate by mechanical processes. The flower lacks both nectar guides and fragrance and insect pollination has not been observed. (USFWS. 2016f)

The primary threat to the small whorled pogonia is the past and continuing loss of populations when their habitat is developed for urban expansion. Some forestry practices eliminate habitat. Also, habitat may be degraded or individual plants lost because of recreational activities and trampling. (USFWS. 2016f)

This species has not been documented to occur in Surry County, but has been documented in York and James City counties, Virginia. Habitat for this species is not located on the SPS site, as forested regions of the site are dominated by pine, and not hardwood stands, as required by this species.

E3.7.8.2 State-Listed Species

Based on a review of the VDGIF and Virginia Natural Heritage Program databases of threatened and endangered species, a total of 28 state-listed species are classified as known to occur, or potentially occurring in Surry County or its adjoining counties. These species are included in Table E3.7-4. With the exception of the 13 species presented in Section E3.7.8.1, the descriptions of each species and their ecological requirements are presented below. No state-listed species have been observed on the SPS site.

E3.7.8.2.1 Barking Treefrog

The barking treefrog is state-listed as threatened and listed in Tier II, very high conservation need, in the Virginia WAP (VDGIF. 2015; VaFWIS. 2016).

The barking treefrog is documented to occur in Surry County. This is the largest native treefrog with a length from 2-2.6 inches. The coloration is gray, purple, or green, the skin is granular, and the back is evenly covered with dark, elliptical or round spots encircled with black. Spots may be absent. There is a light stripe that extends along the sides, bordered below by a purplish brown one. There are spots on the side, chin, and the rim of the jaw which are reddish brown. This species breeds from March-August. The eggs are laid singly on the bottom of a pond and are from 0.04-0.07 inches in diameter. This species breeds in cypress ponds and bays, and in pine barren ponds. It climbs high in trees, and often seeks shelter underground in hot, dry weather. (VDGIF. 2016h)

This species is found in the coastal plain and adjacent piedmont from Mathews County south. It is confirmed to occur in five Virginia counties: Mathews, Surry, Isle of Wright, Chesterfield, and Prince George. Unvouchered reports are from Greensville, Southampton, and Sussex counties. Choruses gather at permanent water, streams, cypress ponds, and bayheads to breed. All Virginia breeding sites were found in graminoid dominated temporary ponds. Most of the breeding sites are in open-canopied pools. The forest surrounding the breeding ponds are the supposed nonbreeding habitat. This species inhabits sandy areas near shallow ponds in pine savannas and in low wet woods and swamps. (VDGIF. 2016h)

An evaluation of the VaFWIS species observation yielded four observations of this species within six miles of the SPS site. Species observation numbers 616802 (June 14, 2013), 616804 (June 14, 2013), and 616798 (June 9, 2013) were reported in Surry County, south of SPS, and observation number 365708 (January 1, 1900) was reported in Isle of Wright County, Virginia (VaFWIS. 2016). This species has not been observed on the SPS site.

E3.7.8.2.2 Eastern Tiger Salamander

This species is state-listed as endangered. It has been designated as Tier II, very high conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The tiger salamander is one of the largest terrestrial salamanders in the United States. The biggest specimen recorded was 13 inches long. The average size ranges between 7-8 inches. It is stocky with sturdy limbs and a long tail. The body color is dark brown, almost black, and irregularly marked with yellow to olive colored blotches. The only other salamander with which it might be confused is the smaller spotted salamander *(Ambystoma maculatum)*. The spotted, however, has two rows of regular, yellow-to-orange spots running parallel down its back, as distinct from the irregularly distributed spots of the tiger salamander. (NYDEC. 2016a)

The eastern tiger salamander ranges along the east coast from southern New York to northern Florida, west from Ohio to Minnesota and southward through eastern Texas to the Gulf of Mexico. The tiger salamander inhabits sandy pine barren areas with temporary or permanent pools for breeding. (NYDEC. 2016a)

Disturbance at ponds, introduction of predatory fish into permanent pools, and expansion of bullfrog populations threaten annual reproduction. Recreational activities, especially ORVs, further impact breeding sites and year-round habitat. Increased construction of roads has also bisected habitat, jeopardizing migrating adults. (NYDEC. 2016a)

This species is not listed by the VDGIF as occurring in Surry County. An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site. (VaFWIS. 2016)

E3.7.8.2.3 Mabee's Salamander

Mabee's salamander is state threatened and listed as Tier II, very high conservation need, in the Virginia WAP (VDGIF. 2015; VaFWIS. 2016). Like other members of the mole salamander family, Mabee's salamanders spend the larval period of their life cycle in aquatic environments, but most of the adult life is spent in terrestrial burrows. The breeding habitat is described as fish-free vernal ponds or coastal plain ephemeral sinkholes up to five feet deep. Breeding occurs from late fall to early spring. Females lay 2-6 eggs and attach them to small twigs, leaves, or debris. Larval young live in ponds until April or May, when they become juveniles. Surrounding forests are generally composed of bottomland hardwoods mixed with pines, pine savannas, bogs, and swamps. This species forages for zooplankton, arthropods, crustaceans, and worms in the water and on land. This species is not documented by the VDGIF as occurring in Surry County, but is documented within the adjacent counties of Southampton, Gloucester, and Isle of Wight. (VDGIF. 2016i)

An evaluation of the VaFWIS species observation data yielded three recorded observations of this species within six miles of the SPS site. Observation numbers 615437 (March 12, 2013), 3528 (June 5, 1990), and 4216 (June 5, 1990) were all recorded in York County, Virginia (VaFWIS. 2016). This species has not been observed on the SPS site.

E3.7.8.2.4 Bachman's Sparrow

This species is state-listed as threatened. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

Bachman's sparrow *(Peucaea aestivalis)* is considered one of the most rapidly declining bird species in North America. This species could be most commonly found in mature pine forests. As most of its habitat has been logged and degraded, presently this sparrow can be found to inhabit regions of pine woodlands that have a more open understory and more grassy conditions than a dense and heavily vegetated lower-canopy brush. (USFWS. 2016g)

Historically, this species was known to breed from Illinois, Ohio, Indiana, West Virginia, Pennsylvania, and Maryland. Today it is found to breed primarily from central Florida north to southern Virginia, west to Tennessee, Kentucky, and Missouri to eastern Oklahoma, and eastern Texas and south along the coastal plain. It is considered locally common along the outer coastal plain, uncommon along the inner coastal plain, and rare in the piedmont region. (USFWS. 2016h)

In general, prime habitat for Bachman's sparrow is mature (> 80 years old) pine stands (longleaf, loblolly, shortleaf [P. echinata], slash [P. elliottii], and mixed oak-pine) that are frequently burned (< three-year burn interval). They can also occur in intermediate-age and young pine woodlands as well as recently cutover areas (< five years old). Sparrows abandon sites if fire is excluded for more than three years. Birds are not found in the first year on frequently cut-over lands and occupy a clear-cut from four to seven years following clearing. They can be found in recent clear-cuts with planted longleaf, slash, loblolly, or shortleaf pine where little bluestem *(Schizachyrium scoparium)* or other native grasses dominate the ground cover. It has been found in young slash pine stands with gallberry or palmetto present. In addition, Bachman's sparrow will occupy open field and prairie sites. (USFWS. 2016h)

Bachman's sparrows use areas with open canopies (< 50% canopy cover). The species is more abundant in areas with vegetation < three feet high. Mature stands with lower tree densities (< 81 trees per acre and 15-60 square feet BA) are preferred over areas with more trees per acre. Longleaf and loblolly stands of different ages and management have shown Bachman's sparrow densities were negatively related to the amount of vegetation (by volume) in the mid-story and canopy layers (> seven feet) in South Carolina, Florida, and Georgia. In addition, sparrow breeding areas had significantly lower percent canopy cover, shorter woody vegetation, and fewer trees and shrubs compared to unoccupied areas. (USFWS. 2016h)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site (VaFWIS. 2016). Suitable habitat for this species is not located on the SPS site. Furthermore, activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. (Dominion. 2009a)

E3.7.8.2.5 Black Rail

This species is state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

At six inches in length, the black rail *(Laterallus jamaicensis)* is the smallest of North America's rail species. It is a stocky, short-billed, short-tailed, and round-winged bird, mostly dark gray or black on the head, bill, and chest with white-speckled dark wings, back, and lower abdomen. (NYDEC. 2018)

The extent of migration in this species is poorly understood. Individuals have been recorded in winter as far north as New Jersey, but it is likely that most East Coast populations migrate south. Spring migration occurs from mid-March to May. Peak nesting occurs from June to mid-July. The nest is concealed in grasses and is woven together with live and dead vegetation. It has a deep cup shape with a canopy over top, and an entrance ramp leading up the side. A clutch of 6-10 buffy white eggs with brown spots is incubated for 16-20 days. Both sexes share incubation and brood rearing duties suggesting a monogamous relationship, but it is unknown whether the pair bond lasts longer than one breeding season. Chicks are hatched one at a time and are semi-precocial at birth. The degree of parental care and chick survival is unknown. Fall migration occurs in September to mid-October. (NYDEC. 2018)

Black rails breed locally in California, Kansas, and along the Atlantic coast from southern New England to the Gulf coast states. They winter from the southern Atlantic coast, south to Central America. Historically, the breeding range may have extended as far north as Massachusetts, but today the core breeding range is from New Jersey south along the coast to Florida. (NYDEC. 2018)

Black rails nest on the higher ground portions of coastal salt and brackish marshes dominated by rushes, grasses, and sedges. They have also been documented less frequently in wet meadows and freshwater emergent marshes. (NYDEC. 2018)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site (VaFWIS. 2016). This species has not been observed on the SPS site. Furthermore, activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. (Dominion. 2009a)

E3.7.8.2.6 Henslow's Sparrow

This species is state-listed as threatened. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

Henslow's sparrows *(Ammodramus henslowii)* breed from South Dakota, Minnesota, Wisconsin, Michigan, Ontario, and Massachusetts south to Kansas, Missouri, Illinois, Kentucky, West Virginia, Virginia, and North Carolina, and locally in Texas. (NYDEC. 2016b)

Generally, its habitat consists of fallow, weedy, often moist fields and meadows. Breeding occurs in a variety of habitats with tall, dense grass and herbaceous vegetation, including upland weedy hayfields, pastures without shrubs, wet meadows, drier areas of salt marshes, grassy fields, and sedge covered hillsides with recently planted pine seedlings. Though not associated with grazed areas, they will use lightly grazed pastures. (NYDEC. 2016b)

An evaluation of the VaFWIS species observation yielded a result of no observations for this species within six miles of the SPS site (VaFWIS. 2016). Furthermore, activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. (Dominion. 2009a)

E3.7.8.2.7 Loggerhead Shrike

This species is state-listed as threatened. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The loggerhead shrike *(Lanius ludovicianus)* is an 8-10 inch-long bird with a wing spread of 12.5-13 inches. Its coloration is similar to a mockingbird, with gray above and white below. The shrike is distinguished by a characteristic black facial mask that meets over the base of the bill, a heavy hooked bill, black wings with white wing patches, and a slim black tail with white outer tail feathers. The other North American shrike species, the northern shrike, is slightly larger, has a longer bill and the mask does not meet over the base of the bill. When perching, the shrike holds its tail nearly horizontal, whereas most other birds hold their tails pointing downward. The loggerhead perches alone, usually in treetops or on telephone wires in open country. Its flight pattern is low and undulating with very fast wing beats. (NYDEC. 2016c)

The loggerhead begins nesting in late April or early May. The well-made nest is constructed of thick twigs woven together and lined with fibers and padded with feathers, hair, or cotton. Its breeding habitat consists of agricultural areas that contain hedgerows, hayfields, pastures, and scattered trees and shrubs, especially hawthorn. The shrike lays 4-6 eggs and may raise two broods in the southern portion of its range. (NYDEC. 2016c)

The loggerhead shrike ranges throughout most of North America from southern Canada to southern Mexico. This species' former range was from Maine through New England, south to Virginia, Pennsylvania, and West Virginia. It winters from Virginia to Florida. With an uneven and local distribution, the loggerhead was never considered a common breeding bird in the northeast. (NYDEC. 2016c)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site (VaFWIS. 2016). This species has not been observed on the SPS site. Furthermore, activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species. (Dominion. 2009a)

E3.7.8.2.8 Blackbanded Sunfish

This species is state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The blackbanded sunfish is a small, laterally compressed and deep-bodied species reaching a maximum total length of four inches. There is a prominent notch separating the spinous and soft-rayed portions of the dorsal fin. It is distinctively marked with 5-6 black bars along the sides that extend from the dorsum to the venter. The first of these bars passes through the eye, and the third extends through the first three membranes of the spinous dorsal fin to the upper edge of the fin. No other sunfish has this barring pattern. (GDNR. 2016)

Blackbanded sunfish are restricted to shallow, low-velocity, non-turbid waters of lakes, ponds, rivers, and streams. They are strongly associated with aquatic plants, which provide habitat for foraging and cover. Occupied waters are tea-stained and usually, but not always, with a low pH. Beaver ponds appear to be important habitats for breeding and for juvenile life stages of the fish. (GDNR. 2016)

The blackbanded sunfish ranges below the fall line in Atlantic and Gulf coast drainages from New Jersey to northern Florida. Populations of this species are small and extremely localized, which makes each population vulnerable to extirpation with very limited opportunities for subsequent population recovery. A variety of human-caused and natural factors could lead to local population loss, including drainage modification, changes in aquatic plant communities, extreme drought or excessive water withdrawal, and nutrient pollution. (GDNR. 2016)

An evaluation of the VaFWIS species observation yielded no observations for this species within six miles of the SPS site (VaFWIS. 2016). This species has not been observed on the SPS site.

E3.7.8.2.9 Little Brown Bat

This species is state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The little brown bat *(Myotis lucifugus lucifugus)* is a small- to medium-sized bat, with glossy fur that is a dark yellow-brown to olive brown. The face, ears, and membranes are dark, with the membranes sparsely or not furred. The total length is 3.3-3.8 inches with a wingspread from 8.5-10.5 inches. It has a weight of 0.18-0.5 ounces, and the female is slightly larger than the male. This species mates primarily in the fall. There is delayed fertilization until spring ovulation following departure from the hibernacula. Nursery colonies of several to 1,000 or more females form in late April-May in warm, dark locations. The summer colony may disperse to several hibernacula, and the hibernating colony may come from many summer colonies. When not hibernating, these bats emerge to forage at late dusk, and often repeat hunting flight patterns. They may use waterways, escarpments, even highways for orientation. The mean life expectancy of the males is 1.55 years; for females, 1.17-2.15 years (closer to 2.15). (VDGIF. 2016j)

Migration generally is north to south. There are 13 caves with 100-1,000 individuals of this species and eight caves with more than 1,000. This species will roost in caves, buildings, rocks and trees, under bridges, in mines and in tunnels. They also may dwell in man-made structures. This is one of the most abundant insectivorous bats in Virginia. They are found in all forested regions. (VDGIF. 2016j)

Moths are a major part of the diet as well as midges, mayflies, and aquatic insects. Lactating bats select larger insects than males or nonparous females. They are very effective at feeding in patches of insects. They forage at about 10-20 feet over trees, lawns, pastures, and about 3-6.5 feet over open water. They may sweep low over water for drinking before they begin foraging. (VDGIF. 2016j)

An evaluation of the VaFWIS species observation data yielded one recorded observation of this species within six miles of the SPS site. Observation number 622969 was observed on August 3, 2014, in York County, Virginia (VaFWIS. 2016). While substandard habitat for this species may be located on the forested, unutilized portions of the site, preferred habitat for this species is not located on the portions of the SPS site that are utilized for energy production.

E3.7.8.2.10 Rafinesque's Eastern Big-Eared Bat

This species is state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

Rafinesque's eastern big-eared bat *(Corynorhinus rafinesquii macrotis)* is a medium-sized bat, with the dorsal hair gray-brown with black bases, and the ventral hair whitish-yellowish with black bases. The fur is long and shaggy, and the bat has huge ears up to twice the length of the head, connected across the forehead. There is a glandular mass on either side of the muzzle, and elongated nostril openings. The total length (male smaller than female) is 3-4.3 inches, with a wingspread from 10.5-12 inches, and a weight of 0.3-0.48 ounces. Mating is in the fall and winter, and single naked young are born in the nursery colony in May or June. This species roosts singly, in small clusters, or groups to 100 or more in hollow trees, under loose bark, houses, unoccupied buildings, and culverts. It hibernates in the northern part of the range. The ears are coiled back like ram's horns. They may need a variety of roosts to adjust for seasonal temperature and food fluctuations. This bat is a slow flier, but it is agile and can hover. Longevity is 8-10 years or more. (VDGIF. 2016k)

Rafinesque's eastern big-eared bat is incidental in Virginia because it has adapted to the temperate, arboreal zones found only in the extreme southeast portion of the state. This species is most often found in houses, or sometimes in hollow trees, behind loose bark, in culverts, or in caves and mines. (VDGIF. 2016k)

An evaluation of the VaFWIS species observation yielded a result of no observations for this species within six miles of the SPS site (VaFWIS. 2016). Preferred habitat for this species is not located on the portions of the SPS site that are utilized for energy production.

E3.7.8.2.11 Tri-Colored Bat

This species is state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

Tree-colored bats *(Perimyotis subflavus)* over-winter in humid areas deep within caves and mines with a constant temperature of around 52-55°F. A study in Arkansas found tri-colored bats selected larger caves with a wide range of temperatures within a season, but little variability among temperature between seasons. (NYNHP. 2016)

Wooded riparian areas are likely an important foraging habitat for this species during the summer. One study conducted in coastal South Carolina found that tri-colored bats were more frequently found in riparian areas than in upland sites and especially, riparian areas that were wooded or highly vegetated. They may also forage in woods or along waterways or forest edges. Although tri-colored bats are typically considered a clutter-adapted species capable of foraging within forested areas, they also forage over early successional and open habitats. (NYNHP. 2016)

Tri-colored bats may roost in habitats including open woods near water and they may select roosts in buildings, crevices of cliffs and rocks, or in or below the canopy of live or recently dead trees that retain some dead or live leaves. They are occasionally reported from caves during the summer, and have been known to form maternity colonies in barns, and in clusters of dead leaves in oaks or pines. Some habitat characteristics may vary regionally. (NYNHP. 2016)

By far the largest threat to tri-colored bats is WNS, first discovered among bats in a cave in Schoharie County, New York, in 2006. WNS is caused by a fungus *Pseudogymnoascus destructans* (previously *Geomyces destructans*) that is often visible on a bat's muzzle and wings. The fungus may invade hair follicles and cause lesions under the skin. Bats wake from hibernation and consequently burn fat reserves that are needed to survive the winter and they become emaciated. Extensive damage to their wing membranes and dehydration may also be contributing factors to mortality. (NYNHP. 2016).

Bats are particularly sensitive to environmental toxins, including those found in herbicides and pesticides. Although no studies have targeted tri-colored bats directly, elevated levels of persistent organic pollutants including polychlorinated biphenyls (PCBs), DDT, chlordanes, and polybrominated diphenyl ethers (PBDEs) have been found in a similar species, the little brown bat, in the Hudson River Valley in New York. The levels found in the bats were only one to three times less than lethal concentrations reported from previous studies. High toxin levels are expected in bats that obtain a high a composition of their diet from prey with an aquatic life stage. This may be a concern for tri-colored bats, as well, since caddisflies have been reported as an important food item in some regions. Bats are highly susceptible to DDT residue, a chemical that was widely used as a pesticide to control bat infestations in houses in the 1940s. DDT was widely used as an agricultural pesticide in the 1950s and 60s until its agricultural use was banned in 1972. Because DDT is highly persistent (soil half-life is 2-15 years, aquatic half-life is about 150 years), it can pose a threat to bats when there is exposure to trace residues remaining in the environment. Tri-colored bat populations are thought to have been impacted by heavy pesticide use in the mid-1950s. Extensive applications of insecticides and some biological control methods could also pose an indirect risk to tri-colored bats by reducing availability of prey. (NYNHP. 2016)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site (VaFWIS. 2016). Preferred habitat for this species is not located on the portions of the SPS site that are utilized for energy production.

E3.7.8.2.12 Canebrake Rattlesnake

This species is state-listed as endangered. It has been designated as Tier II, very high conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

This is a large venomous snake that grows to lengths of 36-60 inches. The canebrake rattlesnake *(Crotalus horridus)* differs from the timber rattlesnake in that the canebrake is pinkish to light tan with dark-brown to black blotches and chevrons, and it has a marked stripe down the back and a stripe from the eye to the jaw. There are no yellow and black phases in the canebrake. Both rattlesnakes have a triangular head and a pit below each eye. The pupil of the eye is vertical and elliptical. The black tail is tipped with a rattle. Males grow larger than females. Mating occurs late July to August, one year previous to the female bearing the live young. This snake bears live young in litters of 7-13 during late August and early September. This species is diurnal in the spring and fall, and nocturnal in the summer. (VDGIF. 2016l)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site (VaFWIS. 2016). While suitable habitat for this species may be located in the forested portions of the site, there is no record of this species occurring at the SPS site.

E3.7.8.2.13 Eastern Chicken Turtle

This species is state-listed as endangered. It has been designated as Tier I, critical conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

This species is a medium-sized turtle with a carapace (top of shell) that has a reticulated (netlike) yellow pattern on a dark brown to black background. In adults, the carapacial pattern can be quite faded. The patternless plastron (bottom of shell) is yellow with (or without) black streaks on the bridge area. Black spots occur on the plastral side of the marginal scutes. The wide, flattened head with a notably long neck has two or three yellow stripes. The front feet and legs have a broad yellow stripe on black skin, while the feet have multiple thin yellow stripes. Feet are weakly webbed. Females are larger than males and have a highly domed carapace. The pattern is much bolder in hatchlings and juveniles. (VDGIF. 2016m)

Eastern chicken turtles *(Deirochelys reticularia reticularia)* may reach sexual maturity in about two years. Females usually lay two clutches within a year (5-13 eggs) in early spring and again in late August and September. If eggs are deposited in late summer, hatchlings will not emerge until the following spring. Beginning in early October, they will begin to leave their aquatic habitats to hibernate terrestrially. During the summer when their aquatic habitats begin to dry, chicken turtles will aestivate (temporary period of dormancy) in the surrounding forest and wait for the rains to refill the wetlands. Chicken turtles are carnivorous, actively hunting a variety of aquatic invertebrates and amphibian larvae. Females particularly favor crayfish. (VDGIF. 2016m)

Southeastern Virginia is the northern limit of this species and only two isolated populations are known to occur. One in Isle of Wight County and the other at First Landing (formerly Seashore) State Park in Virginia Beach. They inhabit interdunal ponds and sinkhole complexes that experience seasonal water fluctuations and are free of predatory fish. (VDGIF. 2016m)

An evaluation of the VaFWIS species observation yielded no observations of this species within six miles of the SPS site (VaFWIS. 2016). This species is not known to occur in Surry County.

E3.7.8.2.14 Northern Diamond-Backed Terrapin

This species is state-listed as a collection concern, for loss to the pet trade. It has been designated as Tier III, high conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The northern diamond-backed terrapin *(Malaclemys terrapin terrapin)* is a moderately sized estuarine turtle reaching a maximum carapace length of about nine inches. The carapace is smooth, with the rear half of the shell the widest part. The carapace (upper shell) is gray, brown, yellowish green, or nearly black, and has brown concentric circles alternating with gray, black, or yellow. The plastron (lower shell) is yellowish to greenish, and often has an irregular pattern of black flecks; it may have a dark brown blotch in each scute and the margins of the scutes may be outlined with thin black lines. The skin is usually gray with an irregular pattern of small to large, comma-shaped flecks on the head and limbs. The eyes are black and the "lips" are yellow. The female is significantly larger than the male. This species breeds and lays eggs in the spring and summer. Mating always occurs in the water. Nests are usually constructed in sand, but may also be in fill dirt. These turtles usually overwinter in the mud in channels and tidal flats. This is the only truly estuarine reptile in Virginia, and the only species in the family Emydidae that possesses a nasal salt gland used for excreting excess salts. (VDGIF. 2016n)

This species is found in the Chesapeake Bay and on the ocean side of the eastern shore and southeast Virginia. It may be found in coastal rivers as far as tidal influence. It inhabits brackish water, saltwater estuaries, and tidal marshes. It is sometimes seen in the Atlantic Ocean. (VDGIF. 2016n)

An evaluation of the VaFWIS species observation data yielded two recorded observation of this species within six miles of the SPS site. Observation numbers 50916 (May 13, 1996) and 50917 (October 3, 1995) were recorded in James City County, Virginia (VaFWIS. 2016).

E3.7.8.2.15 Spotted Turtle

This species is state-listed as a collection concern, for loss to the pet trade. It has been designated as Tier III, high conservation need, in the Virginia WAP. (VDGIF. 2015; VaFWIS. 2016)

The spotted turtle *(Clemmys guttata)* is a small freshwater turtle reaching a maximum carapace length of five inches. The carapace (upper shell) is black to blue-black with 3-92 yellow or cream-colored spots. The plastron (lower shell) is yellow, cream, or orangish with large black blotches. The skin on head, neck, and limbs is dark gray to black with a variable number of yellow spots on them; the undersides of the limbs are reddish to yellowish in color. Juveniles are colored and patterned as adults, but with one spot in most pleural and vertebral scutes. Older individuals usually have more spots than juveniles, and the carapace may be very worn, eroded, and spotless. The non-breeding territory for this species is 1.3 acres (0.002 square miles). This species is active from spring thaw until June. Mating occurs in spring in shallow water. Two to seven eggs are laid in the late spring or summer. Basking on logs, stumps, grass mats, and tussocks occurs frequently, especially early in the activity season. This turtle overwinters underwater in mud, under banks, or in muskrat burrows. (VDGIF. 2016o)

An evaluation of the VaFWIS species observation data yielded five recorded observation of this species within six miles of the SPS site. Observation numbers 601597 (June 3, 2010), 312094 (April 25, 2005), and 312053 (May 5, 2004) were reported in Newport News; observation 29731 (January 1, 1900) was reported in James City County, and 2932 (January 1, 1900) in Surry County, Virginia. (VaFWIS. 2016)

Occurrences of this species would be restricted to tidally influenced fringes of the peninsula, and is not likely to occur in to portions of the SPS site utilized for plant operations. This species has not been recorded to occur at the SPS site.

E3.7.8.3 Species Protected under the Bald and Golden Eagle Protection Act

Bald eagles are protected under the BGEPA. Current and future bald eagle nests located on the SPS site would be subject to all protections under the BGEPA.

The BGEPA [16 USC 668-668c], enacted in 1940, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

"Disturb" means "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

There are currently no BGEPA permitting requirements associated with SPS site operations or in-scope transmission lines under the scope of the SPS SLRA. An eagle disturbance application has been submitted to the USFWS in association with the construction of Skiffs Creek, an out-of-scope transmission line.

E3.7.8.4 Species Protected under the Migratory Bird Treaty Act

In addition to the Bachman's sparrow, the bald eagle, the black rail, Henslow's sparrow, loggerhead shrike, the peregrine falcon, the red knot, and the red-cockaded woodpecker, there are numerous bird species protected under the MBTA that may visit the site. The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations.

Currently, Dominion maintains a depredation permit authorizing it to take a maximum of 70 black vultures, 20 turkey vultures, and 40 Canada geese at all Dominion power generation locations (USFWS. 2017b). The 2017 permit expired on March 31, 2018. Because Dominion submitted its application for renewal before the expiration date, depredation permit activities are authorized until a new permit is issued.

E3.7.8.5 Essential Fish Habitat

A review of NOAA's essential fish habitat (EFH) database was conducted to determine the locations of EFH within six miles of SPS. The EFH database is based on NOAA's 2009 final South Atlantic Fishery Management Council EFH amendment (NMFS. 2009). According to the 2009 EFH final amendment, potential EFH exists within the proposed project area for the following species (NOAA. 2016c):

- All life stages of the sandbar shark *(Carcharhinus plumbeus)*
- All life stages of the Atlantic butterfish *(Carcharhinus plumbeus)*
- All life stages of the summer flounder *(Paralichthys dentatus)*
- All life stages of the black sea bass *(Centropristis striata)*
- All life stages of the bluefish

None of these species has been documented as entrained or impinged during the any of the monitoring studies conducted by Dominion (HDR. 2016a; HDR. 2016b).

No habitat areas of particular concern (HAPCs) or EFH areas protected from fishing are located on or adjacent to the project site. Continued operation of the SPS facility is not likely to adversely impact EFH, HAPCs, or EFH areas protected from fishing.

The federally managed species noted above are morphologically and behaviorally adapted for feeding on different prey items. However, all tend to follow a feeding pattern displayed by most estuarine fishes. During their youngest life stages, small invertebrates tend to be the predominant prey item. As the fish grow, larger invertebrates and small fish become more important to their diets. As the fish become fully developed, the largest invertebrates and fish they have the capacity to consume become important, although smaller fish and invertebrates continue to be consumed.

SPS operational effects on fish prey can take two forms: effects from impingement and entrainment of invertebrates and finfish, and effects from thermal discharge. Impingement of fish and shellfish is mitigated at SPS by the existing modified travelling screens, which exclude organisms that cannot pass the 1/8 x ½ inch mesh. Organisms impinged on the screens are washed into a trough with flowing water and returned to the James River. Organisms that can pass the travelling screen mesh and are entrained to the station condenser system are eventually returned to the James River via the station discharge canal. The survival rates of organisms entrained at SPS are not known, but studies at other power stations have indicated survival can be substantial, especially for hard-bodied invertebrates. The station's thermal discharge (condenser cooling water) exits SPS through the discharge canal and increases water temperatures in a localized section of the James River in the immediate vicinity of the canal outlet.

Dominion is currently conducting studies required by CWA §316(b) that will address impingement and entrainment mortality of finfish and shellfish, and determine if there is a need for additional protective measures. Dominion currently operates SPS under a VPDES permit that places limits on heat rejection, and is based on the results of a CWA §316(a) demonstration study that made use of physical and biological data collected 1970-1976. Effects of thermal discharge on fish and shellfish will also be examined as part of the §316(b) agency review.

Figure E3.7-1 NWI Wetlands within a 6-Mile Radius of SPS

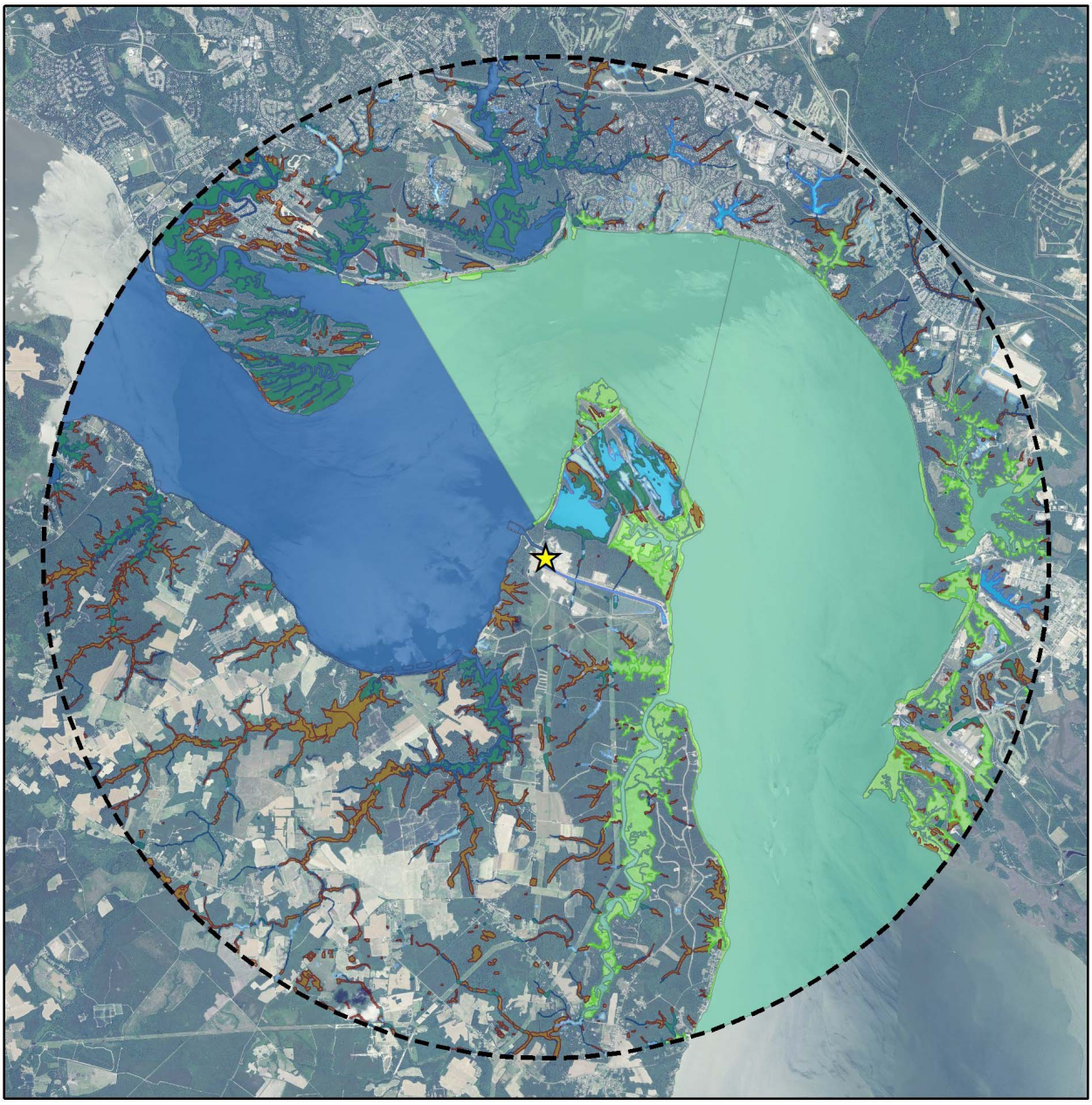


Figure E3.7-2 NWI Wetlands on the SPS Site

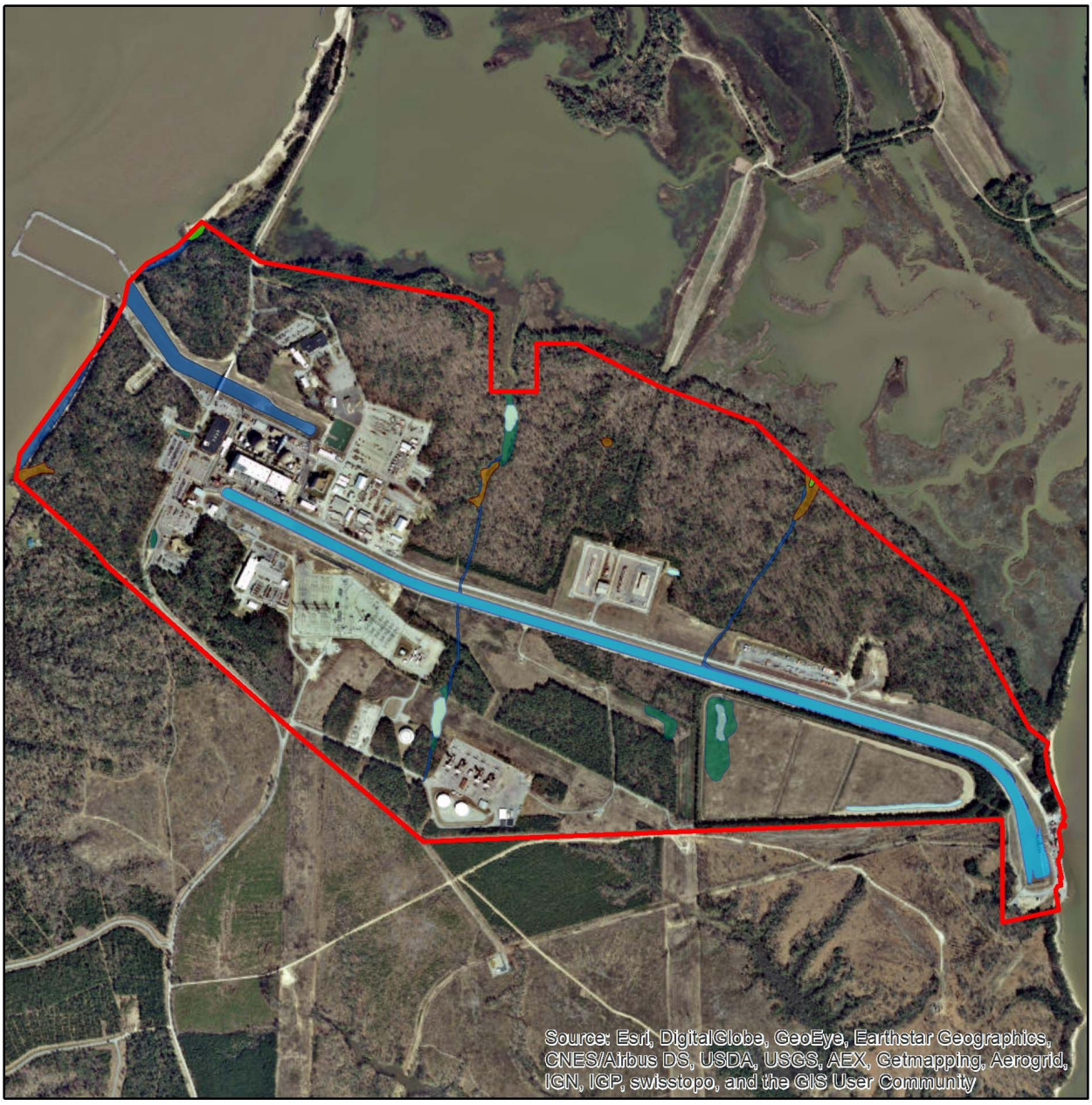


Table E3.7-1 Zooplankton and Phytoplankton Taxa in the Vicinity of SPS

Common Name	Scientific Name
Phytoplankton	
Cryptomonad	*Chroomonas sp.*
Diatom	*Coscinodiscus lacustris*
Diatom	*Melosira subsalsa*
Diatom	*Nitzschia kutzingiana*
Diatom	*Skeletonema spp.*
Dinoflagellate	*Katodinium rotundatum*
Zooplankton	
Cladocerans	*Order: Cladocera*
Copopod	*Acartia spp.*
Copopod	*Eurytemora spp.*
Rotifer	*Phylum: Rotifera*

(Jorden et al. 1976)

Table E3.7-2 Common James River Fish Species in the Vicinity of the SPS

Common Name	Scientific Name
Hogchoker[a]	*Trinectes maculatus*
Summer flounder[b]	*Paralichthys dentatus*
Alewife[(b)]	*Alosa pseudoharengus*
Atlantic croaker[(a)]	*Micropogonias undulatus*
Atlantic menhaden[(a)]	*Brevoortia tyrannus*
Atlantic needlefish[(a)]	*Strongylura marina*
Bay anchovy[(a)]	*Anchoa mitchilli*
Blackcheek tonguefish[(b)]	*Symphurus plagiusa*
Blueback herring[(b)]	*Alosa aestivalis*
Blueback herring[(a)]	*Alosa aestivalis*
Bluespotted sunfish[(a)]	*Enneacanthus gloriosus*
Channel catfish[(a)]	*Ictalurus punctatus*
Feather blenny[(b)]	*Hypsoblennius hentz*
Gizzard shad[(b)]	*Dorosoma cepedianum*
Hickory shad[(b)]	*Alosa mediocris*
Inland silverside[(a)]	*Menidia beryllina*
Naked goby[(b)]	*Gobiosoma bosci*
Northern pipefish[(b)]	*Syngnathus fuscus*
Rough silverside[(b)]	*Membras martinica*

Table E3.7-2 Common James River Fish Species in the Vicinity of the SPS

Common Name	Scientific Name
Silver perch[b]	*Bairdiella chrysoura*
Skilletfish[b]	*Gobiesox strumosus*
Spot[a]	*Leiostomus xanthurus*
Spottail shiner[a]	*Notropis hudsonius*
Weakfish[b]	*Cynoscion regalis*
White mullet[b]	*Mugil curema*
White perch[a]	*Morone americana*
Recreational Sport Fish	
American shad[c]	*Alosa sapidissima*
Black crappie[c]	*Pomoxis nigromaculatus*
Blue catfish[c]	*Ictalurus furcatus*
Channel catfish[c]	*Ictalurus punctatus*
Large mouthed bass[c]	*Micropterus salmoides*
Striped bass[c]	*Morone saxatilis*

a. (NRC. 2006, Section 8.5)
b. (CH2MHill. 2006)
c. (VDGIF. 2016b)

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Amphibians				
American bullfrog	*Lithobates catesbeianus*	Yes	BOVA, SppObs	
Atlantic coast leopard frog	*Lithobates kauffeldi*		BOVA	
Atlantic coast slimy salamander	*Plethodon chlorobryonis*	Yes	BOVA, SppObs	
Barking treefrog	*Hyla gratiosa*	Yes	BOVA, SppObs	IIa
Brimley's chorus frog	*Pseudacris brimleyi*		BOVA	
Cope's gray treefrog	*Hyla chrysoscelis*	Yes	BOVA, SppObs	
Eastern American toad	*Anaxyrus americanus americanus*	Yes	BOVA, SppObs	
Eastern cricket frog	*Acris crepitans*	Yes	BOVA, SppObs	
Eastern lesser siren	*Siren intermedia intermedia*		BOVA	IIIa
Eastern mud salamander	*Pseudotriton montanus montanus*	Yes	BOVA, SppObs	IVa
Eastern narrow-mouthed toad	*Gastrophryne carolinensis*	Yes	BOVA, SppObs	
Eastern red-backed salamander	*Plethodon cinereus*	Yes	BOVA, SppObs	
Eastern tiger salamander	*Ambystoma tigrinum*		BOVA	IIa
Eastern spadefoot	*Scaphiopus holbrookii*	Yes	BOVA, SppObs	IVc
Four-toed Salamander	*Hemidactylium scutatum*		BOVA	
Fowler's toad	*Anaxyrus fowleri*	Yes	BOVA, SppObs	
Greater siren	*Siren lacertina*		BOVA	IVa
Green frog	*Lithobates clamitans*	Yes	BOVA, SppObs	
Green treefrog	*Hyla cinerea*	Yes	BOVA, SppObs	
Little grass frog	*Pseudacris ocularis*		BOVA	IVa
Mabee's salamander	*Ambystoma mabeei*	Yes	BOVA, Habitat, SppObs	IIa
Many-lined salamander	*Stereochilus marginatus*		BOVA	IVa
Marbled salamander	*Ambystoma opacum*	Yes	BOVA, SppObs	
Northern dusky salamander	*Desmognathus fuscus*	Yes	BOVA, SppObs	
Northern red salamander	*Pseudotriton ruber ruber*	Yes	BOVA, SppObs	
Oak toad	*Anaxyrus quercicus*	Potential	BOVA, Habitat	IIa
Pickerel frog	*Lithobates palustris*	Yes	BOVA, SppObs	
Pine woods treefrog	*Hyla femoralis*		BOVA	
Red-spotted newt	*Notophthalmus viridescens viridescens*	Yes	BOVA, SppObs	
Southern chorus frog	*Pseudacris nigrita*		BOVA	IVc

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Southern cricket frog	*Acris gryllus*	Yes	BOVA, SppObs	
Southern dusky salamander	*Desmognathus auriculatus*	Yes	BOVA, SppObs	
Southern leopard frog	*Lithobates sphenocephalus utricularius*	Yes	BOVA, SppObs	
Southern two-lined salamander	*Eurycea cirrigera*	Yes	BOVA, SppObs	
Southern toad	*Anaxyrus terrestris*		BOVA	
Spotted salamander	*Ambystoma maculatum*	Yes	BOVA, SppObs	
Spring peeper	*Pseudacris crucifer*	Yes	BOVA, SppObs	
Squirrel treefrog	*Hyla squirella*	Yes	BOVA, SppObs	
Three-lined salamander	*Eurycea guttolineata*	Yes	BOVA, SppObs	
Two-toed amphiuma	*Amphiuma means*	Yes	BOVA, SppObs	
Upland chorus frog	*Pseudacris feriarum*	Yes	BOVA, SppObs	
White-spotted slimy salamander	*Plethodon cylindraceus*		BOVA	
Birds				
Acadian flycatcher	*Empidonax virescens*		BOVA	
American black duck	*Anas rubripes*		BOVA	IIa
American tree sparrow	*Spizella arborea*		BOVA	
American bittern	*Botaurus lentiginosus*		BOVA	
American coot	*Fulica americana*		BOVA	
American crow	*Corvus brachyrhynchos*		BOVA	
American goldfinch	*Spinus tristis*		BOVA	
American kestrel	*Falco sparverius sparverius*		BOVA	
American oystercatcher	*Haematopus palliatus*		BOVA	IIa
American pipit	*Anthus rubescens*		BOVA	
American redstart	*Setophaga ruticilla*		BOVA	
American robin	*Turdus migratorius*		BOVA	
American wigeon	*Anas americana*		BOVA	
American woodcock	*Scolopax minor*		BOVA	IIa
Bald eagle	*Haliaeetus leucocephalus*	Yes	BOVA, BECAR, SppObs, BAEANests	
Baltimore oriole	*Icterus galbula*		BOVA	
Bank swallow	*Riparia riparia*		BOVA	IIIc
Barn owl	*Tyto alba pratincola*		BOVA	IIIa
Barn swallow	*Hirundo rustica*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Barred owl	*Strix varia*		BOVA	
Belted kingfisher	*Ceryle alcyon*		BOVA	IIIb
Black rail	*Laterallus jamaicensis*	Potential	BOVA, Habitat	Ia
Black scoter	*Melanitta nigra americana*		BOVA	
Black skimmer	*Rynchops niger*		BOVA	IIa
Black vulture	*Coragyps atratus*	Yes	BOVA, SppObs	
Black-and-white warbler	*Mniotilta varia*		BOVA	IVa
Black-billed cuckoo	*Coccyzus erythropthalmus*		BOVA	IIb
Black-crowned night-heron	*Nycticorax nycticorax hoactii*		BOVA	IIIa
Black-legged kittiwake	*Rissa tridactyla*		BOVA	
Blackpoll warbler	*Setophaga striata*		BOVA	
Black-throated blue warbler	*Setophaga caerulescens*		BOVA	
Black-throated gray warbler	*Setophaga nigrescens*		BOVA	
Black-throated green warbler	*Setophaga virens*		BOVA	
Blue grosbeak	*Guiraca caerulea caerulea*		BOVA	
Blue jay	*Cyanocitta cristata*		BOVA	
Blue-gray gnatcatcher	*Polioptila caerulea*		BOVA	
Blue-headed vireo	*Vireo solitarius*		BOVA	
Blue-winged teal	*Anas discors orphna*		BOVA	
Blue-winged warbler	*Vermivora cyanoptera*		BOVA	
Boat-tailed grackle	*Quiscalus major*		BOVA	
Bobolink	*Dolichonyx oryzivorus*	Yes	BOVA, SppObs	
Brant	*Branta bernicla brota*		BOVA	IIIa
Broad-winged hawk	*Buteo platypterus*		BOVA	
Brown creeper	*Certhia americana*		BOVA	
Brown pelican	*Pelecanus occidentalis carolinensis*		BOVA	
Brown thrasher	*Toxostoma rufum*		BOVA	IVa
Brown-headed cowbird	*Molothrus ater*		BOVA	
Brown-headed nuthatch	*Sitta pusilla*		BOVA	
Bufflehead	*Bucephala albeola*		BOVA	
Canada goose	*Branta canadensis*	Yes	BOVA, SppObs	
Canada warbler	*Cardellina canadensis*		BOVA	IVb
Canvasback	*Aythya valisineria*		BOVA	
Carolina chickadee	*Poecile carolinensis*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Carolina wren	*Thryothorus ludovicianus*		BOVA	
Caspian tern	*Sterna caspia*		BOVA	
Cattle egret	*Bubulcus ibis*		BOVA	
Cedar waxwing	*Bombycilla cedrorum*		BOVA	
Cerulean warbler	*Setophaga cerulea*		BOVA	IIa
Chestnut-sided warbler	*Setophaga pensylvanica*		BOVA	
Chimney swift	*Chaetura pelagica*		BOVA	IVb
Chipping sparrow	*Spizella passerina*		BOVA	
Chuck-will's-widow	*Antrostomus carolinensis*		BOVA	
Clapper rail	*Rallus crepitans*		BOVA	IVa
Clay-colored sparrow	*Spizella pallida*		BOVA	
Common goldeneye	*Bucephala clangula americana*		BOVA	
Common grackle	*Quiscalus quiscula*		BOVA	
Common loon	*Gavia immer*		BOVA	
Common merganser	*Mergus merganser americanus*		BOVA	
Common moorhen	*Gallinula chloropus cachinnans*	Yes	BOVA, SppObs	
Common nighthawk	*Chordeiles minor*		BOVA	
Common tern	*Sterna hirundo*		BOVA	IIa
Common yellowthroat	*Geothlypis trichas*		BOVA	
Connecticut warbler	*Oporornis agilis*		BOVA	
Cooper's hawk	*Accipiter cooperii*		BOVA	
Dark-eyed junco	*Junco hyemalis*		BOVA	
Dickcissel	*Spiza americana*		BOVA	
Double-crested cormorant	*Phalacrocorax auritus*		BOVA	
Downy woodpecker	*Picoides pubescens medianus*		BOVA	
Eastern wood pewee	*Contopus virens*		BOVA	IVb
Eastern bluebird	*Sialia sialis*	Yes	BOVA, SppObs	
Eastern kingbird	*Tyrannus tyrannus*		BOVA	IVa
Eastern meadowlark	*Sturnella magna*		BOVA	IVa
Eastern phoebe	*Sayornis phoebe*		BOVA	
Eastern screech-owl	*Megascops asio*		BOVA	
Eastern towhee	*Pipilo erythrophthalmus*		BOVA	IVa
Eastern whip-poor-will	*Antrostomus vociferus*		BOVA	IIIa
Eurasian wigeon	*Anas penelope*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
European starling	Sturnus vulgaris	Yes	BOVA, SppObs	
Evening grosbeak	Coccothraustes vespertinus		BOVA	
Field sparrow	Spizella pusilla		BOVA	IVa
Fish crow	Corvus ossifragus		BOVA	
Forster's tern	Sterna forsteri		BOVA	IIIa
Fox sparrow	Passerella iliaca		BOVA	
Fulvous whistling duck	Dendrocygna bicolor		BOVA	
Gadwall	Anas strepera		BOVA	
Glossy ibis	Plegadis falcinellus		BOVA	Ia
Golden-crowned kinglet	Regulus satrapa		BOVA	
Golden-winged warbler	Vermivora chrysoptera		BOVA	Ia
Grasshopper sparrow	Ammodramus savannarum pratensis		BOVA	IVa
Gray catbird	Dumetella carolinensis		BOVA	IVa
Gray-cheeked thrush	Catharus minimus		BOVA	
Great black-backed gull	Larus marinus		BOVA	
Great blue heron	Ardea herodias herodias	Yes	BOVA, SppObs, CWB	
Great crested flycatcher	Myiarchus crinitus		BOVA	
Great horned owl	Bubo virginianus		BOVA	
Great cormorant	Phalacrocorax carbo		BOVA	
Great egret	Ardea alba egretta	Yes	BOVA, SppObs, CWB	
Green heron	Butorides virescens		BOVA	IVb
Green-tailed towhee	Pipilo chlorurus		BOVA	
Green-winged teal	Anas crecca carolinensis		BOVA	
Hairy woodpecker	Picoides villosus		BOVA	
Henslow's sparrow	Ammodramus henslowii	Potential	Habitat	Ia
Hermit thrush	Catharus guttatus		BOVA	
Hooded merganser	Lophodytes cucullatus		BOVA	
Hooded warbler	Setophaga citrina		BOVA	
Horned grebe	Podiceps auritus		BOVA	
Horned lark	Eremophila alpestris		BOVA	
House finch	Haemorhous mexicanus	Yes	BOVA, SppObs	
House sparrow	Passer domesticus		BOVA	
House wren	Troglodytes aedon		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Indigo bunting	*Passerina cyanea*		BOVA	
Kentucky warbler	*Geothlypis formosa*		BOVA	IIIa
Killdeer	*Charadrius vociferus*		BOVA	
King rail	*Rallus elegans*		BOVA	IIb
Laughing gull	*Leucophaeus atricilla*		BOVA	IVa
Lazuli bunting	*Passerina amoena*		BOVA	
Least bittern	*Ixobrychus exilis exilis*		BOVA	IIIa
Least sandpiper	*Calidris minutilla*		BOVA	
Least tern	*Sterna antillarum*		BOVA	IIIa
Lesser snow goose	*Chen caerulescens caerulescens*		BOVA	
Lesser scaup	*Aythya affinis*		BOVA	
Lesser yellowlegs	*Tringa flavipes*		BOVA	
Lincoln's sparrow	*Melospiza lincolnii*		BOVA	
Little blue heron	*Egretta caerulea caerulea*		BOVA	IIa
Loggerhead shrike	*Lanius ludovicianus*		BOVA	Ia
Long-billed dowitcher	*Limnodromus scolopaceus*		BOVA	
Long-tailed duck	*Clangula hyemalis*		BOVA	
Louisiana waterthrush	*Parkesia motacilla*		BOVA	
Magnolia warbler	*Setophaga magnolia*		BOVA	
Mallard	*Anas platyrhynchos*		BOVA	
Marbled godwit	*Limosa fedoa*		BOVA	IVa
Marsh wren	*Cistothorus palustris*		BOVA	IVa
Merlin	*Falco columbarius*		BOVA	
Migrant loggerhead shrike	*Lanius ludovicianus migrans*		BOVA	
Mourning dove	*Zenaida macroura carolinensis*	Yes	BOVA, SppObs	
Mourning warbler	*Geothlypis philadelphia*		BOVA	
Nashville warbler	*Oreothlypis ruficapilla*		BOVA	
Nelson's sparrow	*Ammodramus nelsoni*		BOVA	IIIa
Northern rough-winged swallow	*Stelgidopteryx serripennis*		BOVA	IVc
Northern bobwhite	*Colinus virginianus*		BOVA	IIIa
Northern cardinal	*Cardinalis cardinalis*		BOVA	
Northern flicker	*Colaptes auratus*		BOVA	IVb
Northern harrier	*Circus cyaneus*	Yes	BOVA, SppObs	IIIa
Northern mockingbird	*Mimus polyglottos*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Northern parula	*Setophaga americana*		BOVA	
Northern pintail	*Anas acuta acuta*		BOVA	IVa
Northern shoveler	*Anas clypeata*		BOVA	
Northern waterthrush	*Parkesia noveboracensis*		BOVA	
Orange-crowned warbler	*Oreothlypis celata*		BOVA	
Orchard oriole	*Icterus spurius*		BOVA	
Osprey	*Pandion haliaetus carolinensis*	Yes	BOVA, SppObs	
Ovenbird	*Seiurus aurocapilla*		BOVA	
Painted bunting	*Passerina ciris ciris*		BOVA	
Palm warbler	*Setophaga palmarum*		BOVA	
Parasitic jaeger	*Stercorarius parasiticus*		BOVA	
Peregrine falcon	*Falco peregrinus*	Yes	BOVA, SppObs	Ia
Philadelphia vireo	*Vireo philadelphicus*		BOVA	
Pied-billed grebe	*Podilymbus podiceps*		BOVA	
Pileated woodpecker	*Dryocopus pileatus*		BOVA	
Pine siskin	*Spinus pinus*		BOVA	
Pine warbler	*Setophaga pinus*		BOVA	
Piping plover	*Charadrius melodus*		BOVA	IIa
Pomarine jaeger	*Stercorarius pomarinus*		BOVA	
Prairie warbler	*Setophaga discolor*		BOVA	
Prothonotary warbler	*Protonotaria citrea*		BOVA	
Purple finch	*Haemorhous purpureus*		BOVA	
Purple martin	*Progne subis*		BOVA	
Purple sandpiper	*Calidris maritima*		BOVA	IVc
Red knot	*Calidris canutus rufa*		BOVA	Ia
Red-bellied woodpecker	*Melanerpes carolinus*		BOVA	
Red-breasted merganser	*Mergus serrator serrator*		BOVA	
Red-breasted nuthatch	*Sitta canadensis*		BOVA	
Red-cockaded woodpecker	*Picoides borealis*		BOVA	Ia
Red-eyed vireo	*Vireo olivaceus*		BOVA	
Redhead	*Aythya americana*		BOVA	
Red-headed woodpecker	*Melanerpes erythrocephalus*		BOVA	
Red-necked grebe	*Podiceps grisegena*		BOVA	
Red-shouldered hawk	*Buteo lineatus lineatus*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Red-tailed hawk	*Buteo jamaicensis*		BOVA	
Red-throated loon	*Gavia stellata*		BOVA	IVa
Red-winged blackbird	*Agelaius phoeniceus*	Yes	BOVA, SppObs	
Ring-billed gull	*Larus delawarensis*	Yes	BOVA, SppObs	
Ring-necked duck	*Aythya collaris*		BOVA	
Ring-necked pheasant	*Phasianus colchicus*		BOVA	
Rock pigeon	*Columba livia*		BOVA	
Roseate tern	*Sterna dougallii dougallii*		BOVA	
Rose-breasted grosbeak	*Pheucticus ludovicianus*		BOVA	
Rough-legged hawk	*Buteo lagopus johannis*		BOVA	
Royal tern	*Sterna maxima maximus*		BOVA	IVa
Ruby-crowned kinglet	*Regulus calendula*		BOVA	
Ruby-throated hummingbird	*Archilochus colubris*		BOVA	
Ruddy duck	*Oxyura jamaicensis*		BOVA	
Ruddy turnstone	*Arenaria interpres morinella*		BOVA	
Rufous hummingbird	*Selasphorus rufus*		BOVA	
Rusty blackbird	*Euphagus carolinus*	Yes	BOVA, SppObs	IVb
Saltmarsh sparrow	*Ammodramus caudacutus*		BOVA	IIIa
Sanderling	*Calidris alba*		BOVA	IVa
Sandwich tern	*Sterna sandvicensis acuflavidus*		BOVA	
Savannah sparrow	*Passerculus sandwichensis*		BOVA	
Scarlet tanager	*Piranga olivacea*		BOVA	
Seaside sparrow	*Ammodramus maritimus*		BOVA	IVa
Sedge wren	*Cistothorus platensis*		BOVA	
Sharp-shinned hawk	*Accipiter striatus velox*		BOVA	
Short-billed dowitcher	*Limnodromus griseus*		BOVA	IVa
Short-eared owl	*Asio flammeus*		BOVA	
Snow bunting	*Plectrophenax nivalis nivalis*		BOVA	
Snow goose	*Chen caerulescens*		BOVA	
Snowy egret	*Egretta thula*		BOVA	IIa
Solitary sandpiper	*Tringa solitaria*		BOVA	
Song sparrow	*Melospiza melodia*		BOVA	
Sora	*Porzana carolina*		BOVA	
Spotted sandpiper	*Actitis macularia*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Stilt sandpiper	*Calidris himantopus*		BOVA	
Summer tanager	*Piranga rubra*	Yes	BOVA, SppObs	
Surf scoter	*Melanitta perspicillata*		BOVA	
Swainson's thrush	*Catharus ustulatus*		BOVA	
Swainson's warbler	*Limnothlypis swainsonii*		BOVA	IIc
Swamp sparrow	*Melospiza georgiana*		BOVA	
Tennessee warbler	*Oreothlypis peregrina*		BOVA	
Tree swallow	*Tachycineta bicolor*		BOVA	
Tricolored heron	*Egretta tricolor*		BOVA	
Tufted titmouse	*Baeolophus bicolor*		BOVA	
Tundra swan	*Cygnus columbianus columbianus*		BOVA	
Turkey vulture	*Cathartes aura*		BOVA	
Upland sandpiper	*Bartramia longicauda*		BOVA	
Veery	*Catharus fuscescens*		BOVA	
Vesper sparrow	*Pooecetes gramineus*		BOVA	
Virginia rail	*Rallus limicola*		BOVA	IVa
Warbling vireo	*Vireo gilvus gilvus*		BOVA	
Western sandpiper	*Calidris mauri*		BOVA	
Western tanager	*Piranga ludoviciana*		BOVA	
White ibis	*Eudocimus albus*		BOVA	
White-breasted nuthatch	*Sitta carolinensis*		BOVA	
White-crowned sparrow	*Zonotrichia leucophrys*		BOVA	
White-eyed vireo	*Vireo griseus*		BOVA	
White-throated sparrow	*Zonotrichia albicollis*		BOVA	
White-winged crossbill	*Loxia leucoptera*		BOVA	
White-winged scoter	*Melanitta fusca deglandi*		BOVA	
Wild turkey	*Meleagris gallopavo silvestris*	Yes	BOVA, SppObs	
Willet	*Catoptrophorus semipalmatus semipalmatus*		BOVA	IIIa
Wilson's phalarope	*Phalaropus tricolor*		BOVA	
Wilson's snipe	*Gallinago delicata*		BOVA	
Wilson's warbler	*Cardellina pusilla*		BOVA	
Winter wren	*Troglodytes troglodytes*		BOVA	
Wood duck	*Aix sponsa*		BOVA	
Wood stork	*Mycteria americana*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Wood thrush	*Hylocichla mustelina*	Yes	BOVA, SppObs	IVb
Worm-eating warbler	*Helmitheros vermivorus*		BOVA	
Yellow warbler	*Setophaga petechia*		BOVA	
Yellow-bellied sapsucker	*Sphyrapicus varius*		BOVA	
Yellow-billed cuckoo	*Coccyzus americanus*		BOVA	IIIa
Yellow-breasted chat	*Icteria virens virens*		BOVA	IVa
Yellow-crowned night-heron	*Nyctanassa violacea violacea*		BOVA	IIa
Yellow-rumped warbler	*Setophaga coronata*		BOVA	
Yellow-throated vireo	*Vireo flavifrons*		BOVA	
Yellow-throated warbler	*Setophaga dominica*		BOVA	
Insects				
Aaron's skipper butterfly	*Poanes aaroni*		BOVA	
American lady butterfly	*Vanessa virginiensis*	Yes	BOVA, SppObs	
American snout butterfly	*Libytheana carinenta*		BOVA	
Appalachian brown butterfly	*Satyrodes appalachia*	Yes	SppObs	
Banded hairstreak butterfly	*Satyrium calanus*		BOVA	
Black dash butterfly	*Euphyes conspicua*		BOVA	IVc
Black swallowtail butterfly	*Papilio polyxenes asterius*		BOVA	
Brazilian skipper butterfly	*Calpodes ethlius*		BOVA	
Broad-winged skipper butterfly	*Poanes viator*	Yes	BOVA, SppObs	
Cabbage white butterfly	*Pieris rapae*	Yes	BOVA, SppObs	
Carolina road-skipper butterfly	*Amblyscirtes carolina*		BOVA	
Carolina satyr butterfly	*Hermeuptychia sosybius*	Yes	BOVA, SppObs	
Carus skipper butterfly	*Polites carus*		BOVA	
Checkered white butterfly	*Pontia protodice*		BOVA	
Clouded skipper butterfly	*Lerema accius*	Yes	BOVA, SppObs	
Clouded sulphur butterfly	*Colias philodice*		BOVA	
Cloudless sulphur butterfly	*Phoebis sennae eubule*		BOVA	
Codling moth	*Cydia pomonella*		BOVA	
Common buckeye butterfly	*Junonia coenia*	Yes	BOVA, SppObs	
Common checkered-skipper butterfly	*Pyrgus communis*		BOVA	
Common sootywing butterfly	*Pholisora catullus*		BOVA	
Common wood-nymph butterfly	*Cercyonis pegala*	Yes	BOVA, SppObs	
Confused cloudywing butterfly	*Thorybes confusis*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Creole pearly-eye butterfly	*Enodia creola*		BOVA	
Crossline skipper butterfly	*Polites origenes*		BOVA	
Delaware skipper butterfly	*Anatrytone logan*		BOVA	
Diana fritillary	*Speyeria diana*		BOVA	IVc
Duke's (or scarce swamp) skipper	*Euphyes dukesi*		BOVA	IIIc
Dun skipper butterfly	*Euphyes vestris*	Yes	BOVA, SppObs	
Eastern comma butterfly	*Polygonia comma*	Yes	BOVA, SppObs	
Eastern tailed-blue butterfly	*Everes comyntas*	Yes	BOVA, SppObs	
Eastern tiger swallowtail butterfly	*Papilio glaucus*	Yes	BOVA, SppObs	
Fiery skipper butterfly	*Hylephila phyleus*	Yes	BOVA, SppObs	
Gemmed satyr butterfly	*Cyllopsis gemma*	Yes	BOVA, SppObs	
Gray hairstreak butterfly	*Strymon melinus*	Yes	BOVA, SppObs	
Great spangled fritillary butterfly	*Speyeria cybele*		BOVA	
Gypsy moth	*Lymantria dispar*		BOVA	
Hackberry emperor butterfly	*Asterocampa celtis*	Yes	BOVA, SppObs	
Hayhurst's scallopwing butterfly	*Staphylus hayhurstii*		BOVA	
Hobomok skipper butterfly	*Poanes hobomok*		BOVA	
Horace's duskywing butterfly	*Erynnis horatius*	Yes	BOVA, SppObs	
Hydrangea sphinx moth	*Darapsa versicolor*		BOVA	
Juvenal's duskywing butterfly	*Erynnis juvenalis*		BOVA	
Least skipper butterfly	*Ancyloxypha numitor*	Yes	BOVA, SppObs	
Little glassywing butterfly	*Pompeius verna*	Yes	SppObs	
Little wood-satyr butterfly	*Megisto cymela*	Yes	BOVA, SppObs	
Long-tailed skipper butterfly	*Urbanus proteus*		BOVA	
Monarch butterfly	*Danaus plexippus*	Yes	BOVA, SppObs	IIIa
Mourning cloak butterfly	*Nymphalis antiopa*	Yes	BOVA, SppObs	
Ocola skipper butterfly	*Panoquina ocola*		BOVA	
Olive juniper hairstreak butterfly	*Callophrys gryneus gryneus*		BOVA	
Orange sulphur butterfly	*Colias eurytheme*	Yes	BOVA, SppObs	
Orange-barred sulphur butterfly	*Phoebis philea*		BOVA	
Painted lady butterfly	*Vanessa cardui*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Palamedes swallowtail butterfly	*Papilio palamedes*	Yes	BOVA, SppObs	
Palatka skipper butterfly	*Euphyes pilatka*		BOVA	IIIc
Pearl crescent butterfly	*Phyciodes tharos*	Yes	BOVA, SppObs	
Peck's skipper butterfly	*Polites peckius*		BOVA	
Pinkstriped oakworm moth	*Anisota virginiensis*		BOVA	
Question mark butterfly	*Polygonia interrogationis*	Yes	BOVA, SppObs	
Red admiral butterfly	*Vanessa atalanta*	Yes	BOVA, SppObs	
Red-banded hairstreak butterfly	*Calycopis cecrops*	Yes	SppObs	
Red-spotted purple butterfly	*Limenitis arthemis astyanax*	Yes	BOVA, SppObs	
Reversed road-skipper butterfly	*Amblyscirtes reversa*		BOVA	
Sachem butterfly	*Atalopedes campestris*	Yes	BOVA, SppObs	
Salt marsh skipper butterfly	*Panoquina panoquin*	Yes	BOVA, SppObs	
Silver-spotted skipper butterfly	*Epargyreus clarus*	Yes	BOVA, SppObs	
Sleepy duskywing butterfly	*Erynnis brizo*		BOVA	
Sleepy orange butterfly	*Eurema nicippe*	Yes	BOVA, SppObs	
Southern broken dash butterfly	*Wallengrenia otho*	Yes	SppObs	
Southern cloudywing butterfly	*Thorybes bathyllus*		BOVA	
Southern pearly-eye butterfly	*Enodia portlandia*		BOVA	
Southern pine sphinx moth	*Lapara coniferarum*		BOVA	
Spicebush swallowtail butterfly	*Papilio troilus*	Yes	BOVA, SppObs	
Spring azure butterfly	*Celastrina ladon*	Yes	BOVA, SppObs	
Swarthy skipper butterfly	*Nastra lherminier*	Yes	SppObs	
Sweetbay silk moth	*Callosamia securifera*		BOVA	
Tawny emperor butterfly	*Asterocampa clyton*		BOVA	
Tawny-edged skipper butterfly	*Polites themistocles*		BOVA	
Tersa sphinx moth	*Xylophanes tersa*		BOVA	
Twin-spot skipper	*Oligoria maculata*		BOVA	
Variegated fritillary butterfly	*Euptoieta claudia*		BOVA	
Viceroy butterfly	*Limenitis archippus*		BOVA	
Virginia-creeper sphinx moth	*Darapsa myron*		BOVA	
Wild indigo duskywing butterfly	*Erynnis baptisiae*		BOVA	
Yehl skipper butterfly	*Poanes yehl*		BOVA	
Zabulon skipper butterfly	*Poanes zabulon*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Zarucco duskywing butterfly	*Erynnis zarucco*		BOVA	
Zebra swallowtail butterfly	*Eurytides marcellus*	Yes	BOVA, SppObs	
Mammals				
Big brown bat	*Eptesicus fuscus fuscus*	Yes	BOVA, SppObs	
Black bear	*Ursus americanus americanus*		BOVA	
Bobcat	*Lynx rufus rufus*		BOVA	
Common gray fox	*Urocyon cinereoargenteus cinereoargenteus*	Yes	BOVA, SppObs	
Common pine vole	*Microtus pinetorum pinetorum*	Yes	BOVA, SppObs	
Common white-footed mouse	*Peromyscus leucopus leucopus*	Yes	BOVA, SppObs	
Common mink	*Mustela vison mink*		BOVA	
Common muskrat	*Ondatra zibethicus zibethicus*	Yes	BOVA, SppObs	
Cotton mouse	*Peromyscus gossypinus gossypinus*		BOVA	IVa
Coyote	*Canis latrans*		BOVA	
Dark meadow vole	*Microtus pennsylvanicus nigrans*	Yes	BOVA, SppObs	
Eastern gray squirrel	*Sciurus carolinensis carolinensis*	Yes	BOVA, SppObs	
Eastern harvest mouse	*Reithrodontomys humulis humulis*		BOVA	
Eastern harvest mouse	*Reithrodontomys humulis virginianus*		BOVA	
Eastern red bat	*Lasiurus borealis borealis*	Yes	BOVA, SppObs	IVa
Eastern cottontail	*Sylvilagus floridanus mallurus*	Yes	BOVA, SppObs	
Eastern mole	*Scalopus aquaticus aquaticus*		BOVA	
Evening bat	*Nycticeius humeralis humeralis*	Yes	BOVA, SppObs	
Fisher's eastern chipmunk	*Tamias striatus fisheri*		BOVA	
Hispid cotton rat	*Sigmodon hispidus virginianus*		BOVA	
Hoary bat	*Lasiurus cinereus cinereus*		BOVA	IVa
House mouse	*Mus musculus musculus*	Yes	BOVA, SppObs	
Kirtland's short-tailed shrew	*Blarina brevicauda kirtlandi*	Yes	BOVA, SppObs	
Large-toothed muskrat	*Ondatra zibethicus macrodon*		BOVA	
Least shrew	*Cryptotis parva parva*	Yes	BOVA, SppObs	
Lewis' golden mouse	*Ochrotomys nuttalli nuttalli*	Yes	BOVA, SppObs	
Little brown bat	*Myotis lucifugus lucifugus*	Yes	BOVA, SppObs	Ia
Long-tailed weasel	*Mustela frenata noveboracensis*		BOVA	
Marsh rice rat	*Oryzomys palustris palustris*	Yes	BOVA, SppObs	
Marsh rabbit	*Sylvilagus palustris palustris*		BOVA	IVa

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Meadow jumping mouse	*Zapus hudsonius americanus*		BOVA	
Meadow vole	*Microtus pennsylvanicus pennsylvanicus*	Yes	BOVA, SppObs	
Northern long-eared bat	*Myotis septentrionalis*	Yes	BOVA, SppObs	Ia
Northern river otter	*Lontra canadensis lataxina*		BOVA	
Northern short-tailed shrew	*Blarina brevicauda churchi*	Yes	BOVA, SppObs	
Norway rat	*Rattus norvegicus norvegicus*		BOVA	
Pine vole	*Microtus pinetorum scalopsoides*	Yes	BOVA, SppObs	
Pygmy shrew	*Sorex hoyi winnemana*		BOVA	
Raccoon	*Procyon lotor lotor*	Yes	BOVA, SppObs	
Rafinesque's eastern big-eared bat	*Corynorhinus rafinesquii macrotis*		BOVA	Ia
Red fox	*Vulpes vulpes fulva*	Yes	BOVA, SppObs	
Seminole bat	*Lasiurus seminolus*		BOVA	
Silver-haired bat	*Lasionycteris noctivagans*		BOVA	IVa
Southeastern fox squirrel	*Sciurus niger niger*		BOVA	IIIa
Southeastern myotis	*Myotis austroriparius*		BOVA	IVa
Southeastern shrew	*Sorex longirostris longirostris*	Yes	BOVA, SppObs	
Southern bog lemming	*Synaptomys cooperi helaletes*		BOVA	
Southern flying squirrel	*Glaucomys volans volans*	Yes	BOVA, SppObs	
Southern short-tailed shrew	*Blarina carolinensis carolinensis*	Yes	BOVA, SppObs	
Star-nosed mole	*Condylura cristata parva*		BOVA	
Striped skunk	*Mephitis mephitis nigra*	Yes	BOVA, SppObs	
Striped skunk	*Mephitis mephitis mephitis*		BOVA	
Tri-colored bat	*Perimyotis subflavus*		BOVA	Ia
Virginia opossum	*Didelphis virginiana virginiana*	Yes	BOVA, SppObs	
White-tailed deer	*Odocoileus virginianus*	Yes	BOVA, SppObs	
Woodchuck	*Marmota monax monax*	Yes	BOVA, SppObs	
Reptiles				
Broad-headed skink	*Plestiodon laticeps*	Yes	BOVA, SppObs	
Brown watersnake	*Nerodia taxispilota*	Yes	BOVA, SppObs	
Canebrake rattlesnake	*Crotalus horridus*	Potential	BOVA, Habitat	IIa
Coastal plain cooter	*Pseudemys concinna floridana*		BOVA	
Common five-lined skink	*Plestiodon fasciatus*	Yes	BOVA, SppObs	
Common rainbow snake	*Farancia erytrogramma erytrogramma*	Yes	BOVA, SppObs	IVa

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Common ribbonsnake	*Thamnophis sauritus sauritus*	Yes	BOVA, SppObs	IVa
Eastern chicken turtle	*Deirochelys reticularia reticularia*		BOVA	Ia
Eastern fence lizard	*Sceloporus undulatus*	Yes	BOVA, SppObs	
Eastern hog-nosed snake	*Heterodon platirhinos*	Yes	BOVA, SppObs	IVc
Eastern musk turtle	*Sternotherus odoratus*	Yes	BOVA, SppObs	
Eastern painted turtle	*Chrysemys picta picta*	Yes	BOVA, SppObs	
Eastern river cooter	*Pseudemys concinna concinna*		BOVA	
Eastern six-lined racerunner	*Aspidoscelis sexlineata sexlineata*	Yes	BOVA, SppObs	
Eastern slender glass lizard	*Ophisaurus attenuatus longicaudus*		BOVA	IVa
Eastern smooth earthsnake	*Virginia valeriae valeriae*	Yes	BOVA, SppObs	
Eastern cottonmouth	*Agkistrodon piscivorus piscivorus*		BOVA	
Eastern gartersnake	*Thamnophis sirtalis sirtalis*	Yes	BOVA, SppObs	
Eastern kingsnake	*Lampropeltis getula*	Yes	BOVA, SppObs	
Eastern milksnake	*Lampropeltis triangulum*		BOVA	
Eastern mudsnake	*Farancia abacura abacura*		BOVA	IVa
Eastern ratsnake	*Pantherophis alleghaniensis*	Yes	BOVA, SppObs	
Eastern wormsnake	*Carphophis amoenus amoenus*	Yes	BOVA, SppObs	
Glossy crayfish snake	*Regina rigida rigida*		BOVA	IIIc
Little brown skink	*Scincella lateralis*	Yes	BOVA, SppObs	
Mediterranean gecko	*Hemidactylus turcicus*		BOVA	
Mole kingsnake	*Lampropeltis calligaster rhombomaculata*	Yes	BOVA, SppObs	
Northern black racer	*Coluber constrictor constrictor*	Yes	BOVA, SppObs	
Northern diamond-backed terrapin	*Malaclemys terrapin terrapin*	Yes	BOVA, Habitat, SppObs	IIa
Northern red-bellied cooter	*Pseudemys rubriventris*	Yes	BOVA, SppObs	
Northern red-bellied snake	*Storeria occipitomaculata occipitomaculata*		BOVA	
Northern ring-necked snake	*Diadophis punctatus edwardsii*	Yes	BOVA, SppObs	
Northern rough greensnake	*Opheodrys aestivus aestivus*	Yes	BOVA, SppObs	
Northern brownsnake	*Storeria dekayi dekayi*	Yes	BOVA, SppObs	
Northern copperhead	*Agkistrodon contortrix mokasen*	Yes	BOVA, SppObs	
Northern scarletsnake	*Cemophora coccinea copei*		BOVA	IVa
Northern watersnake	*Nerodia sipedon sipedon*	Yes	BOVA, SppObs	
Plain-bellied watersnake	*Nerodia erythrogaster*		BOVA	

Table E3.7-3 Terrestrial Species Likely to be Observed Within a 6-mile Radius of SPS

Common Name	Scientific Name	Confirmed	Database(s)	Tier[(a)]
Red cornsnake	*Pantherophis guttatus*		BOVA	
Red-eared slider	*Trachemys scripta elegans*	Yes	BOVA, SppObs	
Rough earthsnake	*Haldea striatula*	Yes	BOVA, SppObs	
Southeastern crowned snake	*Tantilla coronata*		BOVA	IVc
Southeastern five-lined skink	*Plestiodon inexpectatus*	Yes	BOVA, SppObs	
Southeastern mud turtle	*Kinosternon subrubrum subrubrum*	Yes	BOVA, SppObs	
Southern ring-necked snake	*Diadophis punctatus punctatus*	Yes	BOVA, SppObs	
Spotted turtle	*Clemmys guttata*	Yes	BOVA, SppObs	IIIa
Striped mud turtle	*Kinosternon baurii*	Yes	BOVA, SppObs	
Woodland box turtle	*Terrapene carolina carolina*	Yes	BOVA, SppObs	IIIa
Yellow-bellied slider	*Trachemys scripta scripta*	Yes	BOVA, SppObs	IVb

(VaFWIS. 2016)
a) I = Tier I Critical Conservation Need; II = Tier II Very High Conservation Need; III = Tier III High Conservation Need; IV = Tier IV Moderate Conservation Need.
Virginia WAP Conservation Opportunity Ranking:
a = On-the-ground management strategies/actions exist and can be feasibly implemented;
b = On-the-ground actions or research needs have been identified but cannot feasibly be implemented at this time;
c = No on-the-ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.

Table E3.7-4 Federally and State Listed Threatened and Endangered Species in Surry, James City, York, and Isle of Wight Counties

Common Name	Scientific Name	Federal Legal Status	State Legal Status
Amphibians			
Barking treefrog[a][b]	*Hyla gratiosa*	None	LT
Eastern tiger salamander[d]	*Ambystoma tigrinum*	None	LE
Mabee's salamander[b]	*Ambystoma mabeei*	None	LT
Birds			
Bachman's sparrow[b]	*Peucaea aestivalis*	None	LT
Bald eagle[c]	*Haliaeetus leucocephalus*	DL	None
Black rail[b]	*Laterallus jamaicensis*	None	LE
Henslow's sparrow[b]	*Ammodramus henslowii*	None	LT
Loggerhead shrike[b]	*Lanius ludovicianus*	None	LT
Migrant loggerhead shrike[b]	*Lanius ludovicianus migrans*	None	LT
Peregrine falcon[b]	*Falco peregrinus*	DL	LT
Piping plover[d]	*Charadrius melodus*	LT	LT
Red knot[b]	*Calidris canutus rufa*	LT	LT
Red-cockaded woodpecker[b]	*Picoides borealis*	LE	LE
Roseate tern[d]	*Sterna dougallii dougalli*	LE	LE
Fish			
Atlantic sturgeon[a][b]	*Acipenser oxyrinchus*	LE	LE
Blackbanded sunfish[a][b]	*Enneacanthus chaetodon*	None	LE
Mammals			
Little brown bat[b]	*Myotis lucifugus lucifugus*	None	LE
Northern long-eared bat[b][c]	*Myotis septentrionalis*	LT	LT
Rafinesque's eastern big-eared bat[b]	*Corynorhinus rafinesquii macrotis*	None	LE
Tri-colored bat[b]	*Perimyotis subflavus*	None	LE
Reptiles			
Canebrake rattlesnake[b]	*Crotalus horridus*	None	LT
Eastern chicken turtle[d]	*Deirochelys reticularia reticularia*	None	LE
Kemp's Ridley sea turtle[d]	*Lepidochelys kempii*	LE	LE
Leatherback sea turtle[d]	*Dermochelys coriacea*	LE	LE
Loggerhead sea turtle[d]	*Caretta caretta*	LT	LT
Northern diamond-backed terrapin[b]	*Malaclemys terrapin terrapin*	None	CC
Spotted turtle[b]	*Clemmys guttata*	None	CC

Table E3.7-4 Federally and State Listed Threatened and Endangered Species in Surry, James City, York, and Isle of Wight Counties

Common Name	Scientific Name	Federal Legal Status	State Legal Status
Vascular Plants			
Sensitive joint-vetch[a][c]	*Aeschynomene virginica*	LT	LT
Small whorled pogonia[d]	*Isotria medeoloides*	LT	LE

a) Listed by the VDCR Natural Heritage as occurring or likely to occur in Surry County, Virginia (VDCR. 2016a).

b) Listed by the VaFWIS as occurring or likely to occur in Surry County, Virginia (VaFWIS. 2016).

c) Listed by the USFWS as occurring or likely to occur in Surry County, Virginia (USFWS. 2016c).

d) Not listed as occurring in Surry County, Virginia, by the VaFWIS or the USFWS (USFWS. 2016c; VaFWIS. 2016).

LE = listed endangered; LT = listed threatened; SOC = species of concern (no federal protection)

CC = collection concern

E3.8 HISTORIC AND CULTURAL RESOURCES

Cultural resources include prehistoric era and historic era archaeological sites and objects, architectural properties and districts, and traditional cultural properties, which are defined as significant objects or places important to Native American tribes for maintaining their culture (USDOI. 1998). Of particular concern are those cultural resources that may be considered eligible for listing on the National Register of Historic Places (NRHP). Any cultural resources listed on or eligible for the NRHP are considered historic properties under the National Historic Preservation Act (NHPA) [16 USC 470].

Prior to taking any action to implement an undertaking, Section 106 of the NHPA requires the NRC as a federal agency to do the following:

- Take into account the effects of an undertaking (including issuance of a license) on historic properties, including any district, site, building, structure, or object included in or eligible for inclusion in the NRHP.
- Afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertaking.

To provide early consultation for the Section 106 process, Dominion contacted the Virginia Department of Historic Resources (VDHR) for informal consultation concerning the SPS SLR and potential effects on cultural resources within the approximately 840-acre site and on historic properties within a six-mile radius of SPS (Attachment D). Native American groups recognized as potential stakeholders were also consulted by Dominion with the opportunity for comment (Attachment D).

This ER identifies all known archaeological sites within a six-mile radius of SPS, as well as properties listed on the NRHP within that same radius. The approximately 840-acre Dominion SPS property consists primarily of forest, grassland, wetlands, and developed areas. The land within a six-mile radius is primarily forest, grassland, wetlands, developed areas, and agricultural fields adjacent and near the James River. For the purpose of SLR, the aboveground area of potential effects (APE) is defined as the entire SPS property and everything within a six-mile radius of SPS. The aboveground APE considers the visual integrity of historical properties in relation to continued SPS operation. The archaeological APE is considered bounded by the approximately 840 acres, where ground disturbance, though unanticipated during the subsequent period of extended operation, might compromise the physical integrity of archaeological data.

No ground disturbance associated with SPS is considered within the scope of the 10 CFR 51 evaluation. As such, the SLR consists of an administrative action relative to historic and cultural resources. Although construction of the existing SPS facility itself would have impacted any archaeological resources that may have been located within its footprint, much of the surrounding area remains largely undisturbed. One site, the Lawnes Creek Church site (44SY2), has been recorded on the SPS property, and has not been evaluated for NRHP eligibility. The SPS property has not been completely surveyed for cultural resources, but a probability assessment was completed in 2001. (LBGI. 2001) This investigation was associated with the initial license renewal and included a field inspection and a literature and document review which resulted in identifying one previously recorded archaeological site (44SY2) and the classification of the property into three categories based on the potential for archaeological resources: no potential, low potential, and moderate-to-high potential for archaeological deposits. The majority of the southern, eastern, and central portions of the property was classified as "no potential" and recommended, with SHPO concurrence, for no further archaeological investigations.

The literature review for the SLR of previously recorded archaeological sites included the area within a six-mile radius of SPS. The purpose of the literature review was to help develop an understanding of the local context by conducting an inventory of all previously and newly recorded archaeological sites on the 840-acre SPS property and within a six-mile radius of SPS, regardless of NRHP status. Although only one archaeological site (44SY2, the Lawnes Creek Church site) has been recorded on the SPS property, the facility is located within an area of high prehistoric and historic term site density (LBGI. 2001).

The results of the literature review showed that there are 579 archaeological resources and 269 architectural resources previously recorded within six miles of SPS (VDHR. 2017). There are 27 resources that are either NRHP listed, determined eligible, or recommended eligible for the NRHP, or have the equivalent eligibility or potential eligibility under national heritage or legacy commission designations (Tables E3.8-1 and E3.8-2). There are an additional six contributing resources and 17 undetermined NRHP status within the six-mile radius (Table E3.8-1). Of these resources, seven consist of artifact scatters and below-ground resources and 39 consist of standing structures, which also have the potential for subsurface deposits.

E3.8.1 LAND USE HISTORY

The land use history for SPS and the surrounding region was developed as part of a Phase 1A literature review and archaeological sensitivity assessment of the SPS property and is summarized here. Section E3.8.2 provides a more detailed discussion of historical land use as part of the cultural history. Early maps provide information on how the area was used in the past. An 1863 map depicts multiple cities, roads, and farmsteads, but the property is shown as undisturbed forest with the exception of a road that continues to Hog Island (Figure E3.8-1). Similarly, an 1871 map of

Surry County shows a road to Hog Island through the property boundary but no other cultural features (Figure E3.8-2). USGS maps from 1907 and 1943 have additional roads depicted within the property boundary, as well as two structures within the eastern portion of the property (Figures E3.8-3 and E3.8-4). A plat map from 1950 has a shed depicted along the southern property boundary and a road to Hog Island depicted, with the remaining area labeled "All Woods-No Buildings" (Figure E3.8-5). A 1950 USGS map no longer shows structures within the property, but the road to Hog Island remains (Figure E3.8-6). The 1965 USGS map shows the SPS infrastructure had been constructed including roads, electrical transmission lines, water control features, and structures (Figure E3.8-7). The 1984 USGS map depicts additional infrastructure over a greater portion of the property (Figure E3.8-8).

Photographs taken prior to, during, and after the construction of the SPS facility are useful in showing the environmental context during that time period. At the time of construction, the SPS facility consisted of undeveloped forest (Figure E3.8-9). The trees and brush were removed, and the area was mechanically leveled (Figure E3.8-10). Construction included excavation for the SPS facility components (Figure E3.8-11). Final construction of the SPS facility included multiple buildings, structures, and parking lots surrounded by forest (Figure E3.8-12).

The SPS property and the surrounding region hold evidence of both prehistoric and historic occupation by Native Americans and Euro-Americans. Archaeological records suggest that the SPS property and the surrounding area were potentially occupied by Native American populations during the Paleoindian Period (prior to 8000 BC), the Archaic Period (ca. 8000 BC to 1200 BC), and the Woodland Period (ca. 1200 BC to AD 1600).

Dominion's consultations with Native American groups is included in Attachment D.

E3.8.2 CULTURAL HISTORY

E3.8.2.1 Paleoindian Period (Prior to 8000 BC)

The Paleoindian period is the earliest substantiated cultural adaptation in Virginia (VDHR. 2001). Due to lower global temperatures, more water was trapped in glaciers resulting in a larger area of the continental shelf being exposed. Paleoindian peoples tended to live in small bands which traveled seasonally within set territories for food sources that included hunting megafauna, caribou, elk, and deer (LBGI. 2001). Many of these bands likely lived along large rivers for access to higher resource areas. These same resource areas commonly have lithic resources suitable for tool manufacture. The material culture is characterized by large, fluted points such as the Clovis and the Middle Paleo Point. Later point types, such as Hardaway Side Notched, Hardaway Blade, and Hardaway-Dalton no longer exhibited fluting, but retained a high level of technical sophistication

that is indicative of Paleoindian tools. Subsistence of Paleoindian peoples focused on large game as well as small game, fishing, and foraging. A more diversified view of the Paleoindian economy is becoming accepted as a result of recent research, in contrast to the previous view emphasizing a heavy reliance on the exploitation of megafauna. Paleoindian sites are primarily located in lowland areas near southeastern Virginia, which due to subsequent sea level rise are located in wetlands or underwater. (LBGI. 2013)

E3.8.2.2 Archaic (8000 to 1200 BC)

The Archaic Period is marked by changes in subsistence and settlement patterns likely associated with rising sea levels related to glacial melt. This period is divided into the Early, Middle, and Late Archaic and is characterized by the exploitation of a larger variety of plant and animal resources with an overall greater diversity in material culture. The transition to the Early Archaic Period is inferred to include a less mobile and more localized lifestyle than the preceding Paleoindian Period. Projectile points no longer exemplified the intricate work characteristic of Paleoindian tools. Early Archaic tools such as spear points, knives, drills, scrappers, and gravers were still used, but varied in size and shape and were often fashioned with side or corner notches to allow for hafting. (LBGI. 2013)

By the Middle Archaic, the "tool kit" is inferred to have expanded to include Atlas for hunting as well as mortars and pestles for food processing. Stone axes became common for obtaining wood for structures and fire suggesting a greater level of sedentism. The occurrence of steatite and soapstone bowls also suggests longer term occupations and more intense resource exploitation. The occurrence of soapstone across Virginia in addition to quartzite and rhyolite knives and large points in both Virginia and Maryland, suggests the use of trade and exchange networks. Also, by the Late Archaic, estuarine resources were exploited as a food source as well as native plants such as sunflowers, amaranth, and gourds (VDHR. 2001). Overall the exploitation strategy during the Archaic Period appears to have been a mostly mobile population conducting hunting and foraging activities. (LBGI. 2013)

E3.8.2.3 Woodland (1200 BC to AD 1600)

The Woodland Period is primarily marked by the emergence of pottery and other technological changes in the material culture of the prehistoric inhabitants of the region. Pottery and subterranean storage pits are found at sites dating to the Early Woodland Period, which similar to Archaic Period sites, are predominantly in riverine locations. (LBGI. 2001; VDHR. 2001)

By the Middle Woodland, trade and exchange networks had greatly expanded based on the presence of non-local artifacts. This is evident in the large number of exotic items and materials in grave goods such as pendants and copper beads. The diet continued to include aquatic and game resources, but began to include more plants. The carbohydrate-rich diet, evident in human bone analysis, suggests an increase in agriculture and less reliance on hunting and foraging. Smaller projectile points, resulting from the conversion from atlatls and darts to the bow and arrow and celts appear. Sedentism was common, as seen in large base camps and increased reliance on agriculture in the archeological record. (LBGI. 2001; VDHR. 2001)

By the Late Woodland, political stratification was evident within permanent and semi-permanent large villages, some located within palisades, suggesting an increase in inter-community violence. Agriculture appears to increase in importance, with a reliance on corn, squash and beans. However, foraging and hunting remained important to survival. (LBGI. 2001) During this time local cultures, such as the Coastal Plain Indians, became evident which led to more specialized and stratified social and political roles. During the Late Woodland, Virginia appears to have been inhabited by western Siouan groups and eastern Algonquin groups. With an increase in trade networks and craft specialization, material culture diversified, particularly goods manufactured from bone such as needles and fishhooks. Ceremonial and status objects became commonplace as seen in elaborate burials for the elite. (VDHR. 2001) The material culture suggests that villages were organized into redistributive chiefdom-level societies (LBGI. 2001).

E3.8.2.4 Settlement to Society, AD 1607 to 1750

The northeastern portion of present-day Surry County was an early focus of colonial development in Virginia owing to its proximity to Jamestown Island. In 1608 the first English settlement at Hog Island was established by settlers from Jamestown. The principal purpose of the settlement at Hog Island was for use of the island as a natural pen for the colony's hogs. In addition, a blockhouse was established on Hog Island to provide Jamestown Island with further security against the Spanish. While the island's use for raising hogs continued in subsequent years, the military value of the island was not very great and the garrison was moved to the northern side of the James River. (LBGI. 2013)

In 1619 two patents were issued for Hog Island, giving the western portion of the island to one Captain Ralph Hamer and the eastern portion of the island to a John Bailey. There is little mention of the developments that occurred on the island during these early years of the seventeenth century. Captain Hamer reported in 1624 that he had lost much of his plantation on Hog Island to the massacre of 1622. In 1643, Randall Holt, through marriage, came to own the entire island. The Holt family continued to own the island until the early nineteenth century. (LBGI. 2013)

In the early eighteenth century, the Holts were granted a license to operate a ferry between Jamestown Island and Hog Island. The agreement under which they operated the ferry required them to maintain the bridge that connected Hog Island with the mainland to the south. Although this ferry concession appears to have been financially successful, the Holts failed to maintain the bridge. After 1748 there is no reference to the Holts obtaining a new license for ferry operation. (LBGI. 2013)

The land to the south of Hog Island, between Chippokes Creek and Lawnes Creek, was settled not long after the settlement of Hog Island. Early references to this area call it Hog Island "Maine," to distinguish it from Hog Island proper. In 1619 this area was patented by Captain Christopher Lawne. In that same year, a settlement called Lawnes Hundred was established on Lawnes Creek. The settlement was not successful, and within a year it had been abandoned. From 1620-1632 there is little reference to Hog Island "Maine" and no successful developments appear to have been established in the area. (LBGI. 2013)

This may have been due, in part, to the aftermath of the massacre of 1622, when settlers were wary of establishing settlements too distant from one another. Between 1632 and 1638, however, a number of patents were issued for Hog Island "Maine," and as a result the entire area came into the possession of a William Spencer by 1637. Spencer does not appear to have been much more successful in establishing a settlement than his predecessors had been. With his death in 1656, Spencer's plantation was repatented to a William Cockerham. In 1662, the land then passed to a Major William Caulfield. Caulfield expanded his landholdings and became a prominent resident of Surry County, serving as Burgess in 1676. Caulfield reported that as a result of Bacon's Rebellion (1676), he had suffered losses of 500 pounds sterling. This amount would suggest that his house and belongings rivaled those of Arthur Allen, who was then owner of the house now known as Bacon's Castle. Caulfield died in 1691 leaving the land to his widow and his nephew. After that point little more is recorded regarding the development of Hog Island "Maine." (LBGI. 2013)

Although there is little documentary evidence regarding the structures that existed on Hog Island and Hog Island "Maine," it is noted that several plantations had been established in both locations. In addition, the original site of the Lawnes Creek Parish Church is reported to have been located near Hog Island on the mainland. The first Lawnes Creek Parish Church stood from circa 1628-1650. This church is believed to have been located "on a hill overlooking the James, near Hog Island Creek, and west of a road leading to Hog Island." Lawnes Creek Parish Church was the first church established in Surry County. A second church replaced the first church in 1650 and remained in use until around 1695. At that time a third church was established near Bacon's Castle. On January 13, 1673, Lawnes Creek Parish Church was the site of a protest against what were considered to be unjust taxes. While the sites of the first two churches remain unknown, the ruins of the third church are still extant. (LBGI. 2013)

E3.8.2.5 Colony to Nation, AD 1750 to 1789

During the period from 1750-1789, the Holts moved from Hog Island to the mainland, where, in about 1782, they built a two-story dwelling, kitchen, stable, blacksmith shop, shed, and two frame houses. By this time many of the buildings on the island had reportedly fallen into disrepair, been abandoned, and were lost. In the events leading up to the battle of Yorktown, which took place in the fall of 1781, the Americans crossed the James River at Hog Island in pursuit of the British forces. The island was then used as a commissary depot by the French and American forces during the siege of Yorktown. Cattle and other food supplies were brought to Hog Island to supply the troops involved in the siege. (LBGI. 2013)

E3.8.2.6 National Period, 1789 to Present

In the early nineteenth century, Hog Island was owned by Thomas Wilson. The first land tax records for the area began in 1820, and in 1821 there were no taxable buildings located on Hog Island or the adjacent mainland. Wilson's land was sold under order of the Williamsburg District Chancery Court in the late 1820s. The land was purchased by three men, named Robertson, French, and McFarland, who in 1830 partitioned the land among themselves. (LBGI. 2013)

Little information is available about the Hog Island area during the antebellum period (1830-1860). For Hog Island itself, it is noted in the tax records that several improvements (totaling $1,075) had been made to the Robertson portion of the island. (LBGI. 2013)

During the Civil War (1861-1865), Hog Island and the mainland immediately south were reported to be forested, with little development. On the mainland, only the property of Nicholas Savage is known to have had any structures standing at this time. However, during the Civil War, the Confederate military operated a signal station on Hog Island. It is uncertain where this station was located, what types of structures were involved, or how many men were stationed on the island. (LBGI. 2013)

During the reconstruction and growth period (1865-1917), Hog Island's owner was a Mr. Barney. Barney established a residence called Homewood on the northern portion of Hog Island, at the northern end of Hog Island Road. Originally consisting only of Barney's small house, Homewood came to represent a growing development, which eventually became a postal town. There is currently only one structure extant believed to date to the original Homewood residence. It is a brick smokehouse standing just west of the northern end of Route 650. From 1895-1933, all of Hog Island came under the ownership of Allen Gray. (LBGI. 2013)

From the time of World War I to the present, very little additional development is noted in the Hog Island area. In 1933 a portion of Hog Island was purchased by the Newport News Yacht club. The purchase was most likely in the vicinity of Homewood. (LBGI. 2013)

After World War II, Hog Island became a wildlife refuge under the jurisdiction of the Commonwealth of Virginia. Originally known as the Hog Island Waterfowl Refuge, it is currently called the Hog Island WMA. The Hog Island WMA now includes all of Hog Island plus two additional tracts of land south of the SPS property (Figure E3.1-5).

The most notable development to occur in the Hog Island area after World War II was the construction of SPS, which began in the late 1960s. By the end of 1972, SPS Unit 1 was in commercial operation.

E3.8.3 ONSITE CULTURAL RESOURCES

Onsite cultural resources are those located within the 840-acre SPS property. That property includes the entirety of the archaeological APE, which is also the onsite portion of the aboveground APE. The VDHR reviewed the proposed project and determined that no historic properties would be affected due to the disturb ed nature of the project area. (VDHR. 2016)

No NRHP-eligible cultural resources have been confirmed within the 840-acre SPS property (Figure E3.8-13). No structures within the SPS property have been documented through the Historic American Buildings Survey (HABS) or Historic American Engineering Record (HAER) programs.

The single cultural resource recorded on the SPS site is the Lawnes Creek Church Site (44SY2), which is located in the western portion of the SPS property (Figure E3.8-8). This site consists of a scatter of handmade bricks with shell mortar and a four-foot deep cellar. The NRHP status of the site has not yet been determined. Additional investigations would be necessary to determine significance should ground-disturbing activities be planned in this location.

In 2001, an archaeological sensitivity analysis was completed based on previous archaeological investigations, a review of archival and secondary historical sources, topography, and a walkover of the property. Three zones of sensitivity were delineated on the SPS property: no potential (disturbed); low potential (disturbed location with greater than 15% slope and typically do not have sites); and moderate to high potential (undisturbed, relatively flat, typically have sites). (LBGI. 2001)

E3.8.4 OFFSITE CULTURAL RESOURCES

Offsite cultural resources are those outside the 840-acre SPS property boundary. There are 848 offsite resources within six miles of the SPS. Lists of known archaeological sites and historic properties within a six-mile radius of SPS are presented in Tables E3.8-1 and E3.8-2, but due to the large number of resources, the tables are restricted to NRHP-listed resources, as well as those that are potentially eligible, determined eligible, or within the SPS facility or very close proximity. This includes Hog Island, which is directly adjacent to the SPS property and part of an historic district the USACE determined as NRHP-eligible. The National Park Service is also currently considering inclusion of the CAJO (nearest location described in Section E3.1.3) in the NRHP eligibility process (83 FR 19108). There are 13 NRHP-listed resources within six miles of SPS (Table E3.8-2 and Figure E3.8-13).

E3.8.5 CULTURAL RESOURCE SURVEYS

There is no documentation of a cultural resources survey of the 840-acre property conducted prior to the construction of SPS. In 2001, a cultural resource assessment of SPS that included background research and a field inspection was conducted, but a systematic pedestrian survey of the entire SPS property was not undertaken (LBGI. 2001). One previously recorded site (44SY2) was identified and the SPS 840-acre property was divided into three categories based on the potential for cultural resources and recommendations for ground disturbance within those areas.

In 2013, an area of 200 x 300 feet for a BDB storage building was surveyed, including the building footprint, parking areas, access rounds, and underground utilities. This survey included a pedestrian survey and shovel testing. The survey revealed no cultural resources. An addendum was prepared for the report to include a new 600-foot long security border, which also revealed no cultural resources. (LBGI. 2013)

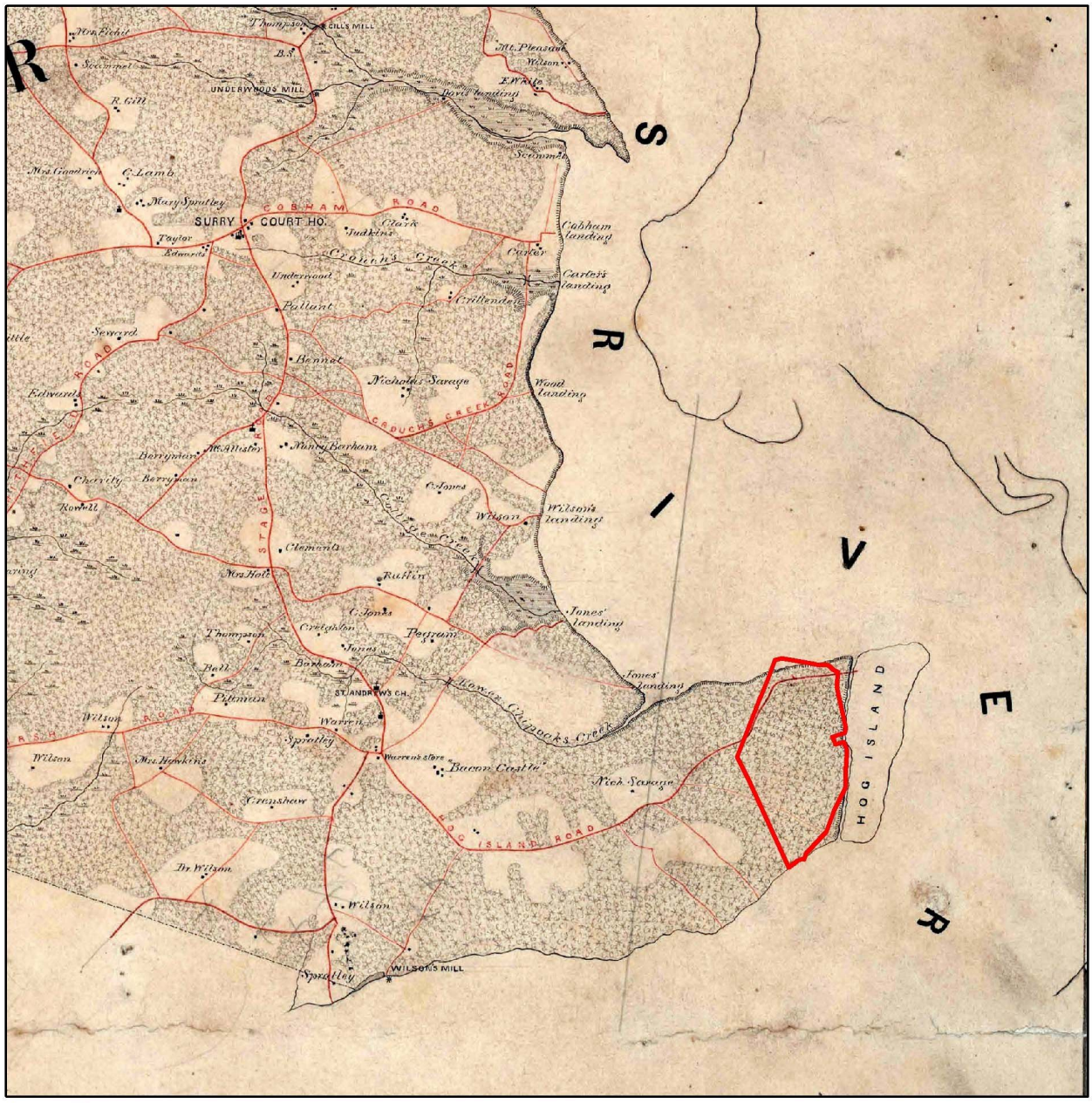
A visual effects assessment and an underwater survey of the James River were conducted for the SPS-Skiffes Creek 500-kV transmission line project (CRI. 2013). These investigations found resources in the proximity of the 840-acre SPS property, but did not identify any resources within the SPS property itself.

E3.8.6 PROCEDURES AND INTEGRATED CULTURAL RESOURCES MANAGEMENT PLAN

Cultural resources on the SPS site are protected by Dominion's historic resources consultation guidance (Dominion. 2009b) and Dominion's cultural resources description process (CRDP), which is specifically applicable to SPS and NAPS. The guidance document and the CRDP ensure that cultural resource remains are not damaged and are protected from unauthorized removal, and that in the event ground disturbance is required in these areas, remains will be appropriately protected for their cultural resource information value. The guidance protects known cultural resources (e.g., the Lawnes Creek Church site), as well as unknown cultural resources, by establishing a process for all activities that require a federal permit or use federal funding, or have the potential to impact historic resources.

The flowchart in Figure E3.8-14 illustrates the associated steps in the CRDP and meets the needs for regulatory requirements, supporting existing station operations, environmental stewardship, licensing proceedings, and SLR application content. The CRDP integrates the various Dominion policy statements, programs, procedures, and BMPs already being followed. As part of necessary actions for various project work, it calls out in one diagram applicable reference documents and steps to be followed should the question or need for assessment of historic or cultural resources be raised.

Figure E3.8-1 Surry, Sussex, and Southampton Counties with SPS, 1863



Legend

(CSA 1863; Dominion 2016g)

Property Boundary

Figure E3.8-2 1871 Preliminary Map of Surry County

Legend

SPS

(Dominion 2016f; Hotchkiss 1871)

Figure E3.8-3 Dominion Energy Property, 1907

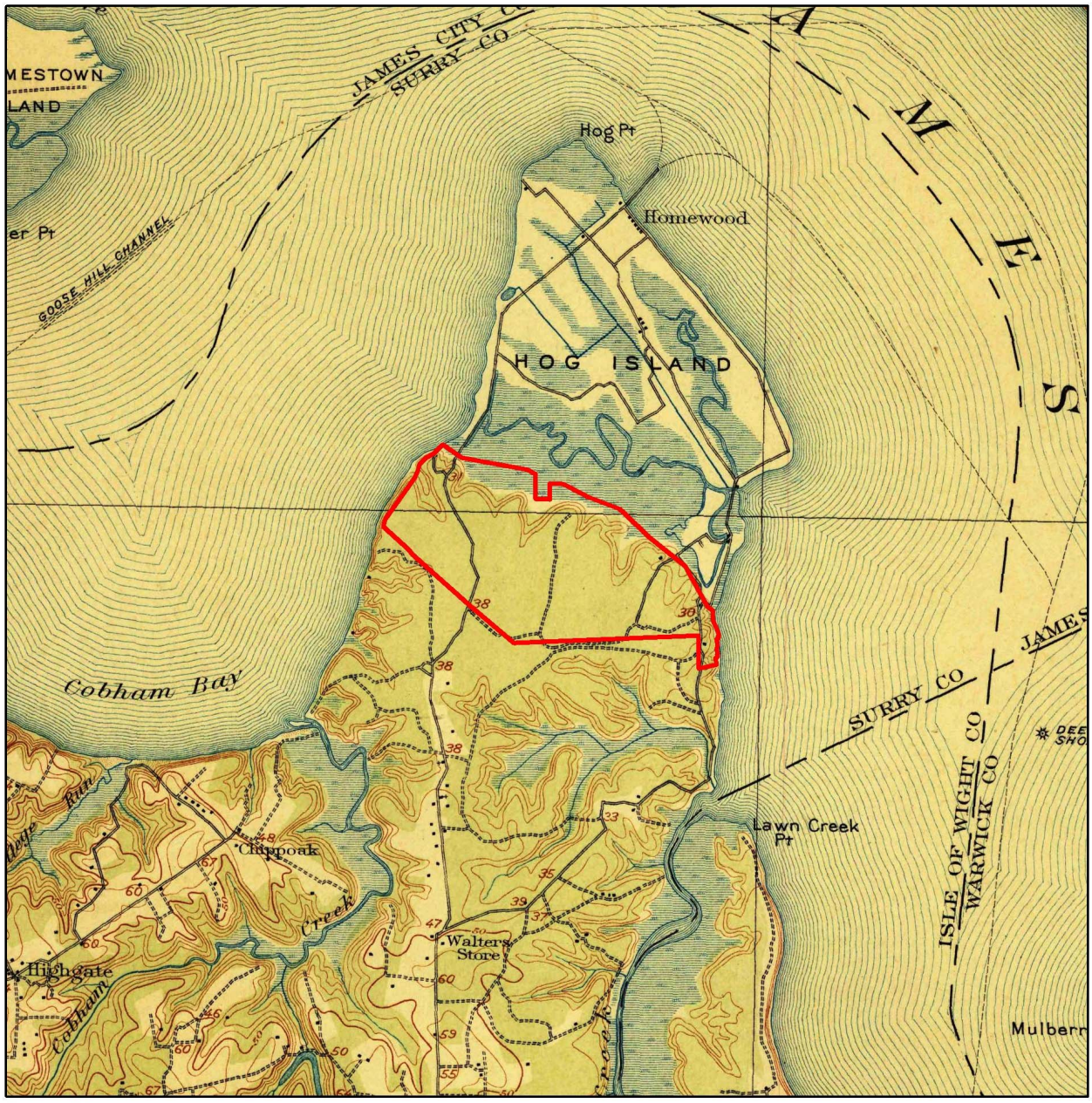
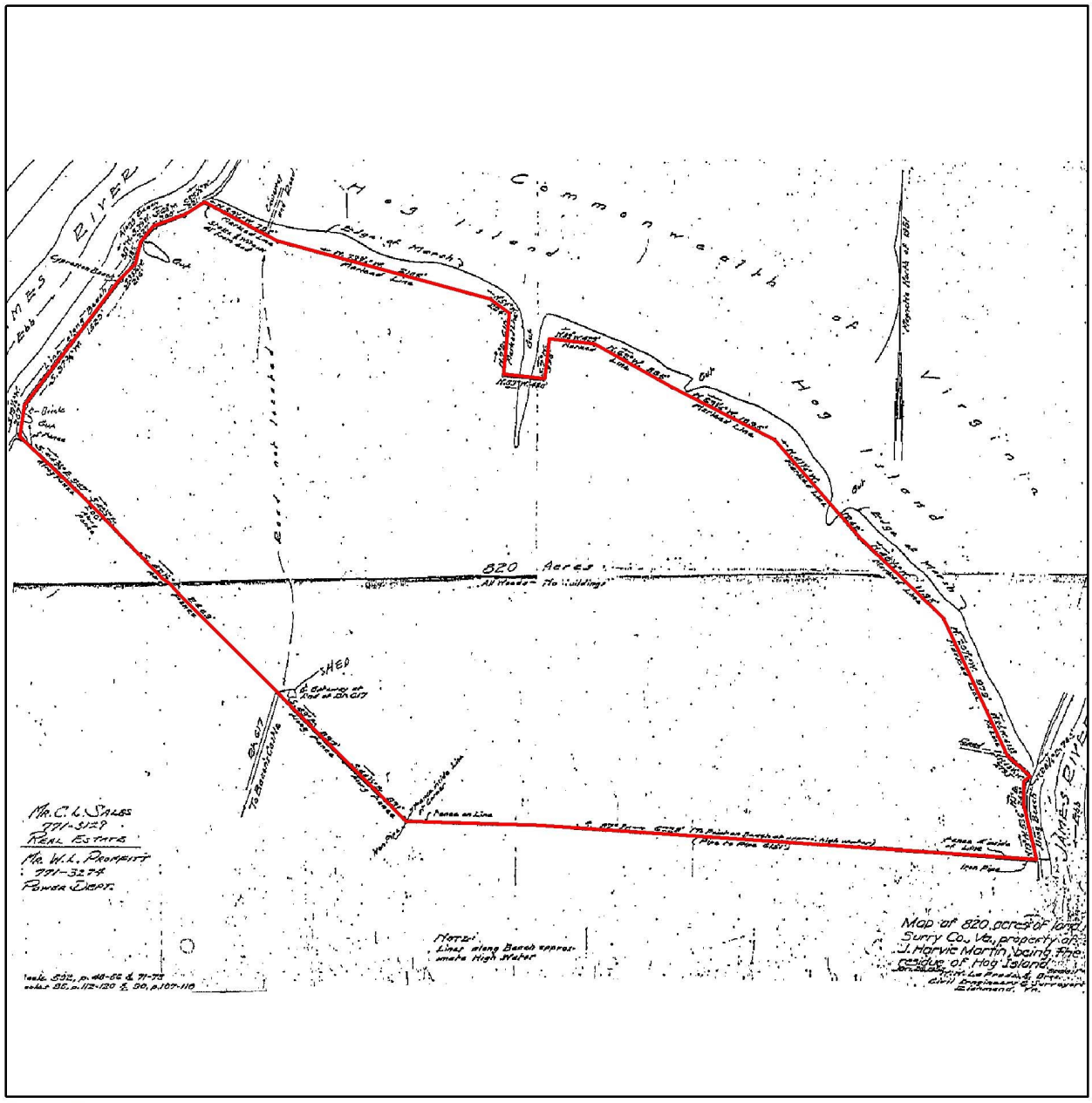


Figure E3.8-4 Dominion Energy Property, 1943

Figure E3.8-5 1950 Plat Map - 820 acres of Land in Surry County



(Dominion 2016g; LGBI 2001)

Legend

Property Boundary

Figure E3.8-6 Dominion Energy Property, 1950

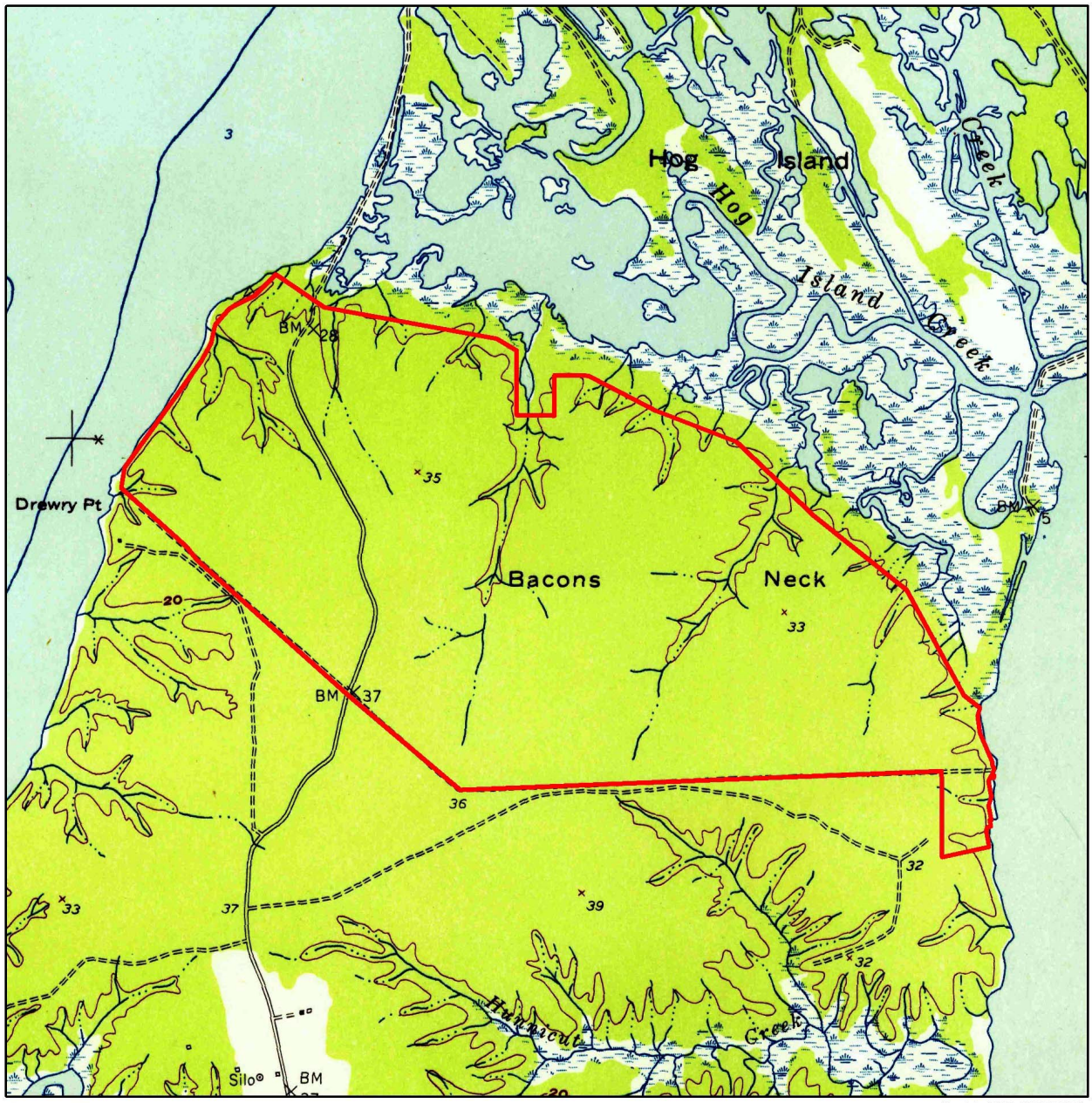


Figure E3.8-7 Dominion Energy Property, 1965

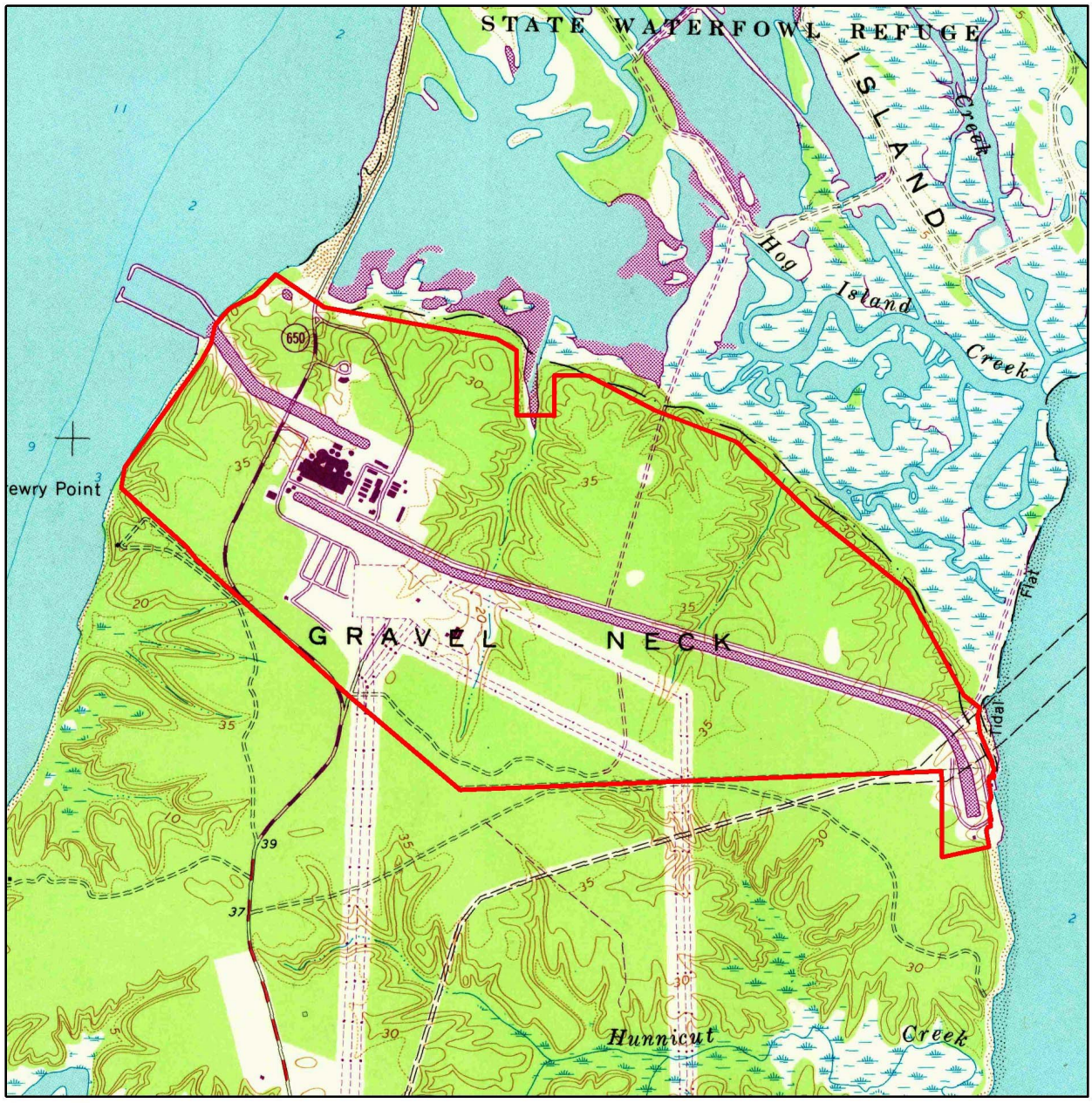
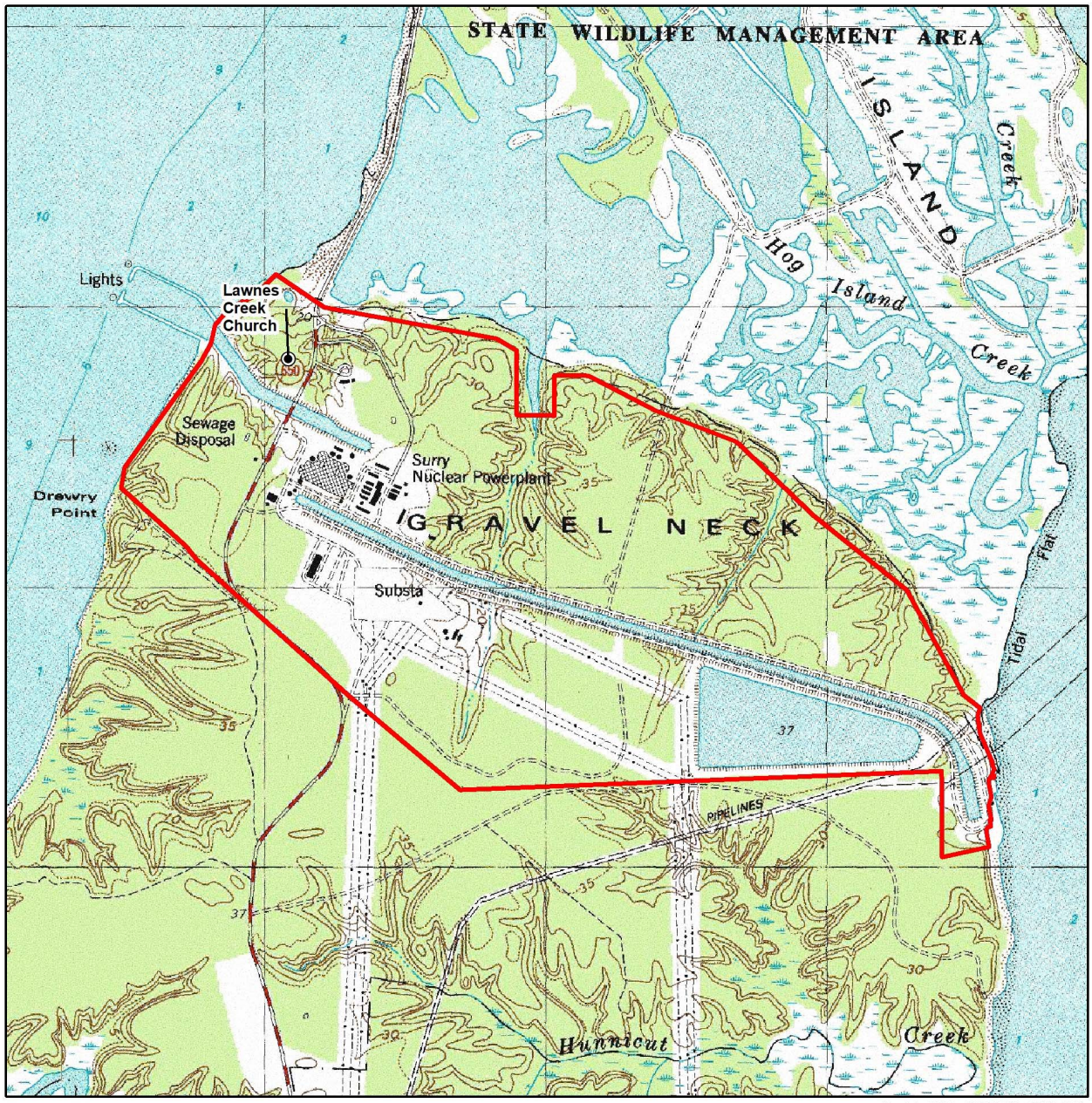


Figure E3.8-8 Dominion Energy Property, 1984



Intentionally Blank

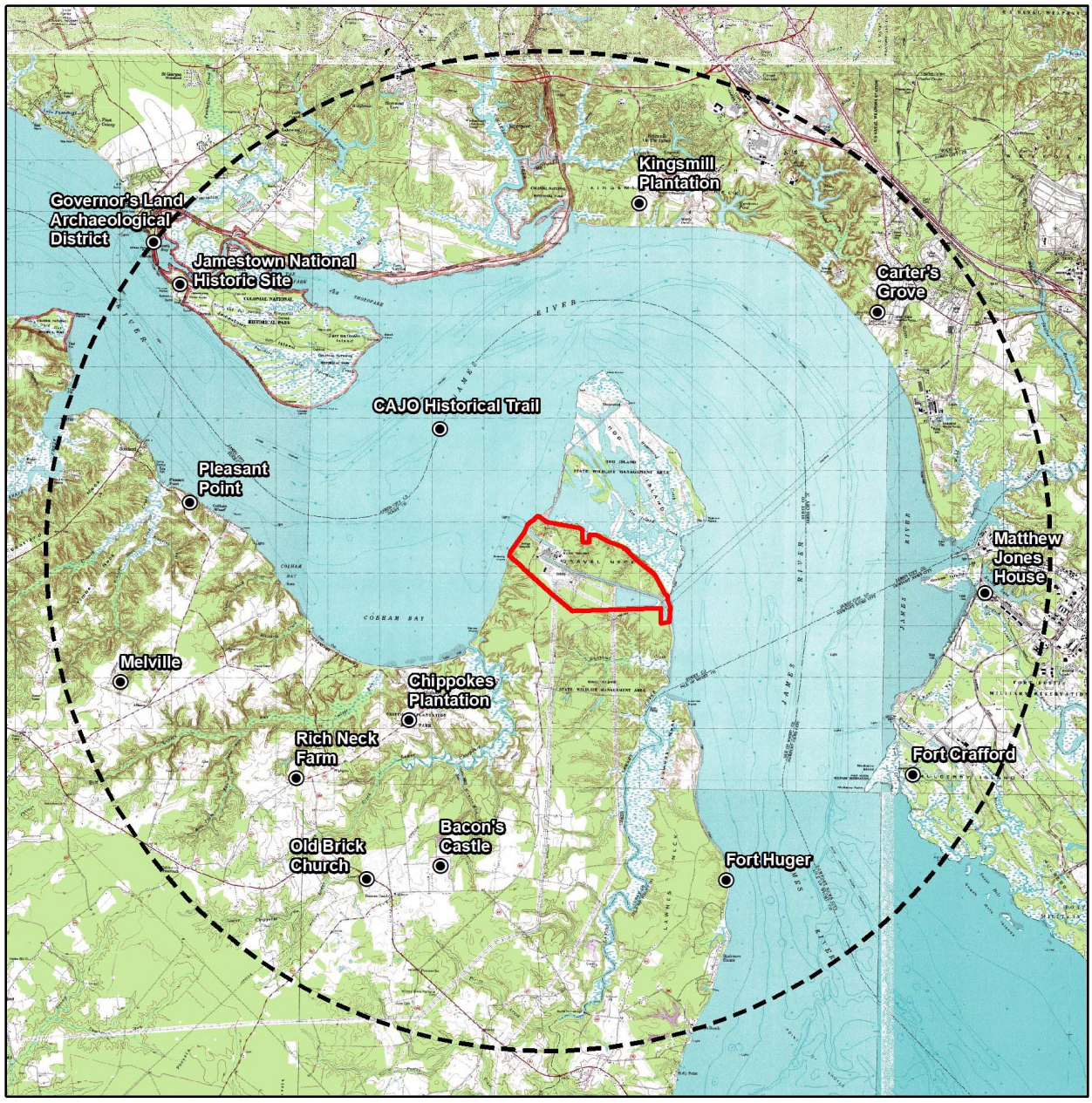
Figure E3.8-9 Pre-Construction Photograph of the SPS Site Showing Primarily Undeveloped Forest

Figure E3.8-10 Construction Photograph of the SPS Site Showing Tree Removal and Mechanical Leveling

Figure E3.8-11 Construction Photograph of SPS, Showing Areas Excavated for Structures

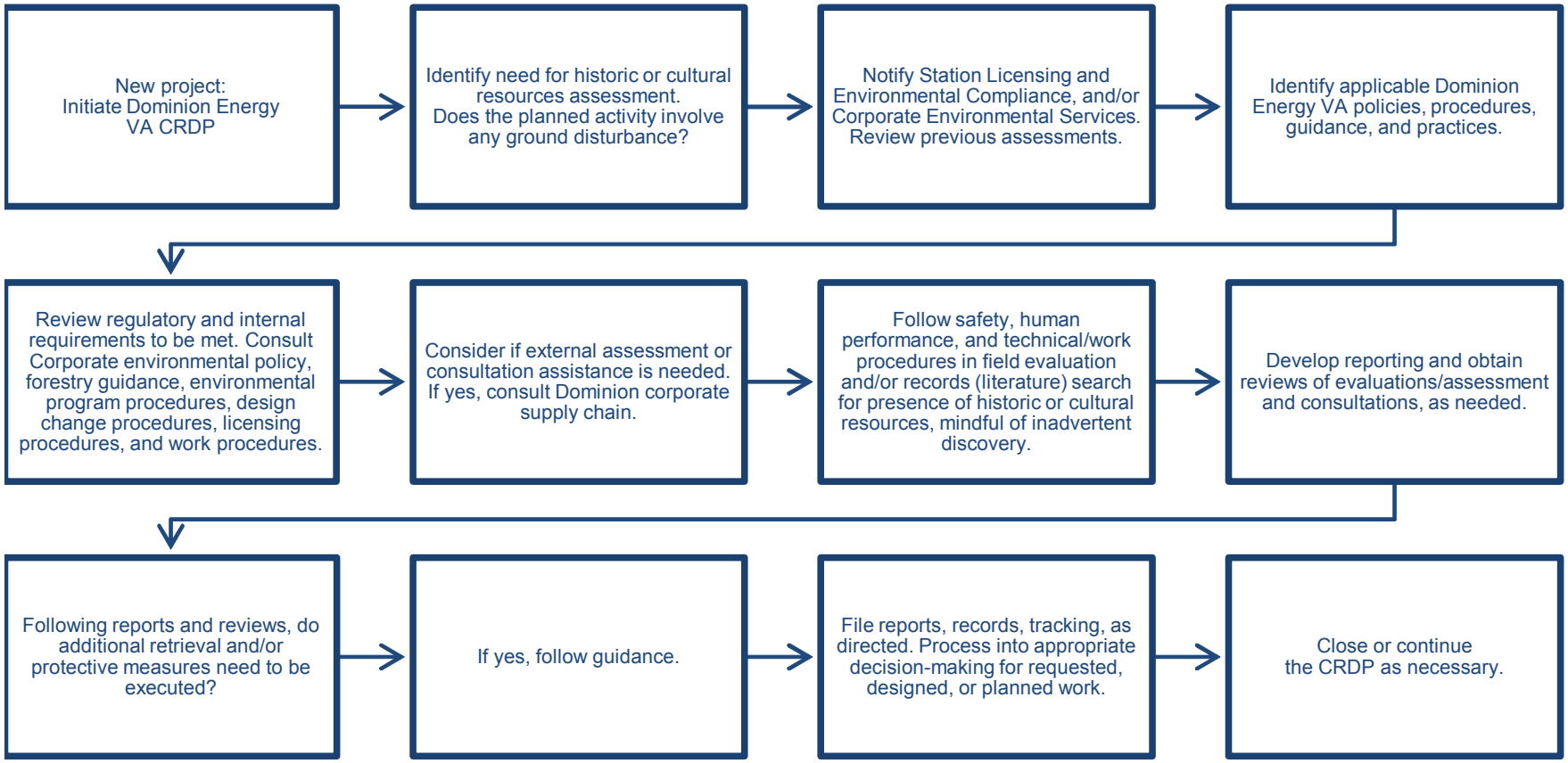
Figure E3.8-12 Post-Construction Photograph of SPS Showing Structures, Buildings, and Parking Lots Surrounded by Forest

Figure E3.8-13 NRHP-Listed Resources within 6 Miles of SPS



Intentionally Blank

Figure E3.8-14 Cultural Resources Description Process (CRDP) Flowchart



Intentionally Blank

Table E3.8-1 Eligible or Potentially Eligible Sites Within a 6-Mile Radius of SPS

VDHR ID#	County	Quadrangle	NRHP Status
046-5415	Isle of Wight	Hog Island	Eligible
047-5307	James City	Hog Island	Potentially eligible
047-5333	James City	Yorktown	Eligible
047-5432	James City	Surry	Potentially eligible
090-0121	Surry	Hog Island	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046	Surry	Surry	Potentially eligible
090-5046-0001	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046-0002	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046-0003	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046-0004	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046-0008	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
121-5068	Newport News City	Yorktown	Eligible
121-5070	Newport News City	Hog Island	Eligible
121-	Newport News City	Yorktown	Eligible
-	Surry/James City	Hog Island/Surry	Eligible
90-26 (44SY2)	Surry	Hog Island	Undetermined
90-27 (44SY3)	Surry	Hog Island	Undetermined
90-52	Surry	Hog Island	Undetermined
90-121-1	Surry	Hog Island	Undetermined
90-121-2	Surry	Hog Island	Undetermined
90-121-3	Surry	Hog Island	Undetermined
90-121-4	Surry	Hog Island	Undetermined
90-121-5	Surry	Hog Island	Undetermined
90-121-6	Surry	Hog Island	Undetermined
90-121-7	Surry	Hog Island	Undetermined
Area 1	Surry	Hog Island	Undetermined
44SY114	Surry	Hog Island	Undetermined
44SY138	Surry	Hog Island	Undetermined
44SY159	Surry	Hog Island	Undetermined
44SY212	Surry	Hog Island	Undetermined
44SY213	Surry	Hog Island	Undetermined

Table E3.8-1 Eligible or Potentially Eligible Sites Within a 6-Mile Radius of SPS

VDHR ID#	County	Quadrangle	NRHP Status
44SY218	Surry	Hog Island	Undetermined
-	James City / Surry	Surry	Eligible (CAJO)

(83 FR 19108; LBGI. 2001; LBGI. 2013; 83 FR 19108; VSCC. 2015)

a. Due to the large number of sites (579) within six miles of SPS, only sites that are potentially eligible, determined eligible, or within the SPS site boundary or in very close proximity are included.

Table E3.8-2 NRHP-Listed Sites within a 6-Mile Radius of SPS

Resource Name	County	Quadrangle	NRHP Listed	Distance from SPS[a]
Fort Huger	Isle of Wight	Bacons Castle	2008	4.5
Carter's Grove	James City	Hog Island	1969	4.9
Jamestown National Historic Site Jamestown Island Jamestown Island Historic District Colonial Parkway Historic District	James City	Hog Island/Surry	1966	3.2-3.6
Kingsmill Plantation	James City	Hog Island	1972	4.3
Governor's Land Archaeological District	James City	Surry	1973	Address restricted[b]
Bacon's Castle	Surry	Bacons Castle	1966	4.0
Melville	Surry	Surry	1980	5.3
Pleasant Point (Crouches Creek Plantation)	Surry	Surry	1976	4.3
Rich Neck Farm	Surry	Surry	1980	4.0
Old Brick Church (Lower Southwark Church)	Surry	Bacons Castle	1986	4.5
Chippokes Plantation Historic District (Chippokes State Park)	Surry	Hog Island	1969	2.6
Matthew Jones House	Newport News City	Yorktown	1969	5.2
Fort Crafford / Crafford House	Newport News City	Yorktown	1974	5.1

(NPS. 2018)

a. Distances are approximate and based on the SPS center point and NRHP location data.
b. Address not depicted on Figure E3.8-13 due to confidential nature of prehistoric site locations.

E3.9 SOCIOECONOMICS

Socioeconomic descriptions are focused on Isle of Wight and Surry counties and the independent cities of Newport News and Williamsburg because approximately 60% of the permanent SPS workforce is located there, while the remaining workforce is dispersed throughout 30 surrounding counties located in Virginia, North Carolina, and New York (Table E2.5-1).

Refueling outages at SPS occur on an 18-month staggered cycle for Units 1 and 2 and historically have lasted approximately 30 days per unit. As presented in Section E2.5, there are approximately 1,000 to 1,500 contracted employees onsite during outages. Within a 50-mile region, there are several municipal areas, including Smithfield, Newport News, Williamsburg, Chesapeake, Norfolk, Newport News, and Hampton. These locations offer numerous motel, campground, and food service conveniences both north and south of SPS, and along the I-64 transportation corridor.

E3.9.1 EMPLOYMENT AND INCOME

The four geographic areas most influenced by SPS operations are Isle of Wight and Surry counties, and the independent cities of Newport News and Williamsburg, because these localities are where the highest percentage of SPS employees reside. Additionally, SPS is one of Dominion's assets on which property taxes are paid to Surry County. As presented in Section E3.11, the populations of these counties and cities are expected to increase during the proposed SLR operating term. Low-income populations and poverty thresholds for these counties and cities are described in Section E3.11.2.

The estimated employed population in Isle of Wight County in 2015 was 15,599 persons. The leading reported occupational sector was manufacturing, with approximately 20.2%, or 3,144 persons employed. This was followed by the government and government enterprises sector, with approximately 10.3%, or 1,611 persons employed; and the retail trade sector with approximately 8.7% or 1,358 persons employed. (BEA. 2017) The major area private sector employers include the Smithfield Packing Co., Keurig Green Mountain Inc., and International Paper (IWC. 2017a). The annual payroll in Isle of Wight County was approximately $1.8 billion in 2015, and the average wage per job was $44,266 (BEA. 2017). In 2015, per capita personal income was $50,643 (BEA. 2017), and the annual unemployment rate decreased from 5.2 in 2014 to 4.6 in 2015 (BLS. 2017).

The estimated employed population in Surry County in 2015 was 3,272 persons. The leading reported occupational sector was government and government enterprises, with approximately 16.8%, or 550 persons employed. This was followed by the construction sector, with approximately 9.9%, or 323 persons employed. (BEA. 2017) Major area employers include Dominion (electricity), S. Wallace Edwards & Son (hams), and Seward Lumber Company. The county's major enterprises are directly tied to natural resources. These include agribusiness, forestry products, quarrying, and natural water bottling. (SC. 2016c) The annual payroll in Surry County was approximately $2.7 million, and the average wage per job was $79,063 (BEA. 2017). In 2015 per capita personal income was $39,631 (BEA. 2017), and the annual unemployment rate decreased from 6.2 in 2014 to 5.2 in 2015 (BLS. 2017).

The estimated employed population in the independent city of Newport News in 2015 was 123,464 persons. The leading reported occupational sector was manufacturing, with approximately 21.2%, or 26,216 persons employed. This was followed by the government and government enterprises sector, with approximately 18.9%, or 23,302 persons employed; and the health care and social assistance sector, with approximately 10.7%, or 13,240 persons employed. (BEA. 2017) Located in the city and a contractor for the U.S. Navy, Newport News Shipbuilding is the largest industrial employer in Virginia and the largest shipbuilding company in the U.S. (NNS. 2017). Other major area employers include Northrop Grumman Shipbuilding and Fort Eustis. Both are tied to national defense. The U.S. military accounts for 76% of the city's economic base. (NN. 2016) The annual payroll in Newport News was approximately $7.4 billion in 2015, and the average wage per job was $53,764 (BEA. 2017). In 2015, per capita personal income was $40,453 (BEA. 2017), and the annual unemployment rate decreased from 6.2 in 2014 to 5.4 in 2015 (BLS. 2017).

The estimated employed population of James City County and the independent city of Williamsburg in 2015 was 56,293 persons. The leading reported occupational sector was government and government enterprises with approximately 15.8%, or 8,867 persons employed. This was followed by the retail trade sector with approximately 11.0%, or 6,173 persons employed; and the health care and social assistance sector with approximately 9.5%, or 5,343 persons employed. (BEA. 2017) The city of Williamsburg relies on two industries, education and tourism, as primary sources of employment. The College of William and Mary is the largest employer. The college employs several thousand workers (and private contractors employ hundreds more). Along with the college, the city's largest employers include the Colonial Williamsburg Foundation, Aramark Campus LLC, Williamsburg-James City County Schools, and the City of Williamsburg. (Williamsburg. 2016) The annual payroll in James City County and the city of Williamsburg was approximately $5.2 billion in 2015, and the average wage per job was $38,721 (BEA. 2017). In 2015 per capita personal income was $58,504 (BEA. 2017), and the annual unemployment rate decreased from 7.3% in 2014 to 6.3% in 2015 (BLS. 2017).

E3.9.2 HOUSING

Between 2010 and 2015, the population in Isle of Wight County had a small increase of 3% (Table E3.11-2). As seen in Table E3.9-1, total available housing within the county grew by 21.3% between 2000 and 2010, and by 2.5% between 2010 and 2015. The vacancy rate was 2.0% between 2010 and 2015 which kept up with population growth during the same time period. This would indicate that enough housing was available to keep up with the increase in population. The median home values in Isle of Wight County increased significantly (approximately 98.5%) from 2000 to 2010, but was estimated to slightly decrease in 2015 by approximately 5%. The median rent for the county increased 41.4% between 2000 and 2010, and 35.1% between 2010 and 2015. (USCB. 2016e)

The population in Surry County, Virginia, was estimated to decrease approximately 5% from 2010-2015 (Table E3.11-2). Conversely, the total available housing for the county illustrated a growth trend, increasing by 4.6% between 2000 and 2010, and 1.5% from 2010-2015 (Table E3.9-1). The resulting vacancy rate for the county for the 2010-2015 period increased by 5.8%, indicating that enough housing was available for the population. The median housing values declined between 2010 and 2015 by 1.6%, but median rent rose during the same time period by 35.6%. (USCB. 2016e)

Between 2010 and 2015 the population for the independent cities of Newport News and Williamsburg, Virginia, both illustrated small increases at 1% and 7% respectively (Table E3.11-2). As noted in Table E3.9-1, between 2000 and 2010, total available housing in these cities has increased, with Newport News at 2.8% and Williamsburg at 33.4%. Between 2010 and 2015, Newport News increased by 1.3%, but Williamsburg decreased by 3%. The vacancy rate for Newport News grew by 3.2% between 2010 and 2015, and the Williamsburg vacancy rate declined by 2.1%. This would indicate that there is enough housing available for the increasing population. After a sharp increase in housing values between 2000 and 2010, both Newport News and Williamsburg median housing values have declined between 2010 and 2015 by 2.7% and 7%, respectively. The median rent increased between 2010 and 2015 for Newport News (9.4%) and Williamsburg (10.6%). (USCB. 2016e)

E3.9.3 WATER SUPPLY AND WASTEWATER

As described in Section E3.6, SPS gets potable water from a series of groundwater wells and is not connected to a municipal system. As seen in Figure E3.1-1, the site also has an onsite sewage treatment plant for disposal of sanitary waste.

E3.9.3.1 Water Supply

Isle of Wight County (population 35,270 in 2010) has municipal water supply systems in the towns of Smithfield and Windsor. The major water sources in the county are groundwater wells and purchased water. Approximately 16,509 people in the county use private groundwater wells for residential water supply. Overall, Isle of Wight County reported using approximately 43.79 MGD in 2010, with water use demand projected to rise to 55.00 MGD by 2040. Of this total, community water systems used approximately 2.999 MGD in 2010, with use currently projected to rise to 10.295 MGD by 2040. Small self-supplied users (under 300,000 gallons per month) used approximately 1.369 MGD in 2010, which is expected to rise to 1.900 MGD by 2040. While population and water demand are projected to increase during the requested period of extended operation, existing water sources are expected to meet increasing needs. (VDEQ. 2017b)

Surry County (population 7,058 in 2010) has municipal water supply systems in the towns of Surry, Dendron, and Claremont. The major water sources in the county include groundwater wells and the James River. Approximately 6,634 people use private groundwater wells for residential water supply. Overall, Surry County reported using approximately 18.59 MGD in 2010, with water use demand projected to rise to approximately 18.94 MGD by 2040. Of this total, community water systems used approximately 0.135 MGD in 2010, with use currently projected to rise to 0.196 MGD by 2040. Small self-supplied users (under 300,000 gallons per month) used approximately 0.463 MGD in 2010, which is expected to rise to 0.643 MGD by 2040. While population and water demand are projected to increase during the requested period of extended operation, existing water sources are expected to meet increasing needs. (VDEQ. 2017b)

The city of Newport News' (population 180,719 in 2010) major water sources are the Chickahominy River and the Lee Hall, Harwood's Mill, and Diascund reservoirs. Newport News Waterworks provides water service to approximately 400,000 people in the peninsula sub-region of Hampton Roads, including the cities of Hampton, Poquoson, and Newport News, and portions of James City and York counties. There are no reported users of private groundwater wells for residential water supply. The Newport News Waterworks reported that overall, the cities of Newport News, Hampton, and Poquoson used approximately 60.19 MGD in 2010, with water use demand projected to rise to 70.08 MGD by 2040. Of this total, community water systems used approximately 51.625 MGD in 2010, with use currently projected to rise to 61.510 MGD by 2040. Small self-supplied users (under 300,000 gallons per month) used approximately 0.008 MGD in 2010, which is expected to rise to 0.010 MGD by 2040. While population and water demand are projected to increase during the requested period of extended operation, existing water sources are expected to meet increasing needs. (VDEQ. 2017b)

The city of Williamsburg's (population 14,068 in 2010) major water sources include the Waller Mill Reservoir and groundwater wells. There are no reported users of private groundwater wells for residential water supply. Overall, the city of Williamsburg reported using approximately 4.04 MGD in 2010, with water use demand projected to rise to 5.67 MGD by 2040. Of this total, the community water system used approximately 3.340 MGD in 2010, with use currently projected to rise to 4.971 MGD by 2040. While population and water demand are projected to increase during the requested period of extended operation, existing water sources are expected to meet increasing needs. (VDEQ. 2017b)

E3.9.3.2 Wastewater

The Hampton Roads Sanitation District (HRSD) handles much of the sanitary waste treatment and wastewater disposal in the SPS region. The HRSD service area includes 18 cities and counties of southeastern Virginia, an area of over 3,087 square miles with a population 1.7 million, including Isle of Wight and Surry counties and the cities of Newport News and Williamsburg. (HRSD. 2017)

Wastewater flows from municipal piped systems to HRSD's interceptor system of pipes and pump stations to HRSD treatment plants. HRSD operates nine major treatment plants in Hampton Roads and four smaller plants on the middle peninsula with a combined capacity of 249 MGD. (HRSD. 2017)

The HRSD has a number of ongoing construction projects (Newport News and Williamsburg) along with initiatives to increase the level of service for its customers. These include the development of a regional wet weather management plan, with modeling of local systems to identify potential projects to enhance capacity of the regional system. The HRSD also has the Sustainable Water Initiative for Tomorrow plan, with the purpose of purifying water at seven of the HRSD treatment plants and, rather than discharging it into local waterways, using it to replenish eastern Virginia's groundwater supply. Because of the many environmental benefits offered by this plan, HRSD is proposing prioritization of construction at the treatment plants through 2030. (HRSD. 2017)

Locally, the town of Surry has a central sewerage system with a 60,000 gpd treatment capacity. A county-owned 65,000 gpd system serves the county's industrial park and has the capacity to be increased to 130,000 gpd. (SC. 2016c)

E3.9.4 COMMUNITY SERVICES AND EDUCATION

Isle of Wight County has one public school district. Based on the 2014-2015 school year, there were nine public schools in the county with 5,579 students. The student/teacher ratio was 14.78. There is one private school in the county, Isle of Wight Academy, with an additional 676 students. There are no colleges or universities reported for the county. (NCES. 2016)

The Surry County Public School District is comprised of three public schools, with a total of 867 students in the 2014-2015 school year. These three schools include one elementary school (grades pre-kindergarten to 4), one middle school (grades 5 through 8), and one high school (grades 9 through 12), all of which are located in the town of Dendron. There are no private schools reported for the county. The student/teacher ratio for Surry County was 8.42. There are no colleges or universities reported for Surry County. (NCES. 2016) Although a number of public and private higher education facilities are located in neighboring counties and cities, the closest is the College of William and Mary in Williamsburg, Virginia (SC. 2016c).

In the independent city of Newport News, there is one school district: Newport News City Public Schools. Based on the 2014-2015 school year, there were 46 schools in the Newport News City Public School District, with a total of 29,547 students. The student/teacher ratio for this district was 15.50. (NCES. 2016) The Enterprise Academy/Newport News City is a regional education services agency. It includes one school, the Enterprise Academy, an alternative school that serves students from Newport News, Hampton, York County, Poquoson, and Williamsburg-James County. (Enterprise Academy. 2016) There are 15 private schools in the city with an additional 2,346 students. The city also has several higher education institutions, including one four-year public university, Christopher Newport University, and eight 2- and 4-year private colleges. (NCES. 2016)

The independent city of Williamsburg is served by one school district, the Williamsburg-James City Public School District. The district supports both Williamsburg and James City County and hosts 15 public schools with a total of 11,389 students in the 2014-2015 school year. Two of these schools are located within the independent city of Williamsburg: Berkeley Middle School (908 students) and Matthew Whaley Elementary (521 students). The student/teacher ratio for the district was 13.72. There is one private school, Walsingham Academy, which serves 521 students. Williamsburg also hosts one 4-year public university, the College of William and Mary, which is the second oldest college in the nation. (NCES. 2016; WM. 2016)

Isle of Wight County is served by several state and local law enforcement agencies. The Isle of Wight sheriff's office serves the county as the primary law enforcement agency, but primary law enforcement within Smithfield and Windsor independent cities is provided by their local police departments. Additionally, the county maintains mutual aid agreements with these two cities and the City of Franklin Police Department. (IWC. 2016b) A number of health care services and providers are located within Isle of Wight County, and are also accessible in neighboring cities and counties (IWC. 2017b). The Riverside Diagnostic Center is a no-bed facility located in Smithfield and offers diagnostic services on weekdays (RDC. 2017).

Law enforcement in Surry County is provided by the sheriff's office (SC. 2017a). The county operates a health department and there is a volunteer/paid rescue squad. There is also a home health care agency in Surry County. Horizon Health Service, Inc. operates the Surry Medical Center, a full-time family practice facility that accepts insured and uninsured patients on a sliding fee scale. Hospital services are available in Petersburg, Williamsburg, Richmond, Hopewell, and the Hampton Roads area (all within a one-hour drive). (SC. 2016c) The Surry Medical Center (a no-bed facility) is located in Dendron, Virginia, and is open on weekdays (SMC. 2016).

Newport News is served by the city's sheriff's office and the Newport News Police Department (USACops. 2016). The city reported a total of 416 officers in 2015, with an estimated officer/population ratio of 22.7 officers per 10,000 people (Governing. 2016). Newport News has five healthcare/hospital facilities: Mary Immaculate Hospital (110 staffed beds), Hampton Roads Specialty Hospital (24 staffed beds), McDonald Army Health Center, Riverside Regional Medical Center (450 staffed beds), and Riverside Rehabilitation Institute (County Office. 2016; RRMC. 2017; VHHA. 2016).

The independent city of Williamsburg is served by the Williamsburg-James City County Sheriff's Office and the Williamsburg Police Department (USACops. 2016). Three hospitals serve the city's residents: Riverside Doctors' Hospital, Eastern State Hospital, and Sentara Williamsburg Regional Medical Center (County Office. 2016). The Eastern State Hospital has a staff of over 900 and 300 staffed beds (ESH. 2016). The Riverside Doctors' Hospital opened in 2013 and is licensed for 40 rooms consisting of medical, surgical, and intensive care (RDH. 2016). The Sentara Williamsburg Regional Medical Center is licensed for 145 staffed beds (VHHA. 2016).

The independent city of Newport News has the largest fire department, with 14 stations and a staff of 413 active paid firefighters. This department serves a 2015 population of 182,385, with a ratio of 2.3 firefighters per 1,000 residents. Isle of Wight County has 12 stations, with a staff of 87 full-time paid firefighters and 195 active volunteer firefighters. Serving a 2015 population of 36,314, the ratio of firefighters per 1,000 residents was 7.8. Surry County is served by four stations, all of which rely on volunteers. With a staff of 59 active voluntary firefighters serving a 2015 population of 6,709, the ratio of firefighters to 1,000 residents was 8.8. Williamsburg has one fire station staffed by 35 full-time paid firefighters and 25 active volunteer firefighters. The 2015 city population was 15,052; therefore, the ratio of firefighters to 1,000 residents was 4.0. (USCB. 2016a; USFA. 2016)

E3.9.5 LOCAL GOVERNMENT REVENUES

SPS pays annual property taxes to Surry County. The county's total revenues from the general fund were $25.2 million for the fiscal year (FY) ended June 30, 2016 (FY16). General fund revenues decreased slightly by 0.7%, or $186,833, in FY16. General property taxes, the largest source of revenue, were $21.1 million, including public service corporation taxes ($13.0 million), real estate taxes ($6.5 million), and personal property taxes ($1.2 million). Almost 84% of the county's revenue from governmental activities is derived from property taxes. The second largest local source of revenue is other local taxes, comprised primarily of local sales tax, business and vehicle licenses, utility consumption taxes, and recordation tax. Intergovernmental revenues from the state and federal government are also included in the county total revenue. (SC. 2017b)

The county's total general fund expenses of $24.0 million for FY16 covered a wide range of services. The largest program receiving county funding was education, with 50.61%, or $12.15 million, in payments to the school system. This was followed by 12.36%, or $2.96 million, for public safety, and 9.75%, or $2.34 million, for health and welfare services. The remainder was expended across a variety of programs, including public works, parks, recreation, and cultural programs, etc. Total county expenditures on programs has been consistent over the years, although during FY15 the county issued debt of $18.1 million through the Virginia Resources Authority. Of this amount, $12.7 million paid off the Series 2006 and 2007 debt for the schools and Government Center renovations and construction, resulting in a significant interest savings. The remaining $5.4 million is restricted to four county capital projects. Because of this one-time payoff of existing debt, expenses for the FY ending June 30, 2016, would be significantly skewed when compared to FY15 expenses. (SC. 2017b)

The assessed valuation of Dominion Energy Virginia property in Surry County was approximately $1.9 billion in 2016 (SC. 2017b). As seen in Table E3.9-2, in 2016, Dominion's property tax payments to Surry County represented roughly 65% of the total county property tax revenues.

Dominion's property tax payments remained consistent between 2012 and 2016, and there were no adjustments to these payments caused by reassessments and other actions that resulted in notable increases or decreases. At this time, Dominion does not anticipate any future changes in tax laws, rates, assessed property value, or any other adjustments that could result in notable future increase or decrease in property taxes or other payments to Surry County.

In addition, Dominion actively participates in supporting SPS employees volunteering time to local charitable programs such as the United Way. Through employee-based special event fundraising, donations from Dominion support local programs in SPS surrounding counties (e.g., area fire departments and volunteer rescue squads, Veterans of Foreign Wars, etc.).

E3.9.6 TRANSPORTATION

Transportation in the SPS region includes a rural and urbanized road network, rail, airport, passenger/car ferry, and shipping transportation on the James River.

The primary road network in the area is shown in Figures E3.1-3 and E3.1-4. I-95 is a major north-south interstate that traverses the 50-mile region, running past Richmond south into North Carolina. Running east-west across Surry County, SR 10 connects to I-85, I-95, and I-295. South of the James River, U.S. 460 provides an east/west four-lane corridor between Petersburg (Fort Lee) and Hampton Roads, Virginia. North of the James River, I-64 runs northwest to southeast between the cities of Richmond and Newport News/Hampton. The Jamestown-Scotland Ferry accommodates travel to U.S. 60 and I-64 (north), and U.S. 460 (south) via SR 31. (SC. 2016c)

Within the vicinity, road access to SPS is via SR 650 Hog Island Road (SR 650), which is a two-lane, north-south paved road. SR 650 intersects with SR 10 Colonial Trail (approximately five miles south of the plant), which is a predominately east-west, two-lane paved road. The Virginia Department of Transportation (VDOT) average annual daily traffic (AADT) volumes for state roads in the six-mile radius that link to SPS are listed in Table E3.9-3. Over the years, the traffic volume counts taken on SR 650 in Surry County south of the plant have revealed little fluctuation in traffic flow. The most recent AADT count in 2015 on SR 650 was 2,200. The AADT count for SR 10 has also been consistent over the years, with a reported volume of 3,900 in 2015. (VDOT. 2016b)

The U.S. Transportation Research Board has developed a commonly used indicator called level of service (LOS) to measure how well a highway accommodates traffic flow. LOS is a qualitative assessment of traffic flow and how much delay the average vehicle might encounter during peak hours. LOS categories are listed and defined in Table E3.9-4.

As of 2003, SR 650 carried an LOS designation of "A". In the vicinity of SPS, SR 10 carried an LOS designation of "C" (SPS. 2001, Section 2.10.2). Due to the rural nature of the area and limited access to the SPS site, no additional transportation studies have taken place and no recent LOS assignment updates were available for local road segments. To provide a current evaluation of LOS for SR 650 and SR 10, the known AADT traffic volumes were compared to the estimated capacity of a two-lane highway, as presented in the highway capacity manual. The manual notes that the capacity of a two-lane highway under base conditions is 1,700 passenger cars per hour (pc/h) in one direction, with a limit of 3,200 pc/h for the total of the two directions. Because of the interactions between directional flows, when a capacity of 1,700 pc/h is reached in one direction, the maximum opposing flow would be limited to 1,500 pc/h. (TRB. 2010) Based on 2015 AADT recorded volumes,

SR 650 has a reported flow rate of 92 pc/h on average and SR 10 has a reported flow rate of 163 pc/h on average. Because traffic flow has stayed consistent over the years, and the base condition capacities for two-lane roads are not exceeded by the current average traffic conditions, there should be ample traffic capacity on SR 650 and SR 10 in the road area associated with the plant. Therefore, applying the LOS traffic conditions defined in Table E3.9-4, SR 650 should remain within an LOS "A" range of conditions and SR 10 should still remain within an LOS "C" range of conditions.

According to the Crater Planning District Commission, of which Surry County is a member, road improvements have been proposed to the VDOT for SR 650 and SR 10 in the 2015 six-year transportation improvement program priority list. These would include installation of no passing and horizontal alignment signs at appropriate locations along SR 650 and installation of advance intersection warning signs at the intersection of SR 10 and SR 650. (Crater PDC. 2017)

As presented in Section E3.1, the James River, with a shipping channel for ships and barges, passes within 2.3 miles of SPS. The only railway within 10 miles is the CSX Transportation Railway, which is six miles at its nearest approach to SPS. The site is bordered on the east and west by the James River and is accessible by water craft at the east side pier. Newport News/Williamsburg International Airport is the nearest full-service commercial airport, located approximately 11 miles east-southeast from SPS.

E3.9.7 RECREATIONAL FACILITIES

As depicted in Figure E3.1-5, several historic and recreational areas fall within the vicinity of SPS. These include a national historical park, several state historical parks and WMAs, several local historic sites, themed amusement parks, and local parks.

SPS offers exhibits at its Surry Nuclear Information Center and tours of the facility for school groups and the general public. According to Dominion, the site received a combination of tour groups, walk-in visitors, and company visitors totaling 8,803 in 2014 and 8,862 in 2016.

The Hog Island WMA is located in the vicinity of SPS and consists of three tracts of land totaling 3,908 acres. In Surry County, the Hog Island tract is located north of the SPS boundary at the end of the peninsula (Gravel Neck), while the Carlisle tract is located on the peninsula's east side. The Stewart tract is located in Isle of Wight County. The tracts, characterized by a mixture of flat, open land, tidal marshes, wetlands, ponds, pine forest, and upland areas, were established to preserve favorable habitat for waterfowl, native wildlife, and wetland species. Recreational activities include permitted hunting and fishing, wildlife viewing and photography, and bird watching. During the permitted hunting season, Hog Island WMA management limits site access to the public for non-hunting activities. Visitation data were not available. (VDGIF. 2016p)

The Chippokes Plantation State Park, originally established as a farm in 1619, is approximately 2.7 miles southwest of SPS in Surry County. The park encompasses the historic plantation site, which is also known as one of the oldest continually farmed plantations in the country. Along with a museum and visitors center, the park offers a variety of recreational activities including tours, camping, fishing, biking, hiking, horseback riding and swimming. According to the 2012 Chippokes Plantation State Park Master Plan Executive Summary, the park received 78,303 visitors in 2010 and expects to increase visitation with future renovations and expansion. (VDCR. 2017)

The Colonial National Historical Park stretches from York County, through a portion of Williamsburg and into James City County. The park includes Historic Jamestowne, approximately 5.4 miles northwest of SPS in James City County, which is the site of the first permanent English settlement in North America. The primary activities associated with Colonial National Historical park facilities include historic landmark tours, museums, retail, and nature programs. According to the NPS, the park received 3,335,060 visitors in 2014 and 3,343,909 in 2015 (NPS. 2017). Colonial Williamsburg reported ticket sales of 574,300 in 2015 (does not include non-paying visitors), which was an increase from a previous trend where visitation was in decline (CWF. 2016).

Other notable sites in the vicinity include Bacon's Castle, Old Brick Church, and Busch Gardens Williamsburg. Like the Colonial National Historical Park, the main visitor activities common to Bacon's Castle include historic tours and programs, museums, and nature programs (PV. 2016). The historic cemetery and ruins of the Old Brick Church in Surry County are open for public viewing (SCVT. 2016). Busch Gardens Williamsburg in James City County is a theme park that offers a number of rides, shows, and attractions. The park received 2,699,000 visitors in 2014 and 2,780,000 in 2015 (TEA. 2016).

Table E3.9-1 Housing Statistics, 2000–2015

	Name	2000	2010	200-2010 Change	2015 Estimate	2010-2015 Change
County	**Isle of Wight County**					
	Total housing units	12,066	14,633	21.3%	15,001	2.5%
	Occupied units	11,319	13,718	21.2%	13,769	0.4%
	Vacant units	747	915	22.5%	1,232	34.6
	Vacancy rate (percent)	6.2%	6.3%	0.06%	8.2%	2.0%
	Median house value ($)	129,300	256,600[(a)]	98.5%	243,000	-5.3%
	Median rent ($/month)	502	710[(a)]	41.4%	959	35.1%
	Surry County					
	Total housing units	3,294	3,444	4.6%	3,497	1.5%
	Occupied units	2,619	2,826	7.9%	2,668	-5.6%
	Vacant units	675	618	--8.4%	829	34.1%
	Vacancy rate (percent)	20.5%	17.9%	-2.5%	23.7%	5.8%
	Median house value ($)	88,100	171,800[(a)]	95.0%	169,000	-1.6%
	Median rent ($/month)	402	607[(a)]	51.0%	823	35.6%
Independent City	**Newport News**					
	Total housing units	74,117	76,198	2.8%	77,175	1.3%
	Occupied units	69,686	70,664	1.4%	69,073	-2.3%
	Vacant units	4,431	5,534	24.9%	8,102	46.4%
	Vacancy rate (percent)	6.0%	7.3%	1.3%	10.5%	3.2%
	Median house value ($)	96,400	198,500[(a)]	105.9%	193,100	-2.7%
	Median rent ($/month)	559	881[(a)]	57.6%	964	9.4%
	Williamsburg					
	Total housing units	3,880	5,176	33.4%	5,020	-3.0%
	Occupied units	3,619	4,571	26.3%	4,538	-0.7%
	Vacant units	261	605	131.8%	482	-20.3%
	Vacancy rate (percent)	6.7%	11.7%	5.0%	9.6%	-2.1%
	Median house value ($)	212,000	344,800[(a)]	62.6%	320,600	-7.0%
	Median rent ($/month)	616	988[(a)]	60.4%	1,093	10.6%

(USCB. 2016e)

a) 2006–2010 American Community Survey five-year estimates.

b) 2011–2015 American Community Survey five-year estimates.

Table E3.9-2 Property Tax Payments to Surry County, 2012–2016

Year	Total Property Tax Revenues (USD)	Property Tax Paid by SPS (USD)	Percent of Total Property Tax	Operating Budget (USD)
2012	19,964,237	12,852,566	65	21,724,307
2013	21,012,899	13,159,018	63	22,593,502
2014	21,140,727	13,026,102	62	22,355,581
2015[(a)]	21,119,861	12,865,052	61	35,956,129
2016	20,939,138	13,604,454	65	23,997,697

(SC. 2017b; SC. 2017cSC; SC. 2017d; SC. 2017e; SC. 2017f)

a. Surry County issued debt through the Virginia Resources Authority. Operating monies were used to pay off school debt and Government Center renovations and construction. The remainder was restricted to funding four county capital projects.

Table E3.9-3 Total Average Annual Daily Traffic Counts on State Routes Near SPS

Route	Location	2000	2001	2003	2005	2006	2010	2012	2015
SR 650 Hog Island Road	SR 617 Bacons Castle Terrace to SR 650 Dead End	NC	1,900	NC	2,300	NC	2,000	NC	2,200
SR 10 Colonial Trail	SR 617 Bacons Castle Terrace to Isle of Wight County Line	NC	3,800	NC	3,700	NC	3,700	NC	3,900

NC = no count

AADT for 2001, 2005, 2010, and 2015 from VDOT. 2016b.

Table E3.9-4 Level of Service Definitions

Level of Service	Conditions
A	Free flow of the traffic stream; users are mostly unaffected by the presence of other vehicles.
B	Free flow of the traffic stream, although the presence of other vehicles becomes noticeable. Drivers have slightly less freedom to maneuver.
C	The influence of the traffic density on operations becomes marked and queues may be expected to form. The ability to maneuver with the traffic stream is clearly affected by other vehicles.
D	The ability to maneuver is severely restricted due to traffic congestion. Travel speed is reduced by the increasing volume. Only minor disruptions can be absorbed without extensive queues forming and the service deteriorating.
E	Operations at or near capacity, an unstable level. The densities vary, depending on the free-flow speed. Vehicles are operating with the minimum spacing (or gaps) for maintaining uniform flow. Disruptions cannot be dissipated readily, often causing queues to form and service to deteriorate to LOS F.
F	Forced or breakdown of flow. It occurs either when vehicles arrive at a rate greater than the rate at which they are discharged or when the forecast demand exceeds the computed capacity. Queues form behind these breakdowns. Operations within queues are highly unstable, with vehicles experiencing brief periods of movement followed by stoppages.

(TRB. 2010)

E3.10 HUMAN HEALTH

E3.10.1 MICROBIOLOGICAL HAZARDS

The NRC considered health impacts from thermophilic organisms posed to both the public and plant workers because ideal conditions for thermophilic bacteria can result from nuclear facility operations and discharges. The NRC designated public health impacts resulting from thermophilic organisms a Category 2 issue requiring plant-specific analysis. (NRC. 2013a) Information considered includes whether the plant discharges to a small river, and whether the discharge characteristics are conducive to the survival of thermophilic organisms in public waters (SPS. 2001, Section 4.12).

The James River in the vicinity of SPS is approximately 2.5 miles wide (Figure E3.1-3). It is a tidally influenced freshwater river just upstream of the Gravel Neck Peninsula, and a saline estuary downstream (Section E3.6).

The discharges associated with SPS outfall would be of sufficient temperature for the survival of thermophilic organisms during the late summer months (SPS. 2001, Section 3.1.2.1). Thermophilic microorganisms thrive at temperatures of 122°F or more, with a tolerance minimum of 68°F and a maximum of 158°F (NRC. 2013a). The SPS discharge permit (Attachment B) limits waste heat rejected to the James River estuary from SPS operations, but does not mandate the reporting of discharge temperatures. Dominion conducted extensive pre- and post-operational studies on thermal effects of SPS on the James River. Based on research and monitoring studies over a seven-year period (including computer modeling, field investigations of water quality and aquatic biota, field measurements of water temperatures, and electronic measurements of water temperatures in the SPS intake and discharge canals), temperatures greater than 90°F at the discharge normally occur only in June, July, August, and September when SPS is operating at or near full capacity (SPS. 2001, Section 3.1.2.1).

Late summer effluent temperatures are reported to range between 92.8-99.9°F within the 2,900-foot discharge canal when the SPS units are running at or near full power. Once discharged into the estuary, thermal effluent dispersion rapidly reduces outfall temperatures to or near ambient levels. Effluent temperatures immediately outside the discharge canal decrease 1-2°F with every 1,000 feet from the mouth of the discharge canal. Temperatures were rarely more than 5°F above ambient river temperatures at distances of 3,000 feet from the outfall. (SPS. 2001, Section 3.1.2.1) Both stationary recorders and monthly boat surveys illustrated excess temperatures covered less than 30% of the river surface adjacent to the discharge point, and the thermal plume remained close to shore (NRC. 2002a, Section 4.1.3).

The discharge outfall is located approximately six miles upstream of the SPS intake canal, within an area surrounded by rock jetties that project perpendicularly from the shoreline and extend 1,100 feet into the James River estuary (SPS. 2001, 3.1.2.1). Virginia Code 20-1060-10 ET SEQ §28.2-106.2 delineates a restricted access area encompassing the entire discharge canal from the jetties at its discharge pipe outlet back to the plant canal. No one may enter this restricted area without prior authorization from the marine police. (VMRC. 2011)

Given the size of the river, the saline and tidal influence of the estuary, the documented reduction in water temperatures surrounding the effluent discharge point, and regulatory restrictions placed on public access to the waters adjacent to the discharge structures, microbiologic hazards resulting from public contact with potentially contaminated waters would not be an anticipated issue for SPS.

Microbiological hazards to plant workers is designated a category 1 issue. The GEIS discussion of microbiological hazards focuses on the thermophilic microorganisms Legionella spp., which can be a hazard in cooling towers, and the pathogenic amoeba, Naegleria fowleri, which can be a hazard in cooling water discharges (NRC. 2013a, Section 3.9.3). Naegleria spp. is ubiquitous in nature and can be enhanced in heated water bodies at temperatures ranging from 95-106°F or higher. Naegleria is rarely found in water cooler than 95°F, and infection rarely occurs in water temperatures of 95°F or less. (NRC. 2013a, Section 3.9.3.1)

Exposure to Legionella spp. from power plant operations is a potential problem for a subset of the workforce. Plant personnel most likely to come in contact with Legionella aerosols would be those who dislodge biofilms, where Legionella are often concentrated, such as during the cleaning of condenser tubes and cooling towers (NRC. 2013a, Section 3.9.3.3). Oxidizing biocides are utilized to control fouling of the cooling system components (including condenser tubes) at SPS, which limit potential survival of anaerobic thermophilic organisms and opportunities for plant worker exposure (SPS. 2001, Section 3.1.2.1). In addition, industrial hygiene practices are utilized to minimize the potential for plant worker exposure per federal and state regulatory requirements (NRC. 2013a).

E3.10.2 ELECTRIC SHOCK HAZARDS

As presented in Section E2.2.5 and depicted on Figure E2.2-5, all in-scope transmission lines are located completely within the SPS property boundary. Thus, no induced shock hazards would exist for the public, due to restricted site access.

At SPS, nine transmission lines travel through one of two corridors connecting SPS to the transmission system. For the initial license renewal ER, the in-scope transmission lines were determined to slightly exceed the applicable shock prevention provisions of the National Electric Safety Code (NESC). (SPS. 2001, Section 4.13) Dominion calculated field strength and induced current for the limiting-case of each transmission line. The analysis showed the induced short-circuit current for four of the nine transmission lines marginally exceeded the NESC 5-milliamperes (mA) standard with a result of approximately 5.07 mA. This result has an assumed

voltage of 5% above the nominal value. All limiting-case induced currents are within the 5-mA root mean square limit, when the nominal voltages are assumed. For the 2001 analysis, NRC determined electric shock potential for the evaluated lines was small and did not warrant mitigation measures because the calculated currents were larger than the amount that the limiting-case induced currents exceeded the NESC limits. (NRC. 2002a, Section 4.2.1) To ensure onsite and plant worker safety, Dominion incorporated provisions within its maintenance and surveillance procedures to provide assurance that design ground clearances will not change (SPS. 2001, Section 4.2).

This 2001 analysis did not include the two 230-kV lines between the GNCTS and the SPS switchyard, because their operation was considered independent of SPS operations (SPS. 2001, Section 4.13). They too are located completely within the SPS property boundary and would not result in shock hazards to the general public. However, they are not in-scope transmission lines for SPS.

The transmission lines considered in-scope for this ER are limited to those within the SPS site and connect the plant (Units 1 and 2) to the first switchyard where electricity is fed into the regional power distribution system at the substation, as well as the transmission lines that feed the plant from the grid during outages (Figure E2.2-5).

Dominion adheres to NESC code compliance requirements for shock hazard avoidance through implementation of the Dominion engineering manual (Dominion. 2017c), the 2017 Dominion Blue Book (Dominion. 2017d), and various training materials addressing the proper construction utilizing NESC measurements. These guidance documents ensure all necessary mitigation measures are incorporated for maintaining worker and visitor safety through design ground clearances and other shock prevention measures applicable to the in-scope transmission lines.

E3.10.3 RADIOLOGICAL HAZARDS

The SPS radiological environmental monitoring program (REMP) has been conducted since 1970. This program carefully monitors and documents radiological impacts to the members of the public and site employees by measuring radiation and radioactive materials with potential exposure pathways and confirms measurable concentrations of radioactive effluent releases do not exceed expected concentrations within the environment. Dominion monitors radioactivity levels annually by collecting samples of air, water, silt, shoreline sediment, milk, aquatic biota, and food products, and collects direct radiation exposure using thermoluminescent dosimetry at various sampling locations for each media within a 20-mile radius of the plant. Control samples are collected from areas not

subject to the influence of SPS or any other nuclear facility, while indicator samples are obtained from areas where environmental radiation levels could increase as a result of station operations. Dominion utilizes independent laboratory services from Teledyne Brown Engineering, Inc. (radioanalyses) and Global Dosimetry Solutions, Inc. (Mirion Technologies) (thermoluminescent dosimetry) as a part of Dominion's inter-laboratory comparison program, thus ensuring precise and accurate sample measurements. (SPS. 2013b; SPS. 2014a; SPS. 2015b; SPS. 2016d).

Dominion prepares an annual radiological environmental operating report for SPS, which contains a discussion of the results of the monitoring program performed for the previous year, and submits it to the NRC. The results for 2012-2015 did not detect radionuclides attributable to SPS. The 2012 sampling results are included in the following bullets and the subsequent years were indicated to be similar. Dominion concluded that as in previous years, the operation of SPS has created no adverse environmental effects or health hazards. (SPS. 2013b; SPS. 2014a; SPS. 2015b; SPS. 2016d)

- No station-related radioactivity was detected in air samples.
- Aquatic exposure pathway samples include well and river water, silt and shoreline sediments, crabs, fish, clams and oysters. Naturally occurring radionuclides such as potassium-40, thorium-228, and thorium-232 were detected at average environmental levels.
- Tritium was detected in one of eight river water samples at 6.7% of the NRC reporting level, that sample being from the discharge canal. No other man-made radionuclides were detected in river water.
- Silt samples indicated the presence of cesium-137 and naturally occurring radionuclides.
- Shoreline sediment contained no station-related radionuclides.
- The terrestrial exposure pathway includes milk and food products. Iodine-131 was not detected in any 2012 milk samples and has not been detected in milk prior to or since the 1986 Chernobyl accident. Strontium-90 was also not detected in milk samples in 2012 or 2013; but strontium-90 was detected in milk in 2014 and 2015, and this activity is attributable to past atmospheric nuclear weapons testing. No man-made radionuclides were detected in food product samples.
- The direct exposure pathway measures environmental radiation doses using thermoluminescent dosimetry. The thermoluminescent dosimetry results have remained relatively constant over the years.

As presented in Section E2.3, no license renewal-related refurbishment activities have been identified.

E3.10.3.1 Liquid and Gaseous Effluent Releases

A description of the SPS Units 1 and 2 radwaste system is presented in Section E2.2.6. Normal liquid and gaseous release pathways are continuously monitored to ensure that potential doses to the general public would remain within the allowable limits of 10 CFR 20 and 10 CFR 50, Appendix I. The controls for limiting the release of radiological liquid and gaseous effluents are described in Chapter 11 of the updated final safety analysis report (UFSAR). Offsite dose calculation methods are documented within Appendix 11A.4 of the UFSAR. Controls are based on: (1) concentrations of radioactive materials in liquid and gaseous effluents and projected dose; or (2) dose commitment to a hypothetical member of the public, with consideration of background levels and other source inputs. (SPS. 2016a)

Nuclear power plants are required to submit an annual report to the NRC that lists the types and quantities of radioactive effluents released into the environment, per 10 CFR 50.36(a). Based on review of SPS annual radioactive effluent release reports from years 2010-2015, doses to members of the public were negligible and in accordance with radiation protection standards identified within: (1) Appendix I to 10 CFR 50; (2) 10 CFR 20; and (3) 40 CFR 190 (SPS. 2011; SPS. 2012; SPS. 2013a; SPS. 2014b; SPS. 2015c; SPS. 2016e; SPS. 2017a).

Calculations for dose estimates to members of the public are based on radioactive gaseous and liquid effluent release data, and atmospheric and aquatic transport models. The 2015 annual radioactive effluent release report contains detailed information for each type of radioactive discharge and the resultant dose calculations (SPS. 2016e; SPS. 2017a).

The following summarizes the calculated dose to a member of the public from radioactive gaseous and liquid effluents released during reporting year 2015 (SPS. 2016e; SPS. 2017a):

- The total body dose to an offsite public member from radioactive liquid effluents is 3.43E-04 millirem (mrem), which is 5.72E-03 percent of the six-mrem dose limit specified within 10 CFR 50, Appendix I.
- The maximum organ dose to an offsite public member from radioactive liquid effluents is 2.96E-04 mrem, which is 1.48E-03 percent of the 20-mrem dose limit specified within 10 CFR 50, Appendix I.
- The maximum air dose due to Noble gasses with resulting gamma radiation in gaseous effluents is 5.30E-05 mrad, which is 2.65E-04 percent of the 20-mrad gamma dose criterion specified within 10 CFR 50, Appendix I.
- The maximum air dose from beta radiation in gaseous effluents is 1.38E-04 mrad, which is 3.45E-04 percent of the 40 mrad beta dose criterion specified within 10 CFR 50, Appendix I.
- The critical organ dose to an offsite public member from radiation in gaseous effluents as a result of I-131, I-133, H-3, and particulates with greater than eight-day half-lives is 9.26E-02 mrem, which is 3.09E-01 percent of the 30-mrem dose criterion specified within 10 CFR 50, Appendix I.

A hypothetical individual at the station site boundary exposed to liquid and gaseous effluents released from the station during 2015 would be exposed a maximum total body dose of 0.030 mrem (SPS. 2016d).

E3.11 ENVIRONMENTAL JUSTICE

E3.11.1 REGIONAL POPULATION

The GEIS presents a population characterization method based on two factors "sparseness" and "proximity" (NRC. 1996b, Section C.1.4). Sparseness measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Table E3.11-1 Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles.
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles.
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles.
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles.

(NRC. 1996b, Section C.1.4)

Proximity measures population density and city size within 50 miles and categorizes the demographic information as follows:

Table E3.11-2 Demographic Categories Based on Proximity

		Category
Not close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles.
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles.
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles.
Close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles.

(NRC. 1996b, Section C.1.4)

The GEIS then uses the following matrix to rank the population in the vicinity of the plant as low, medium, or high:

Table E3.11-3 GEIS Sparseness and Proximity Matrix

		Proximity			
		1	**2**	**3**	**4**
Sparseness	**1**	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	**3.4**
	4	4.1	4.2	**4.3**	**4.4**

Low Population Area Medium Population Area High Population Area

(NRC. 1996b, Figure C.1)

The 2010 census population and TIGER/Line data from the USCB were used to determine demographic characteristics in the vicinity of the site. The data were processed at the state, county, and census block levels using ArcGIS (USCB. 2016a; USCB. 2016f; USCB. 2016g). Census data include people living in group quarters such as institutionalized and non-institutionalized populations. Examples of institutional populations living in group quarters are correctional institutions (i.e., prisons, jails, and detention centers); nursing homes; mental (psychiatric) hospitals; hospitals or wards for the chronically ill; and juvenile institutions. Examples of non-institutional populations living in group quarters are group homes; college dormitories; military quarters; soup kitchens; shelters for abused women (shelters against domestic violence or family crisis centers); and shelters for children who are runaways, neglected, or without conventional housing.

The 2010 census data indicate that approximately 442,813 people live within a 20-mile radius of the SPS site, which equates to a population density of 352 persons per square mile (USCB. 2016g). Based on the GEIS sparseness index, the site is classified as Category 4 with greater than or equal to 120 persons per square mile within 20 miles.

The 2010 census data indicate that approximately 2,296,903 people live within a 50-mile radius of the site, which equates to a population density of 292 persons per square mile (USCB. 2016g). Six communities within a 50-mile radius have a population greater than 100,000 residents (Table E3.11-1). Based on the GEIS proximity index, the site is classified as Category 4, greater than or equal to 190 persons per square mile within 50 miles.

As illustrated in the GEIS sparseness and proximity matrix, the combination of sparseness Category 4 and proximity Category 4 results in the conclusion that the SPS site is located in a high population area.

The area within a 50-mile radius of the SPS site totally or partially includes 31 counties and 14 independent cities within the states of North Carolina and Virginia (Table E3.11-2). According to the 2010 census, the permanent population (not including transient populations) of the entire 31 counties and 14 independent cities was approximately 3,045,370 (Table E3.11-2). By 2053, the end of the proposed SLR operating term, the permanent population (not including transient populations) of the entire 31 counties and 14 independent cities is projected to be approximately 4,345,872. Based on 2010-2053 population projections, an annual growth rate of approximately 0.83% is anticipated for the permanent population in the 31 counties and 14 independent cities wholly or partially within a 50-mile radius (NCBM. 2016; UVA. 2016).

As shown in Table E3.11-2, the total population (including transient populations) of the 31 counties and 14 independent cities, which are totally or partially included within a 50-mile radius, is projected to be approximately 4,425,681 in 2053. The total population (including transient populations) within a 50-mile radius is projected to be 3,315,542 in 2053. (NCBM. 2016; USCB. 2016f; USCB. 2016g; UVA 2016; VNC 2016; VTA 2016)

The latest permanent population projections for North Carolina were obtained from the North Carolina Office of State Budget and Management (NCBM. 2016). The latest permanent population projections for Virginia were obtained from the University of Virginia the Weldon Cooper Center for Public Service (UVA. 2016). County-level permanent population values for the counties within a 50-mile radius are shown in Table E3.11-2. Transient data for the State of North Carolina were obtained from the "Visit North Carolina" website (VNC. 2016). Transient data for the Commonwealth of Virginia were obtained from the Virginia Tourism Corporation and the U.S. Travel Association (VTA. 2016; USTA. 2016).

SPS is located in Surry County. As shown in Table E3.11-2, the population of Surry County, Virginia, as reported in the 2010 census was 7,058. Based on Virginia's projected data set (Table E3.11-3), Surry County's projected permanent population for 2053 is expected to be 8,531 (UVA. 2016). Estimated projected populations and average annual growth rates for Isle of Wight County, Newport News City, and Williamsburg City are shown in Table E3.11-3.

Cities, towns, villages, and CDPs with centers falling within a 50-mile radius are listed in Table E3.11-1. The town nearest to SPS with a census-reported population is Scotland. As shown in Table E3.11-1, its 2010 population was reported at 203 residents.

There are four towns in Surry County for which the USCB provides population data. These are Claremont, Dendron, Scotland, and Surry, with estimated 2015 populations of 281, 328, 135, 235 residents, respectively. Six communities within a 50-mile radius have a population greater than 100,000: Chesapeake (approximately 33.5 miles); Hampton (approximately 21.6 miles); Newport News (approximately 19.7 miles); Norfolk (approximately 31.7 miles); Richmond (approximately 49.8 miles); and Virginia Beach (approximately 45.3 miles). These communities, located in the Commonwealth of Virginia, have a 2015 population of 235,429, 136,454; 182,385; 246,393; 220,289; and 452,745 residents, respectively. A total of four additional communities (Mechanicsville, Petersburg, Portsmouth, and Suffolk) within a 50-mile radius have a population greater than 25,000 (Table E3.11-1).

E3.11.2 MINORITY AND LOW-INCOME POPULATIONS

E3.11.2.1 Background

The NRC performs environmental justice analyses utilizing a 50-mile radius around the plant as the environmental "impact area." LIC-203 Revision 3 (NRC. 2013d) defines a geographic area for comparison as a 50-mile radius (also referred to as "the region" in this discussion) centered on the nuclear plant. An alternative approach is also addressed that uses an individual state that encompasses the 50-mile radius individually for comparative analysis as the "geographic area." Both approaches were used to assess the minority and low-income population criteria for SPS.

LIC-203 guidance suggests using the most recent USCB decennial census data. However, low-income data are collected separately from the decennial census and are available in five-year averages. The 2015 low-income and minority census population data and TIGER/Line data for North Carolina and Virginia were obtained from the USCB website and processed using ArcGIS software (USCB. 2016h). Census population data were used to identify the minority and low-income populations within a 50-mile radius of SPS. Environmental justice evaluations for minority and low-income populations are based on the use of USCB block groups for minority and low-income populations.

E3.11.2.2 Minority Populations

NRC procedural guidance defines a "minority" population as Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian/other Pacific Islander, some other race, two or more races, the aggregate of all minority races, Hispanic or Latino ethnicity, and the aggregate of all minority races and Hispanic ethnicity (NRC. 2013d, pages D-4 and D-5). The guidance indicates that a minority population is considered present if either of the following two conditions exists:

1. The minority population in the census block group exceeds 50%; or

2. The minority population percentage is more than 20% greater in the census block group than the minority percentage of the geographic area chosen for the comparative analysis.

To establish minimum thresholds for each minority category, the non-white minority population total for each state was divided by the total population in the state. This process was repeated with a 50-mile radius total minority population and 50-mile radius total population. As described in the second criterion, 20% was added to the minority percentage values for each geographic area. The lower of the two NRC conditions for a minority population was selected as defining a minority area (i.e., census block group minority population exceeds 50%, or minority population is more than 20% greater than the minority population of the geographic area). Any census block group with a percentage exceeding this value was considered a minority population. Minority percentages for North Carolina, Virginia, and a 50-mile radius, and the corresponding criteria, are shown in Table E3.11-4.

A minority category of "Aggregate of All Races" is created when the populations of all the 2015 USCB minority categories are summed. As shown in Table E3.11-4, the 2015 "Aggregate of All Races" category, when compared to the total population, indicates 42.9% of the population in a 50-mile radius are minorities. The "Aggregate of All Races" population percentages for North Carolina and Virginia are 30.5 and 31.0%, respectively. Using the alternate approach defined above, where a 50-mile radius is used as the geographic area, any census block group with a combined "Aggregate of All Races" population equal to or greater than 62.9% would be considered a minority population. Because 62.9% exceeds the 50% noted for Condition 1, defined above, the lower criterion (50%) would be used for the threshold. Similarly, each state was evaluated and a series of criteria for each race and low-income category were defined. When the two states are used as the geographic area, any census block group with an "Aggregate of All Races" population exceeding 50% in North Carolina or Virginia would be considered a minority population.

Because Hispanic is not considered a race by the USCB, Hispanics are already represented in the census-defined race categories. However, because Hispanics can be represented in any race category, some white Hispanics not otherwise considered minorities become classified as a minority when categorized in the "Aggregate and Hispanic" category.

The number of census block groups contributing to the minority population count were evaluated using the criteria shown in Table E3.11-4 and summarized in Table E3.11-5. The results of the evaluation are census block groups flagged as having a minority population(s). The resulting maps (Figures E3.11-1, E3.11-2, E3.11-3, E3.11-4, E3.11-5, E3.11-6, E3.11-7, E3.11-8, E3.11-9, E3.11-10, E3.11-11, E3.11-12, E3.11-13, E3.11-14, E3.11-15,and E3.11-16) depict the location of minority population census block groups flagged accordingly for each race or aggregate category. Because no block group met the criteria for the "American Indian" race category, no figures illustrating that race category were produced.

The percentage of census block groups exceeding the "Aggregate of All Races" minority population criterion was 36.6% when a 50-mile radius was used and 36.6% when the individual state was used as the geographic area (Table E3.11-5). For the "Aggregate and Hispanic" category, 41.7% of the census block groups contained a minority population when the region was used, and 41.7% of the block groups contained minority populations when the individual state was used (Table E3.11-5). The minority population values of the block groups were significantly reduced when races were analyzed individually.

The identified minority population closest to the SPS center point is located adjacent to the site: Block Group 511818601001. This census block group contained a total of 1,699 people, with 714 Black or African American, 22 Two or More Races, and 24 Hispanic or Latino individuals. Using either the individual state criteria or the regional criteria, the block group contains a Black or African American population. (USCB. 2016f; USCB. 2016h)

There are seven block groups within a six-mile radius that meet the criteria for a minority population. There are 711 identified minority population block groups located in, partially within, or adjacent to cities, municipalities, or USCB-defined urban areas. This leaves 48 block groups that do not fall within or are not immediately adjacent to cities, municipalities, or USCB-defined urban areas. (USCB. 2016d; USCB. 2016h)

As presented in Section E3.1.3, the Chickahominy Tribe, the Eastern Chickahominy Tribe, the Mattaponi Tribe, and the Pamunkey Tribe are located in the SPS region.

E3.11.2.3 Low-Income Populations

NRC guidance defines "low-income" using USCB statistical poverty thresholds for individuals or families (NRC. 2013d). As addressed above with minority populations, two alternative geographic areas (North Carolina and Virginia individually and the region) were used as the geographic areas for comparison in this analysis. The guidance indicates that a low-income population is considered present if either of the two following conditions exists:

1. The low-income population in the census block group exceeds 50%; or

2. The percentage of households below the poverty level in a block group is significantly greater (typically at least 20%) than the low-income population percentage of the geographic area chosen for the comparative analysis (i.e., individual state and region's combined average).

To establish minimum thresholds for the individual low-income category, the population with an income below the poverty level for the state was divided by the total population for whom poverty status is determined in the state. To establish minimum thresholds for the family low-income category, the family population count with an income below the poverty level for the state was divided by the total family population count in the state. This process was repeated for the regional population with an income below the poverty level and regional total population for whom poverty status is determined. As described in Condition 2, above, 20% was added to the low-income values for individuals and families and each geographic area. None of the geographic areas described in the first condition exceeded 50%.

As shown in Table E3.11-6, when the 2011-2015 census data category "income in the past 12 months below poverty level" (individual) is compared to "total population for whom poverty status is determined," 13.8% of the population in the region has an individual income below poverty level. In the states of North Carolina and Virginia, the percentages of individuals with an income below poverty level are 17.4% and 11.5%, respectively.

As shown in Table E3.11-6, North Carolina has an estimated 602,058 families and Virginia has an estimated 338,744 families living below poverty level. When the 2011-2015 census data family category "income in the past 12 months below poverty level" is compared to "total family count," 12.9% of the families within the region has an income below poverty level. In the states of North Carolina and Virginia, the percentages of the family population with an income below poverty level are 15.9% and 11.1%, respectively.

As an example, when the region is used as the geographic area, any census block group within a 50-mile radius with populations of low-income individuals equal to or greater than 33.8% of the total block group population would be considered a "low-income population." Using this criterion, 159 of the 1,636 census block groups (9.7%) were identified as low-income populations within a 50-mile radius of the SPS site, as shown in Figure E3.11-17. (USCB. 2016h)

When Virginia is used as the geographic area, any census block group within the region with a low-income population equal to or greater than 37.4% of the total block group, the population would be considered a "low-income population" (individual) (Table E3.11-6). Using the appropriate criteria for the individual state (Virginia and North Carolina), 185 of the total 1636 census block groups (11.3%) have low-income individual population percentages which meet or exceed the threshold criteria noted in Table E3.11-5. These census block groups are illustrated in Figure E3.11-18.

Similarly, these criteria are found using both geographies and family census counts (Table E3.11-5). Using the family individual state and regional criteria, 154 and 133 census block groups were identified as having low-income families in each criterion (Table E3.11-5). These census block groups are illustrated in Figures E3.11-19 and E3.11-20. (USCB. 2016f; USCB. 2016h) The closest low-income block group that meets the guidance criteria for individuals or families is located approximately 4.9 miles west-northwest of the SPS center point. It is Block Group 511818601002. (USCB. 2016h)

E3.11.3 SUBSISTENCE POPULATIONS AND MIGRANT WORKERS

Migrant labor, or migrant worker, is defined by the USDA as "a farm worker whose employment required travel that prevented the migrant worker from returning to his/her permanent place of residence the same day." In 2012, Surry County reported that 37 out of 127 total farms employed farm labor. Isle of Wight County reported 67 out of 213 total farms employed farm labor. The 2012 Census of Agriculture reported that none of the Surry County farms employed migrant farm workers. Farms in Isle of Wight County did not employ migrant workers. For Surry County, an estimated total of 140 farm laborers were hired, of which 74 were estimated to work fewer than 150 days per year. For Isle of Wight County, an estimated total of 223 farm laborers were hired, of which 111 were estimated to work fewer than 150 days per year. (USDA. 2016b)

Subsistence refers to the use of natural resources as food for consumption and for ceremonial and traditional cultural purposes, usually by low-income or minority populations. Specific examples of subsistence use include gathering plants for direct consumption (rather than produced for sale from farming operations), for use as medicine, or in ritual practices. Fishing or hunting activities associated with direct consumption or use in ceremonies, rather than for sport, are other examples.

Determining the presence of subsistence use can be difficult, as data at the county or block group level are aggregated and not usually structured to identify such uses on or near the site. Frequently, the best means of investigating the presence of subsistence use is through dialogue with the local population who are most likely to know of such activity. This may include county officials, community leaders, and land owners in the vicinity who would have knowledge of subsistence activity. For example, in a 2018 conversation with a regional tribal representative, there was no subsistence activity.

The area surrounding SPS is largely rural and agricultural, with no known subsistence-based activity. As reported in the 2002 NUREG-1437 Supplement 6 (NRC. 2002a), the NRC found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the minority and low-income populations could experience disproportionately high and adverse impacts. No additional subsistence studies have been conducted, but plant staff living and working in the area are not aware of any cases of subsistence activity in the vicinity of SPS.

Figure E3.11-1 Census-Aggregate of All Races Populations (Regional)

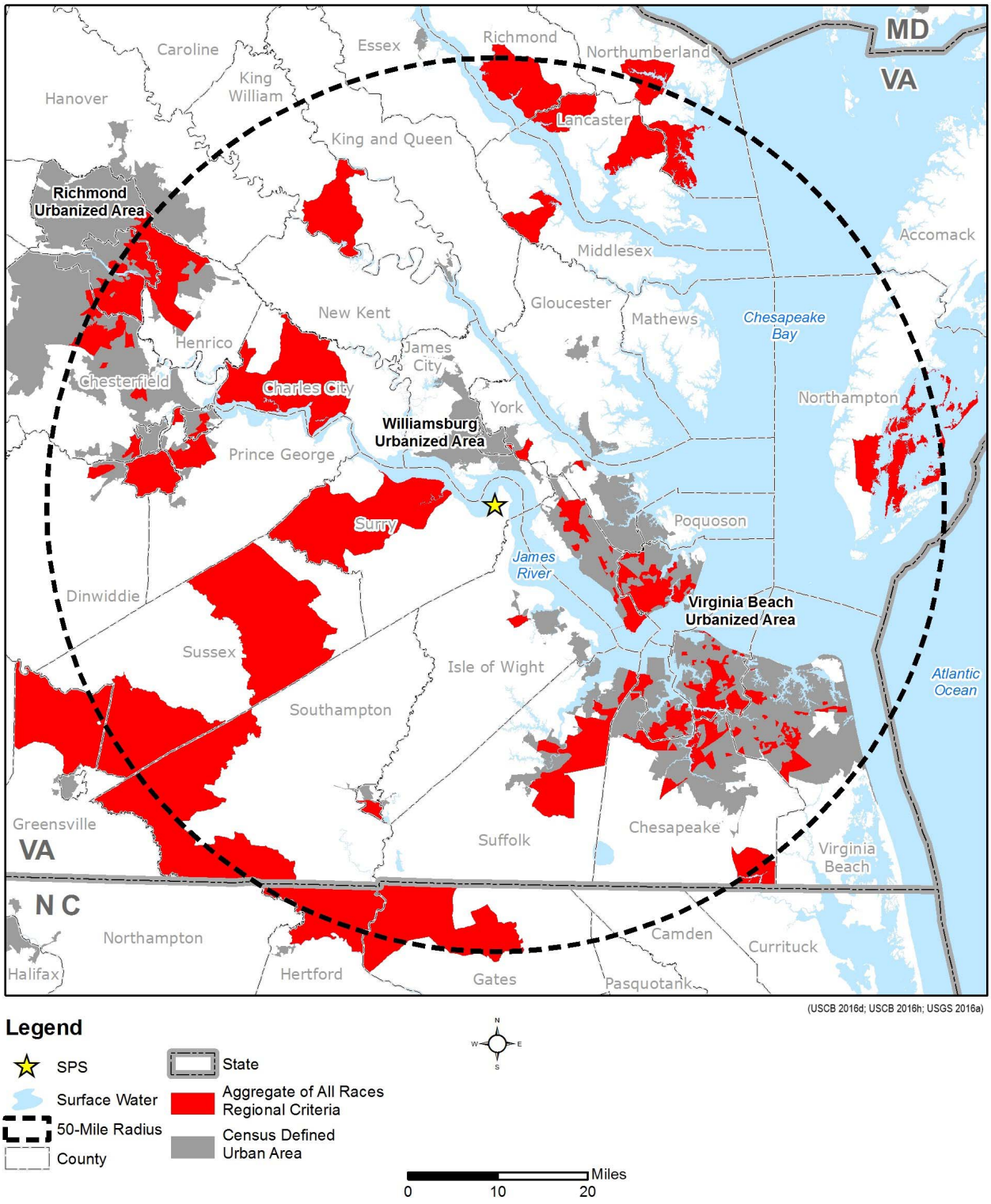


Figure E3.11-2 Census-Aggregate of All Races Populations (Individual State)

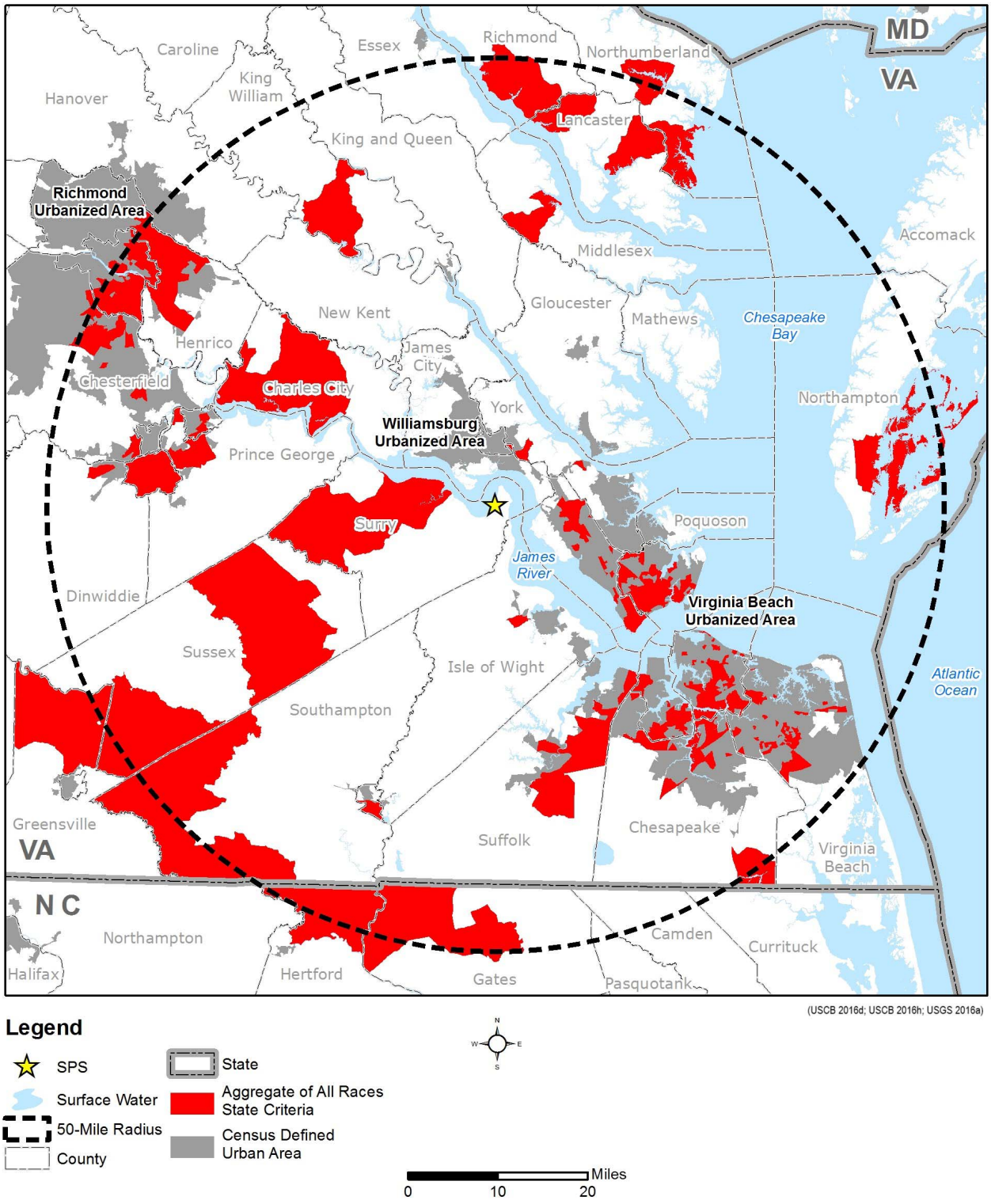


Figure E3.11-3 Census-Aggregate and Hispanic Populations (Regional)

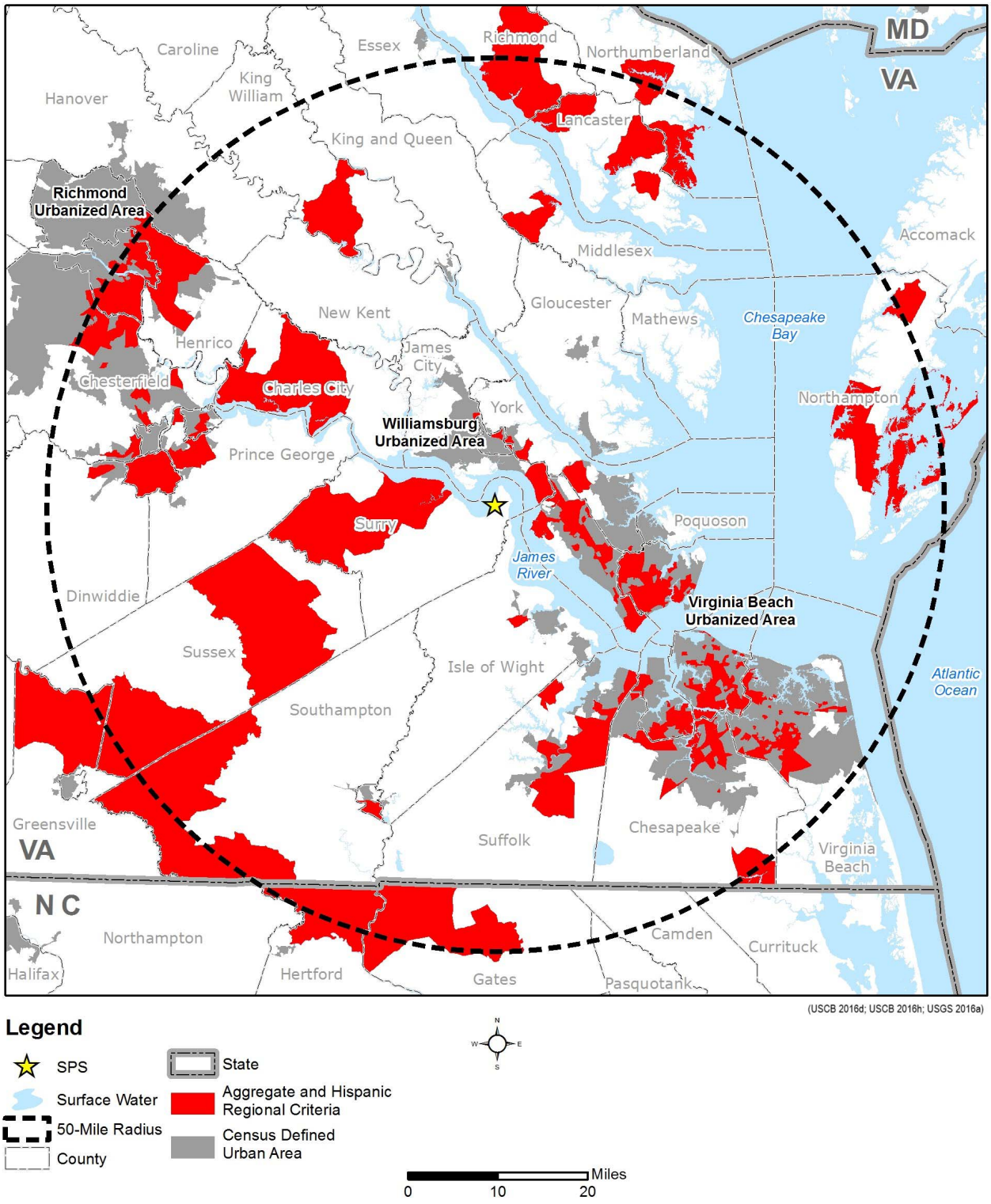


Figure E3.11-4 Census-Aggregate and Hispanic Populations (Individual State)

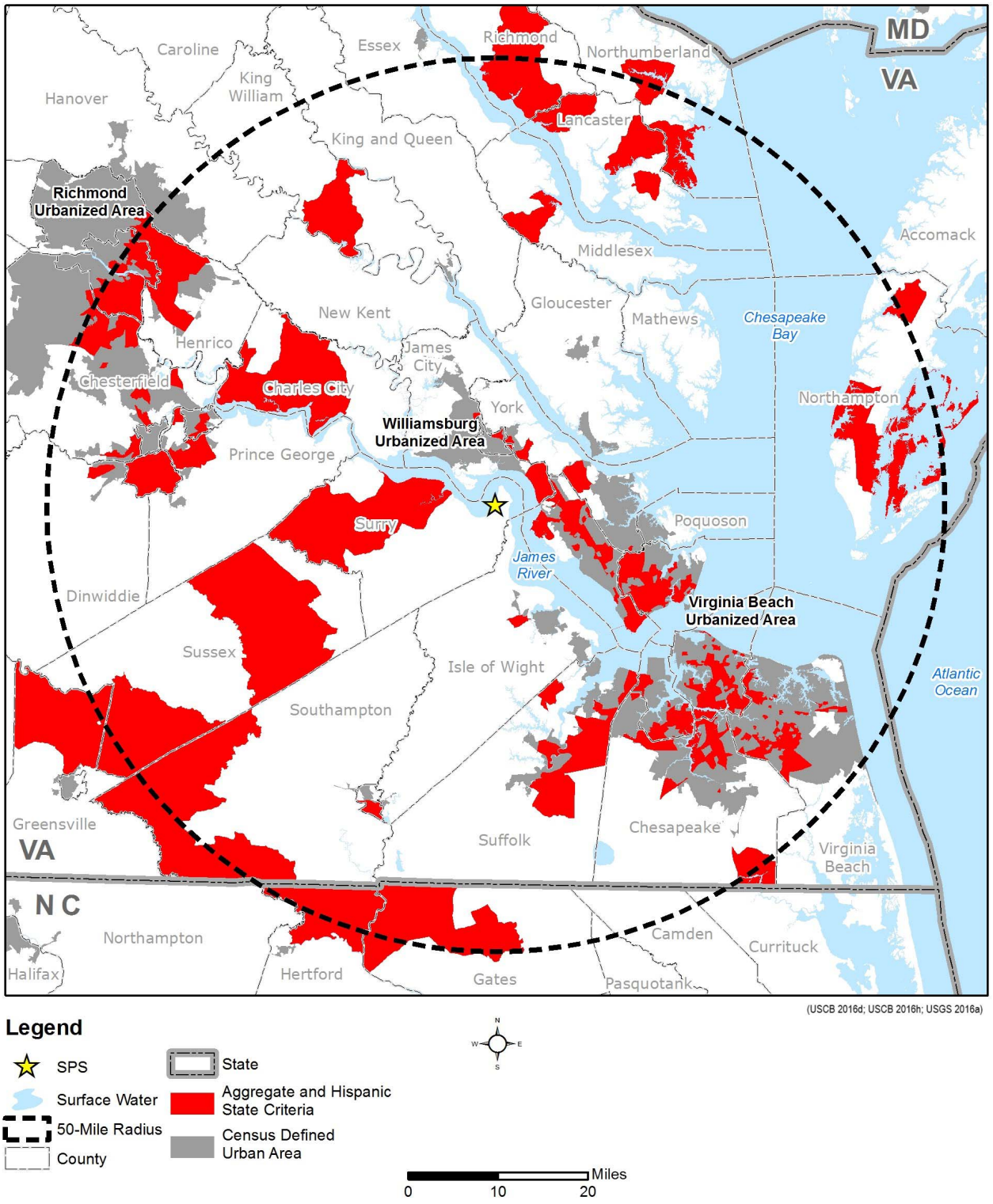


Figure E3.11-5 Census-Black or African American Populations (Regional)

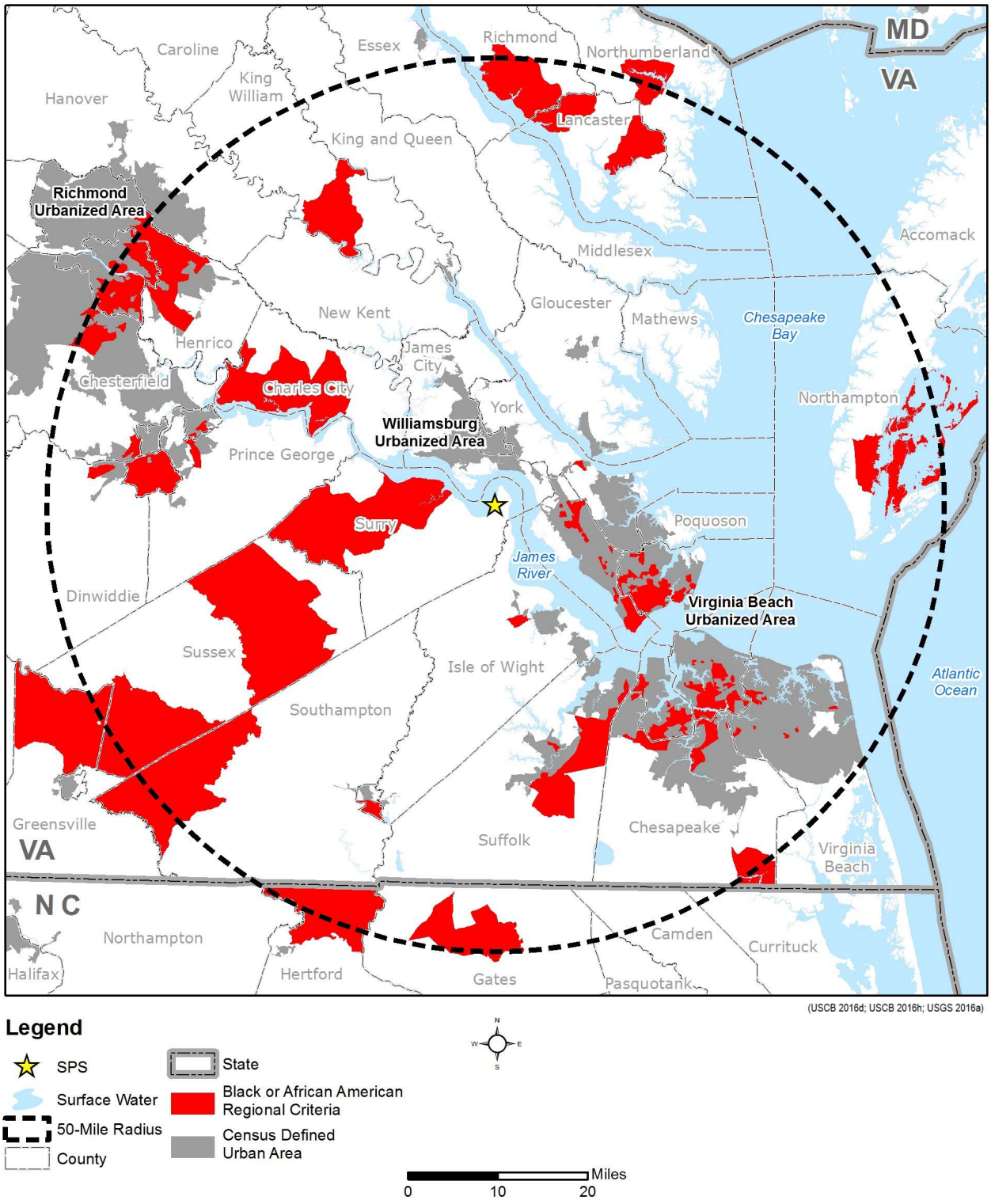


Figure E3.11-6 Census-Black or African American Populations (Individual State)

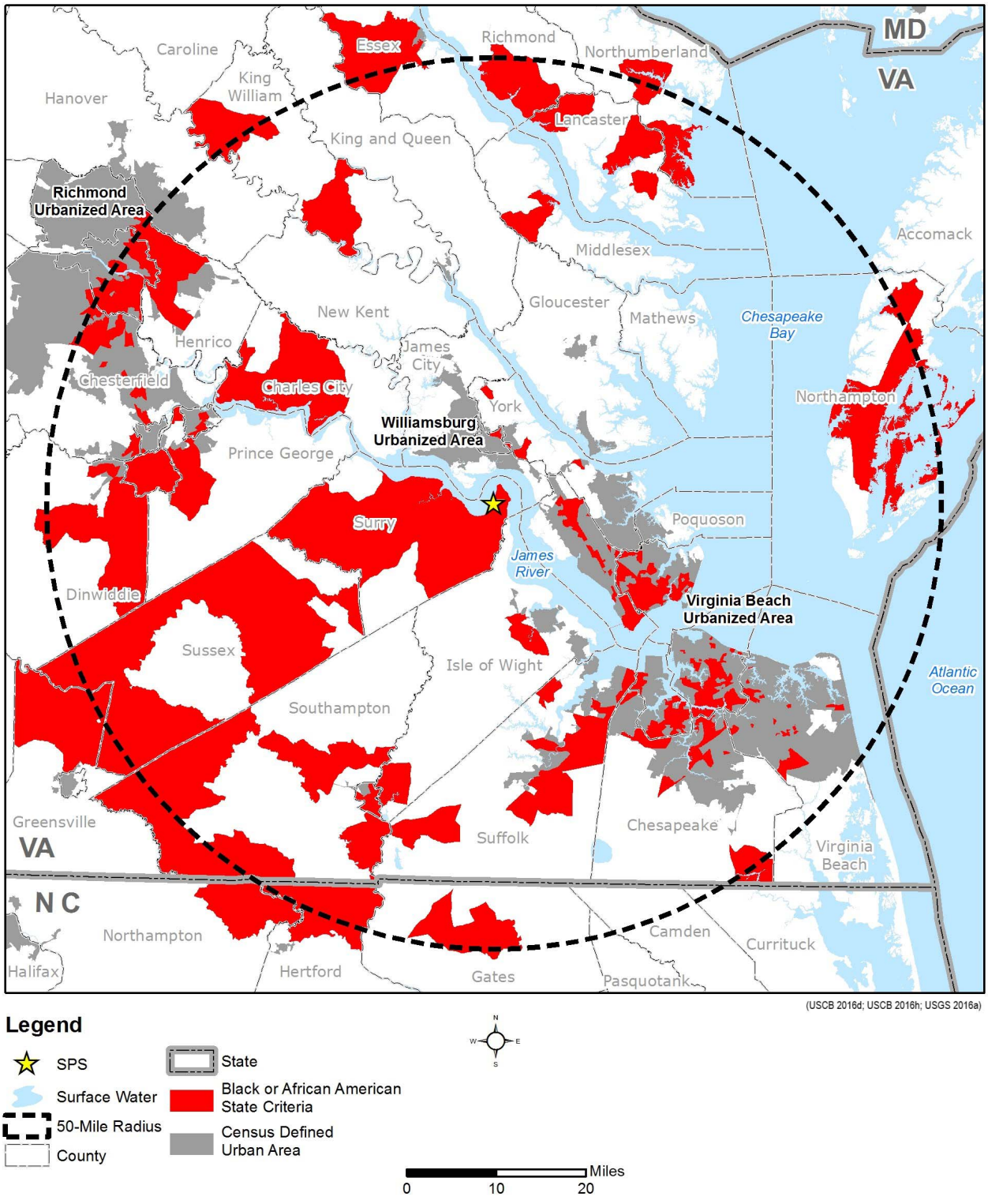


Figure E3.11-7 Census-Asian Populations (Regional)

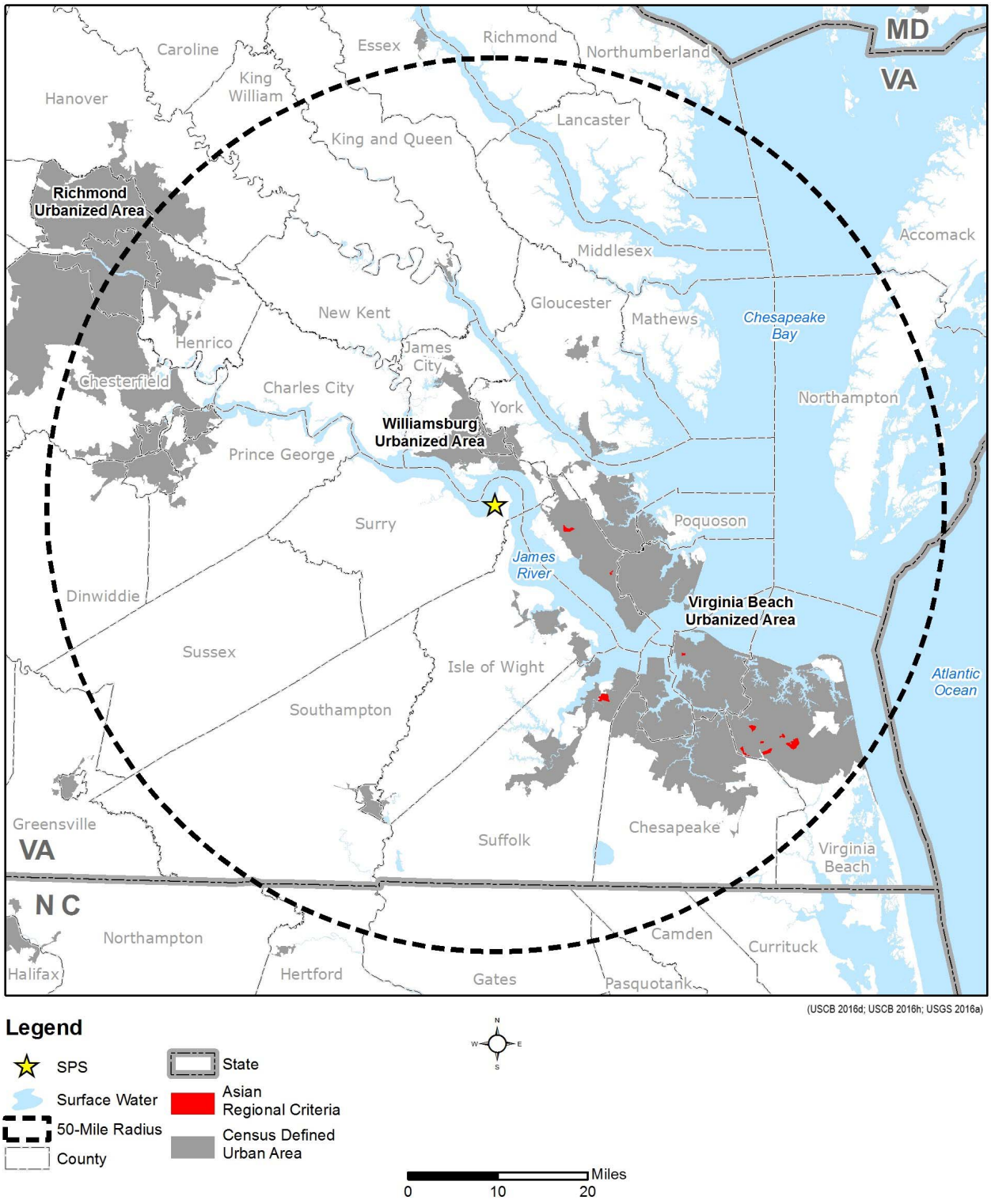


Figure E3.11-8 Census-Asian Populations (Individual State)

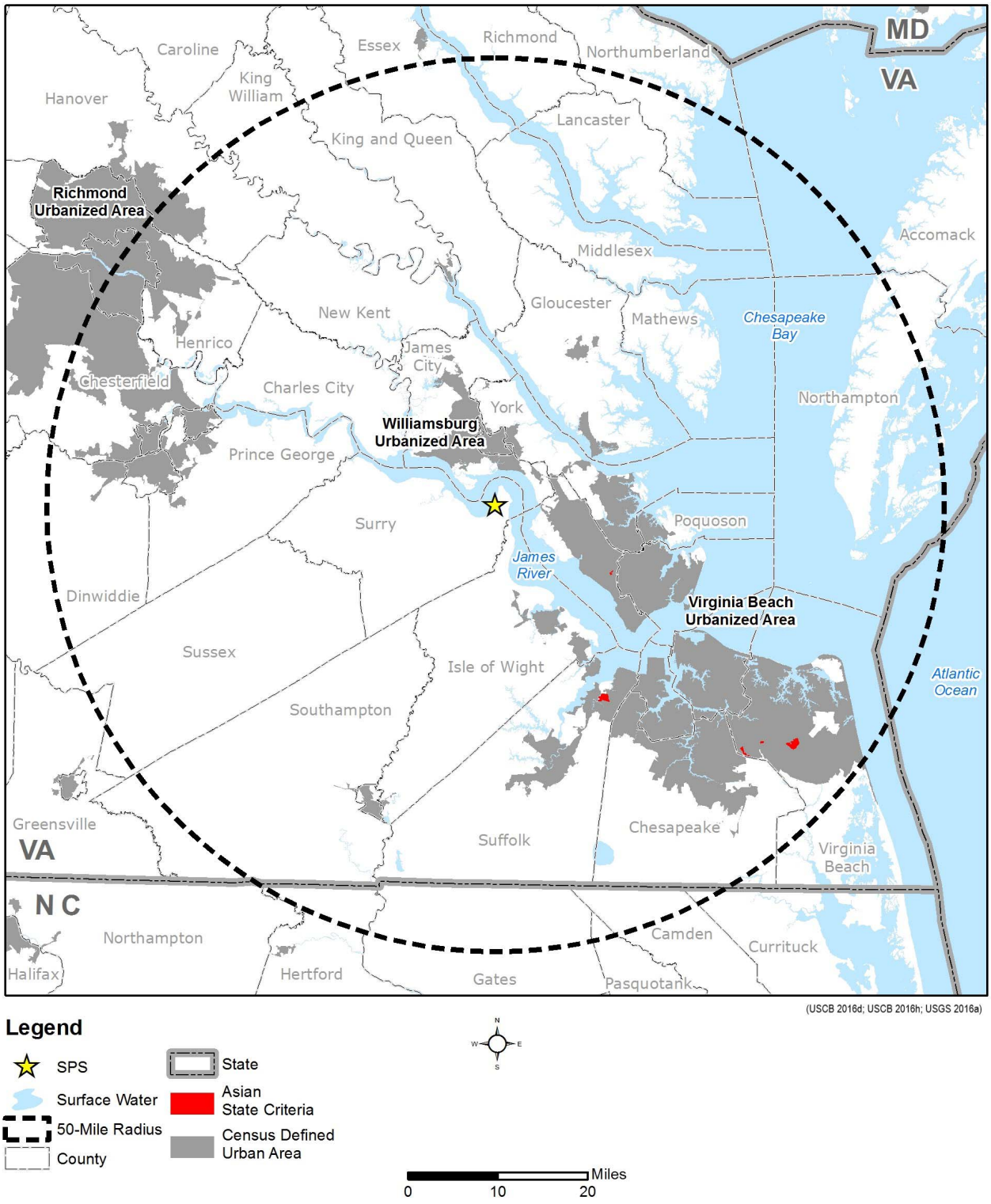


Figure E3.11-9 Census-Native Hawaiian/Other Pacific Islander Populations (Regional)

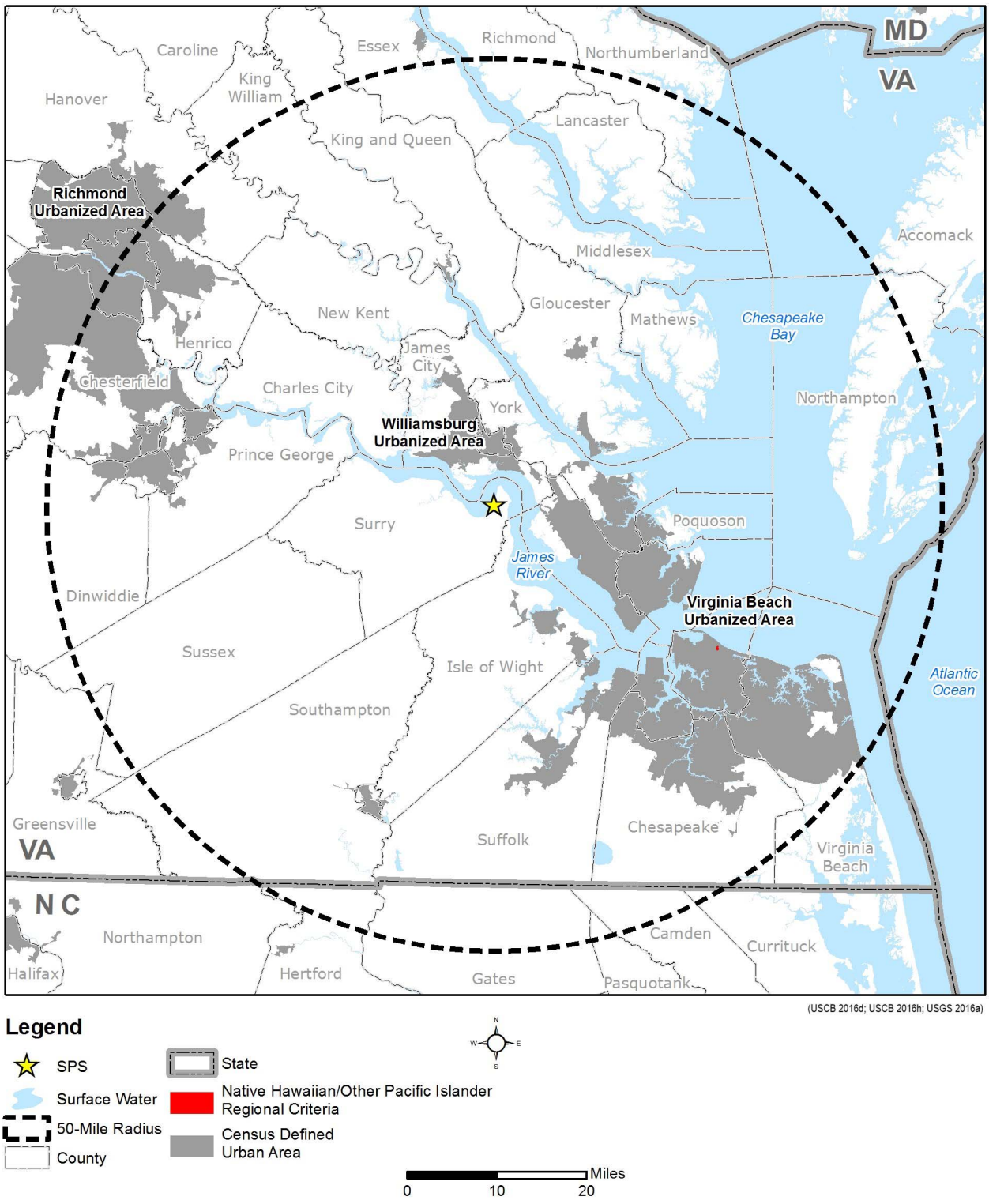


Figure E3.11-10 Census-Native Hawaiian/Other Pacific Islander Populations (Individual State)

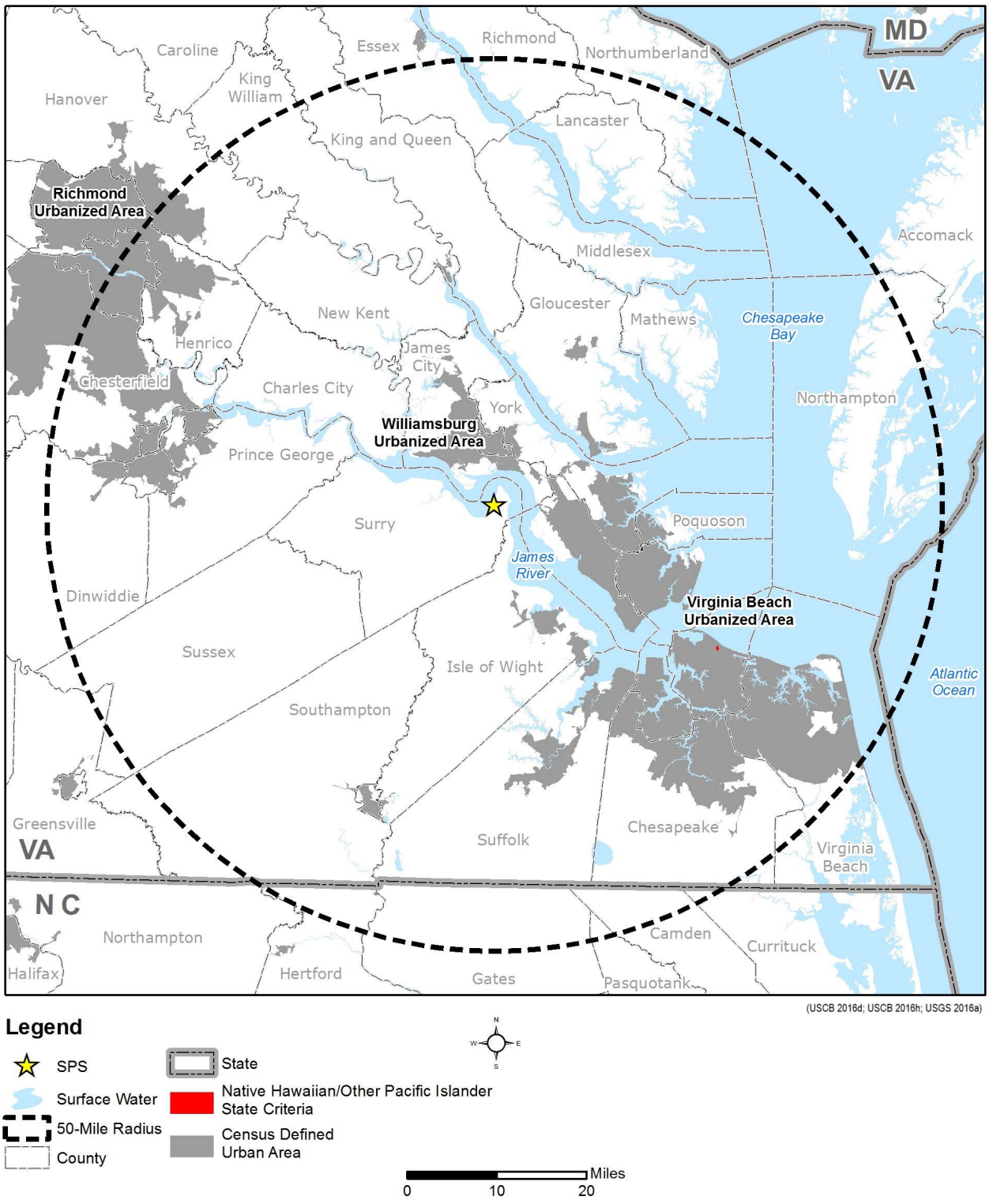


Figure E3.11-11 Census-Some Other Race Populations (Regional)

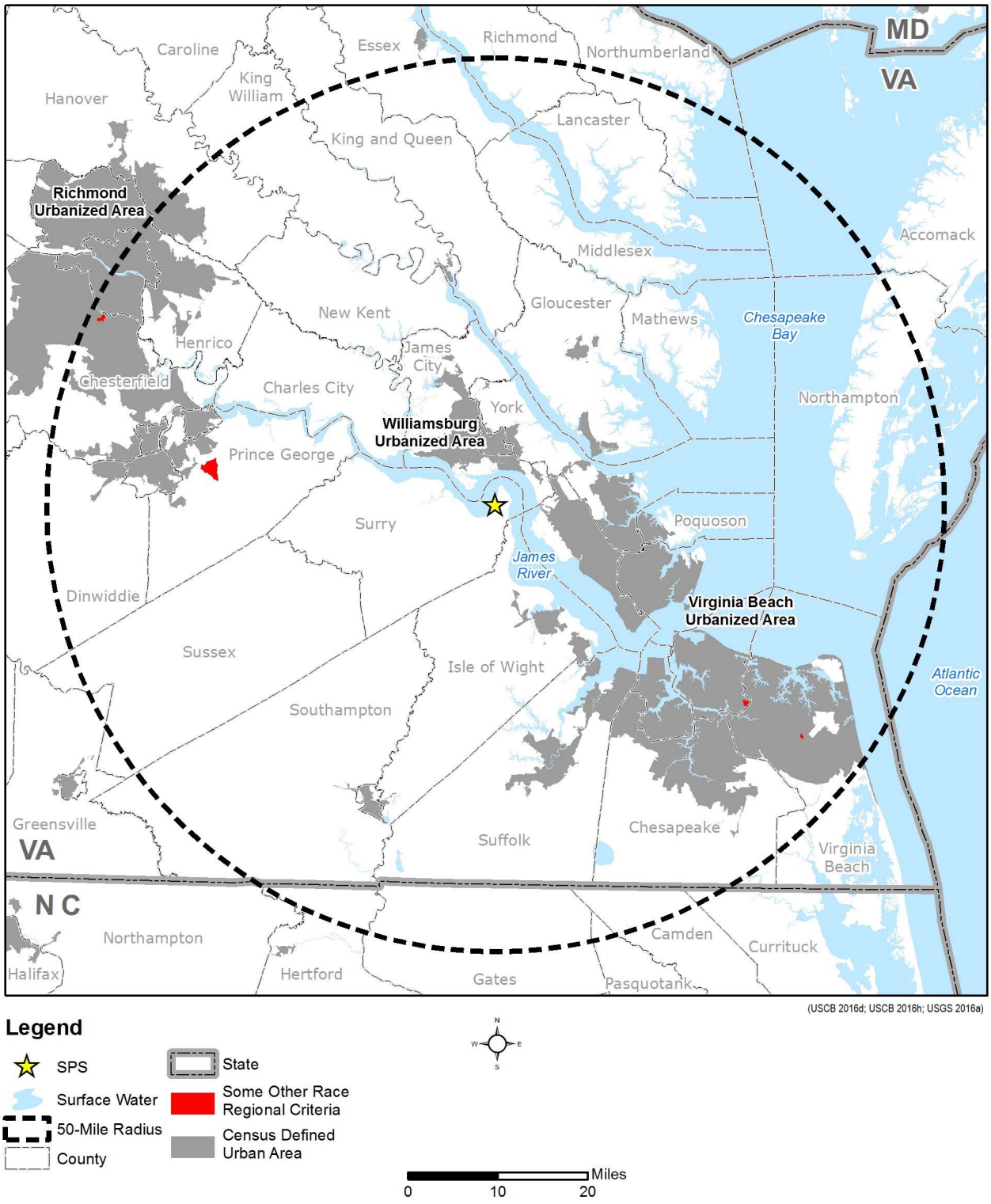


Figure E3.11-12 Census-Some Other Race Populations (Individual State)

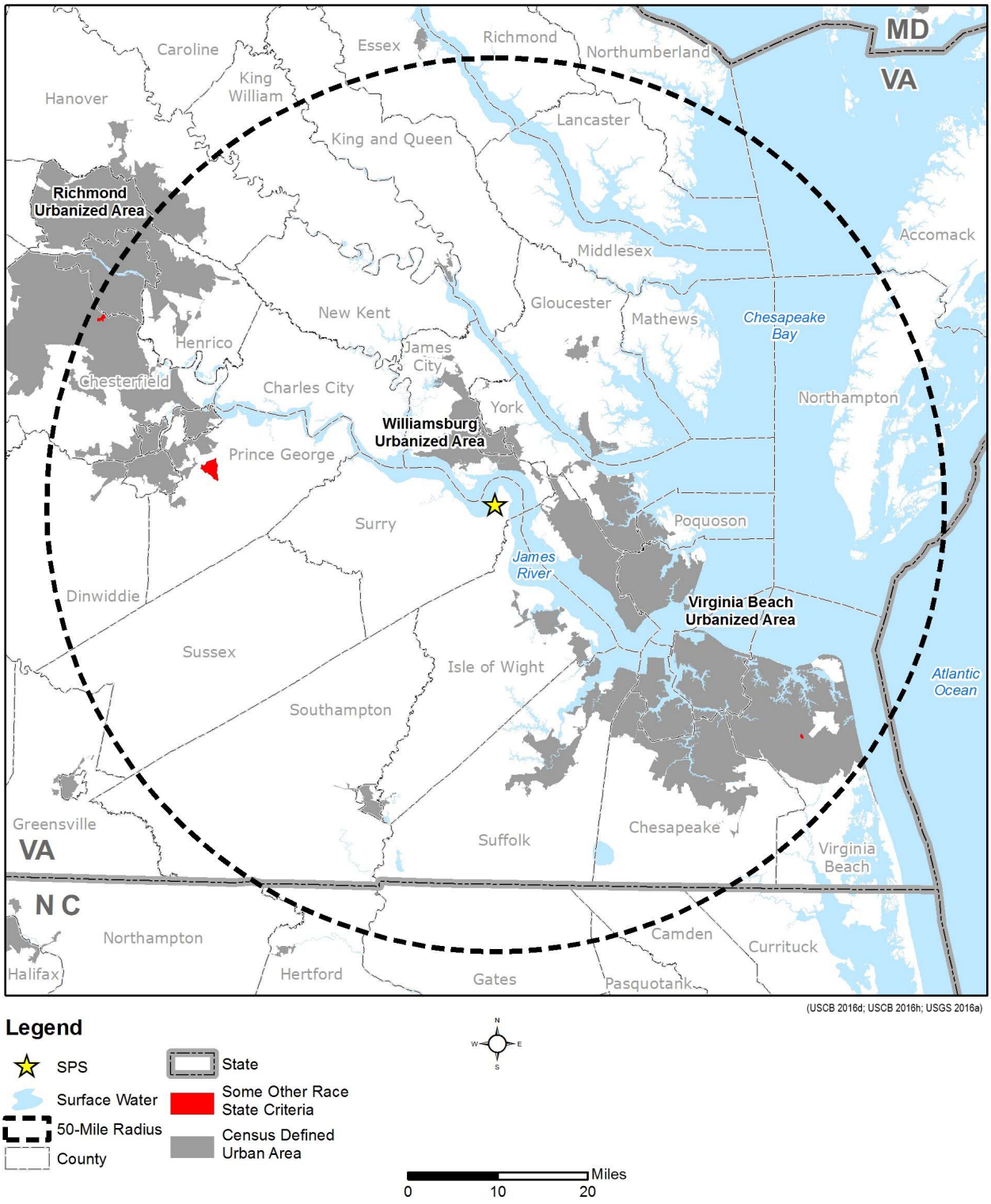


Figure E3.11-13 Census-Two or More Races Populations (Regional)

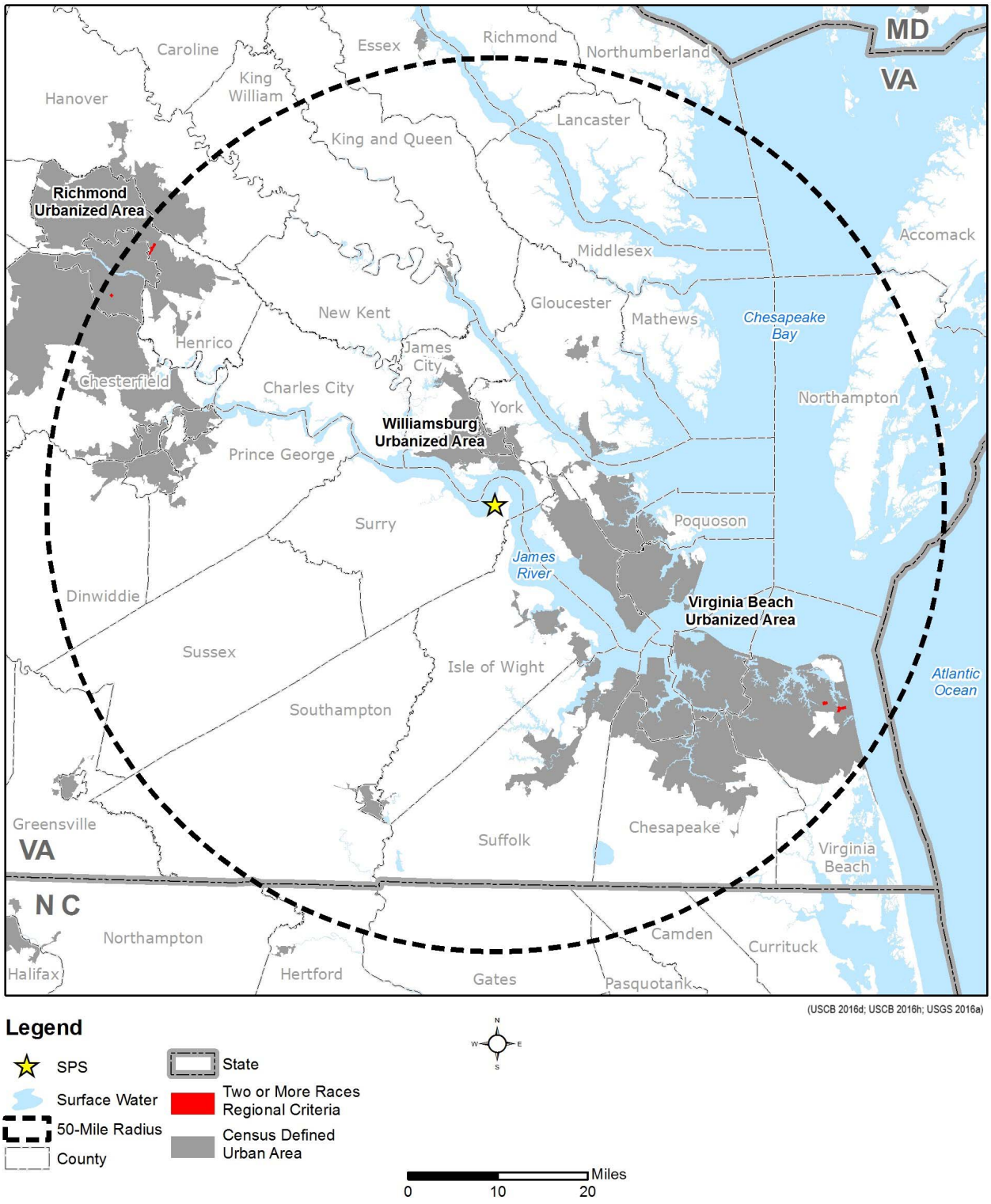


Figure E3.11-14 Census-Two or More Races Populations (Individual State)

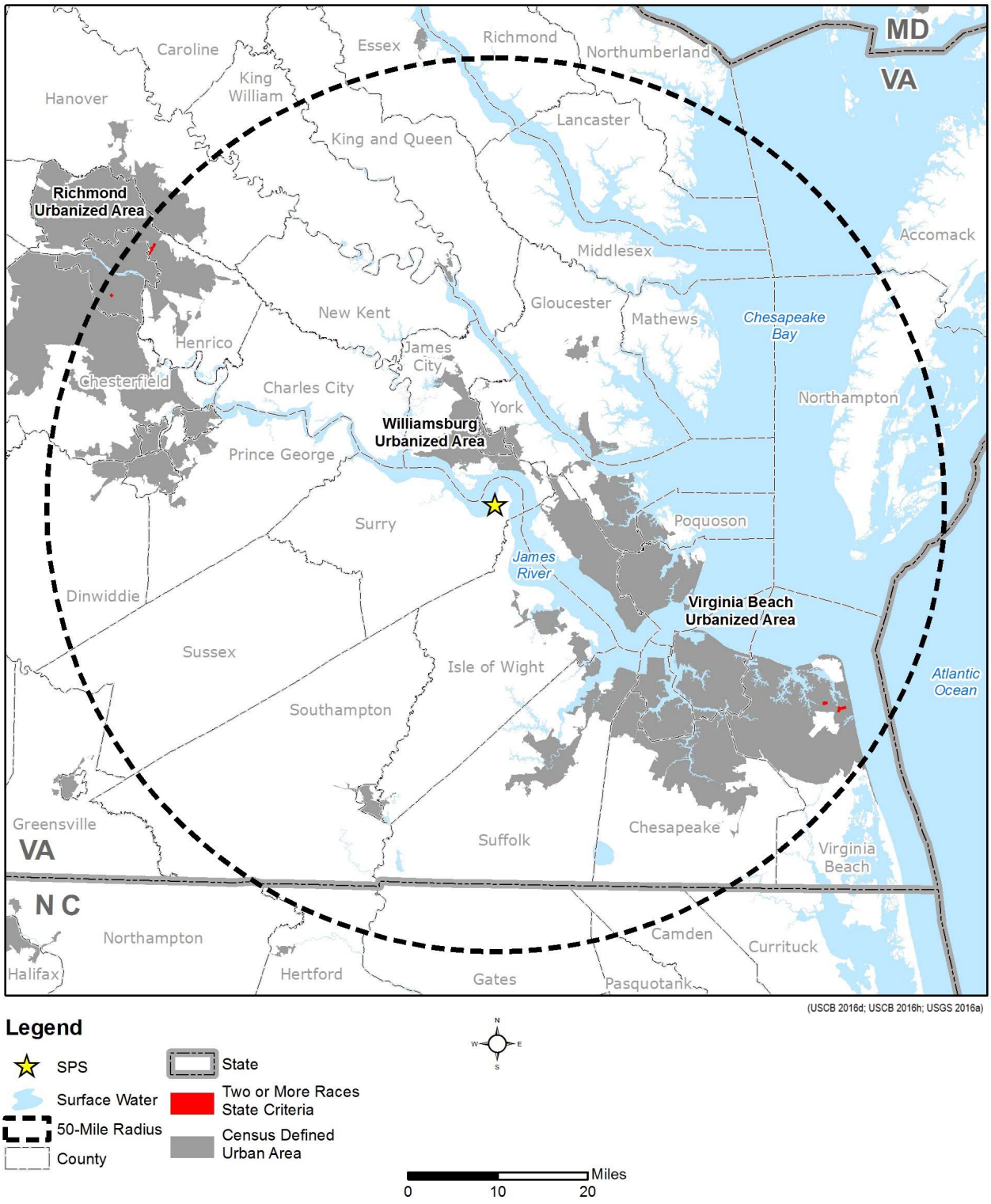


Figure E3.11-15 Census-Hispanic or Latino Populations (Regional)

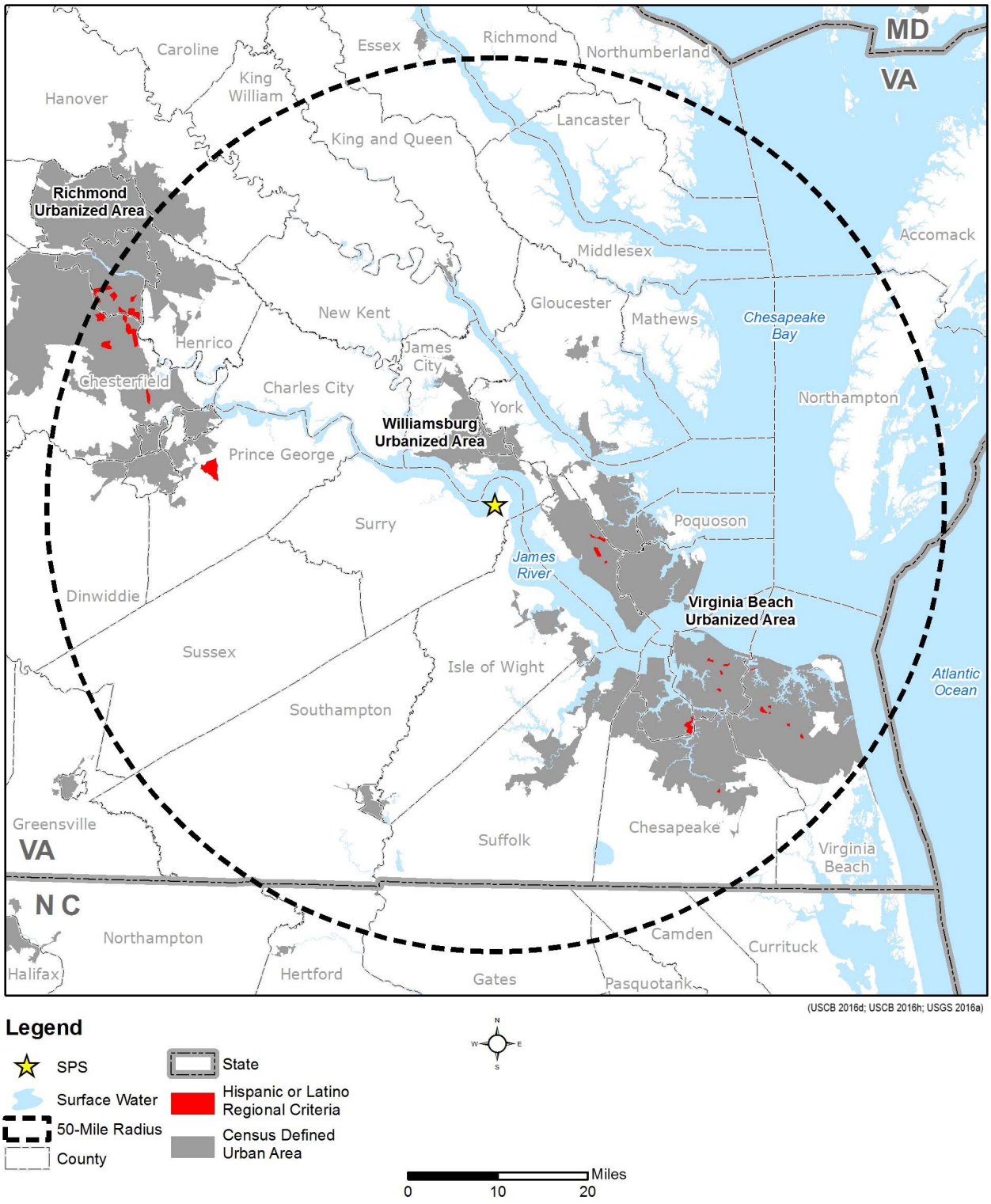


Figure E3.11-16 Census-Hispanic or Latino Populations (Individual State)

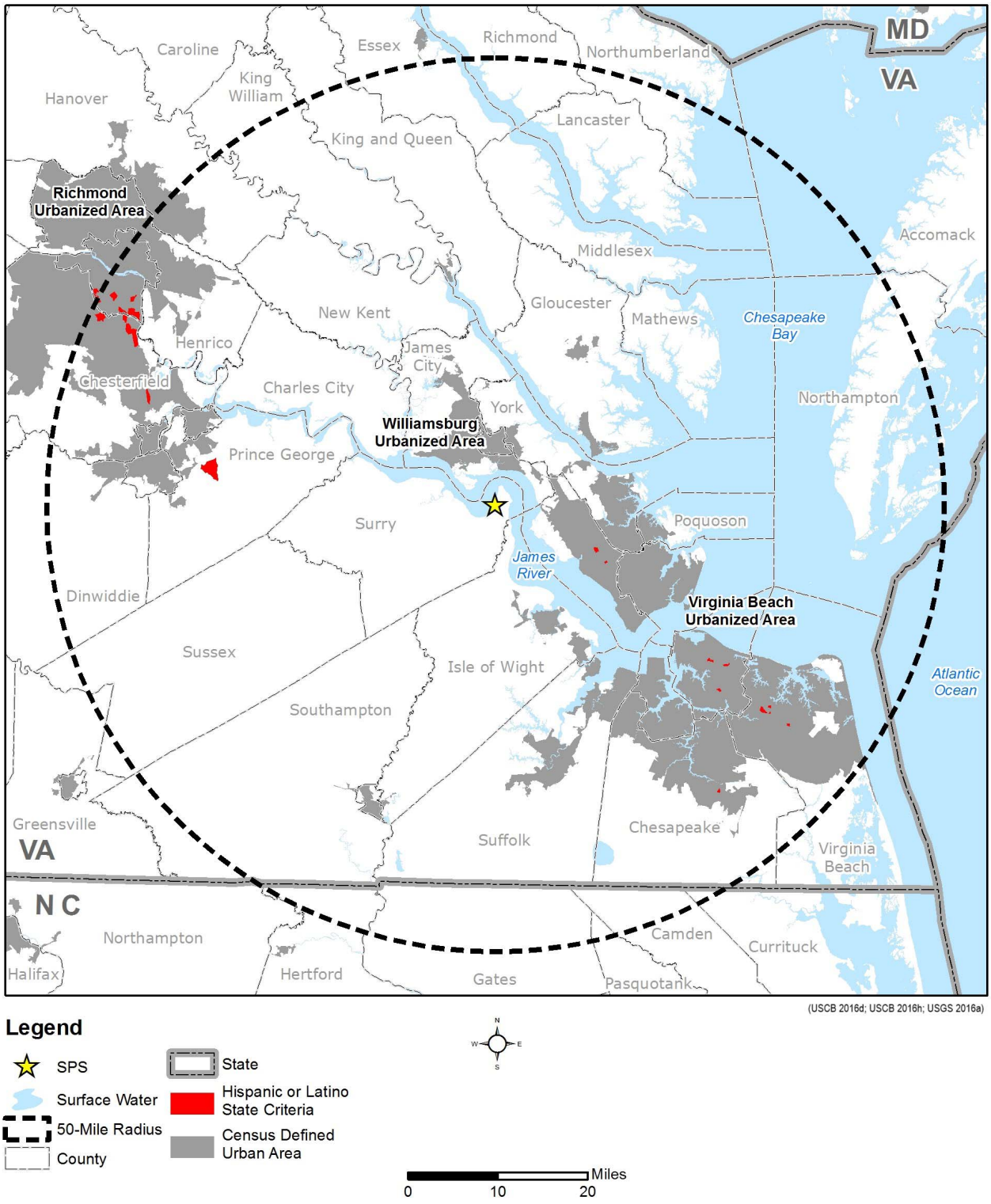


Figure E3.11-17 Census-Low Income Individuals (Regional)

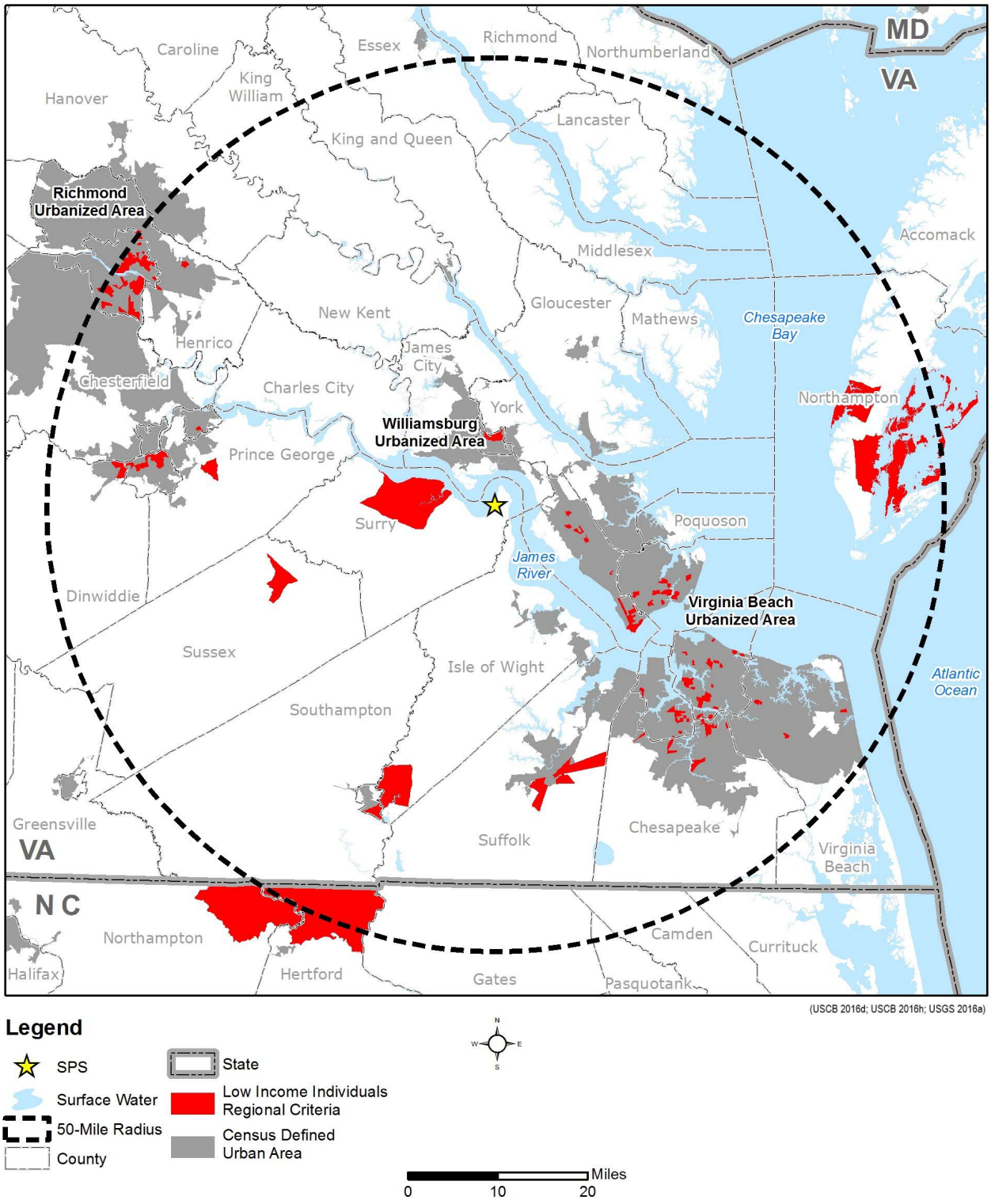


Figure E3.11-18 Census-Low Income Individuals (Individual State)

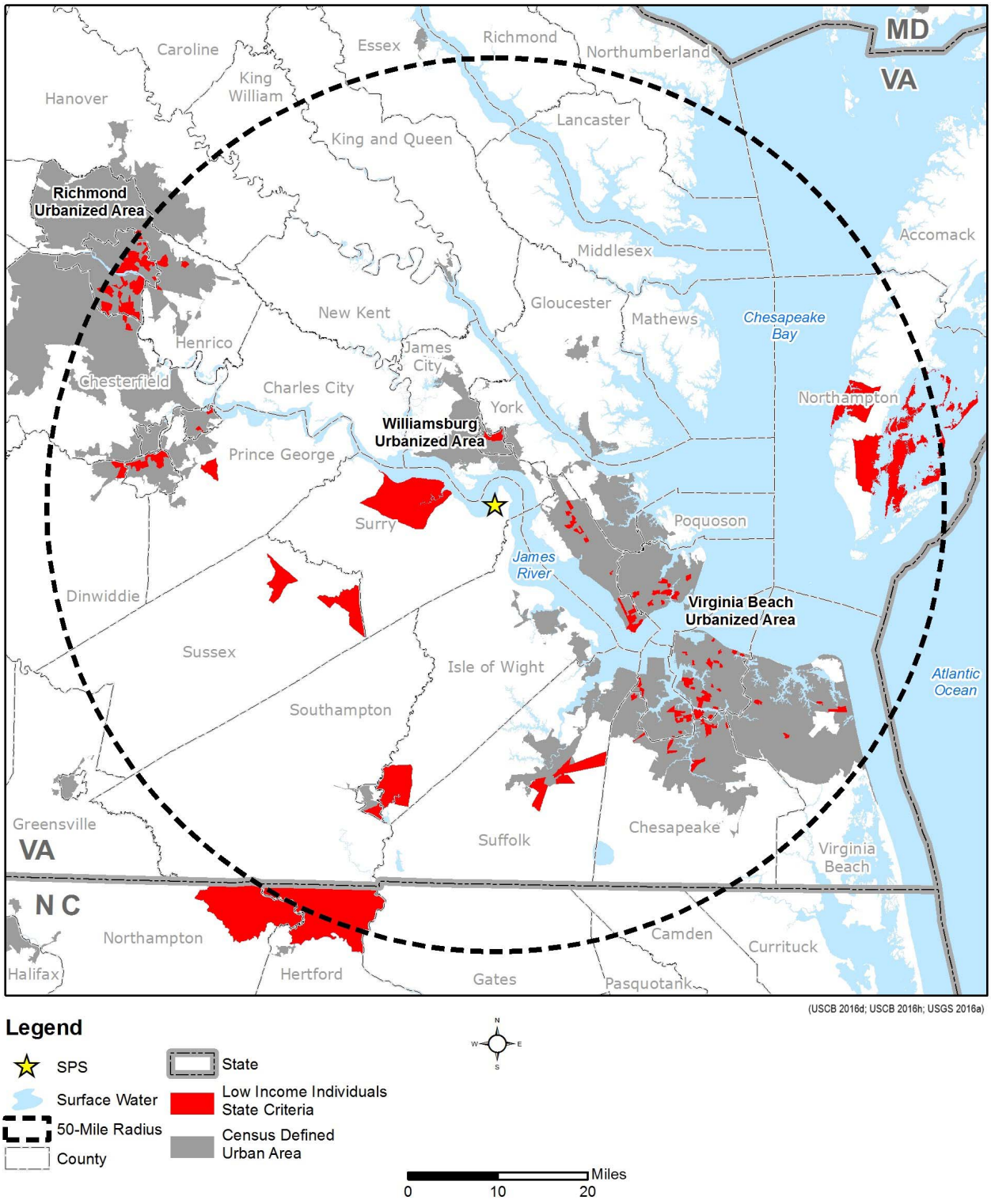


Figure E3.11-19 Census-Low Income Households (Regional)

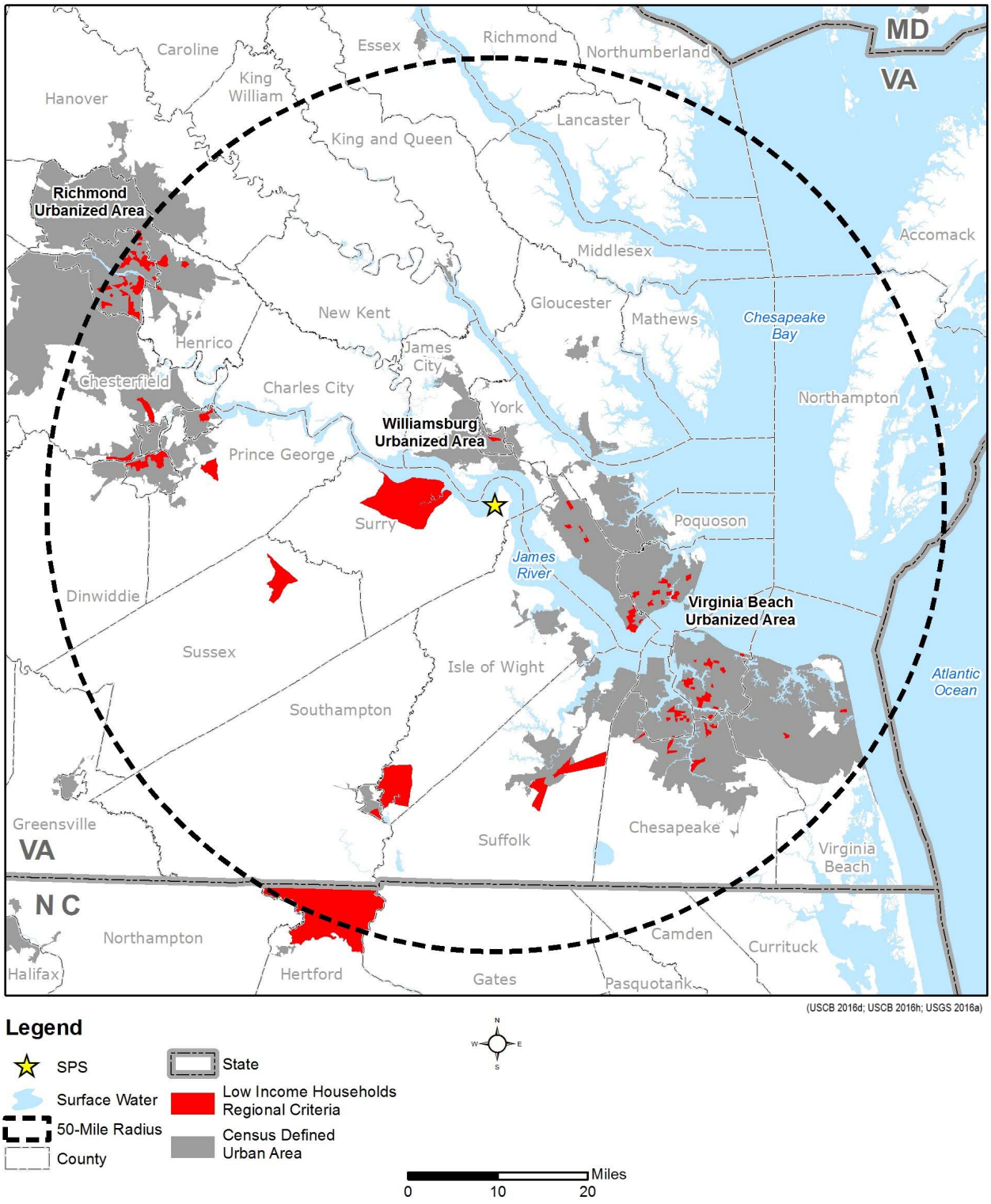
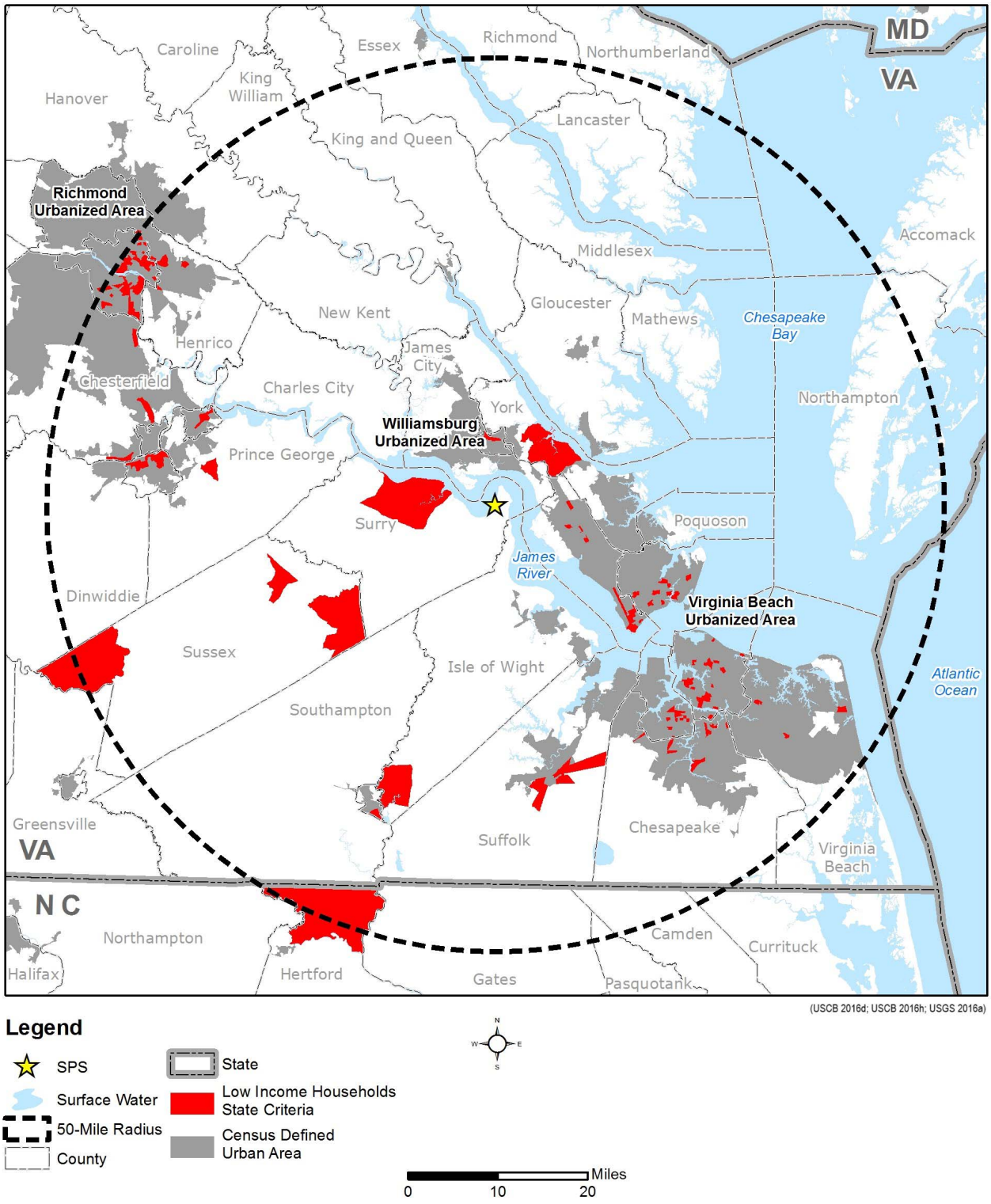


Figure E3.11-20 Census-Low Income Households (Individual State)



Intentionally Blank

Table E3.11-1 Cities or Towns Located Totally or Partially within a 50-Mile Radius of SPS

City/Town/CDP	County	2000 Census Population[a][b]	2010 Census Population[a][b]	2015 Census Population[a][b]	Distance to SPS (miles)[c][d]	Direction to SPS (miles)[c][d]
Boykins	Southampton	620	564	762	49	SW
Cape Charles	Northampton	1,134	1,009	912	38	E
Capron	Southampton	167	166	89	42	SW
Cheriton	Northampton	499	487	462	41	E
Chesapeake	Chesapeake (city)	199,184	222,209	235,429	34	SE
Claremont	Surry	343	378	281	15	WNW
Colonial Heights	Colonial Heights (city)	16,897	17,411	17,820	40	W
Como (NC)	Hertford	78	91	82	49	SSW
Courtland	Southampton	1,270	1,284	2,065	37	SW
Dendron	Surry	297	272	328	16	WSW
Eastville	Northampton	203	305	175	43	ENE
Franklin	Franklin (city)	8,346	8,582	8,490	36	SSW
Hampton	Hampton (city)	146,437	137,436	136,454	22	ESE
Hopewell	Hopewell (city)	22,354	22,591	22,378	34	WNW
Irvington	Lancaster	673	432	490	37	NNE
Ivor	Southampton	320	339	407	21	SSW
Jarratt	Sussex	589	638	628	49	WSW
Kilmarnock	Lancaster	1,244	1,487	1,443	41	NNE
Mechanicsville	Hanover	30,464	36,348	37,210	48	NW
Newport News	Newport News (city)	180,150	180,719	182,385	20	SE
Newsoms	Southampton	282	321	350	44	SSW
Norfolk	Norfolk (city)	234,403	242,803	246,393	32	SE
Petersburg	Petersburg (city)	33,740	32,420	32,477	39	W
Poquoson	Poquoson (city)	11,566	12,150	12,059	20	E

Table E3.11-1 Cities or Towns Located Totally or Partially within a 50-Mile Radius of SPS

City/Town/CDP	County	2000 Census Population[a][b]	2010 Census Population[a][b]	2015 Census Population[a][b]	Distance to SPS (miles)[c][d]	Direction to SPS (miles)[c][d]
Portsmouth	Portsmouth (city)	100,565	95,535	96,201	32	SE
Richmond	Richmond (city)	197,790	204,214	220,289	50	WNW
Scotland	Surry	N/A	203	135	5	WNW
Smithfield	Isle of Wight	6,324	8,089	8,233	13	SSE
Stony Creek	Sussex	202	198	160	42	WSW
Suffolk	Suffolk (city)	63,677	84,585	88,161	31	S
Surry	Surry	262	244	235	8	WSW
Urbanna	Middlesex	543	476	556	33	NNE
Virginia Beach	Virginia Beach (city)	425,257	437,994	452,745	45	ESE
Wakefield	Sussex	1,038	927	850	21	SW
Waverly	Sussex	2,309	2,149	1,570	24	WSW
West Point	King William	2,866	3,306	3,336	26	N
White Stone	Lancaster	358	352	479	37	NNE
Williamsburg	Williamsburg (city)	11,998	14,068	15,052	7	N
Windsor	Isle of Wight	916	2,626	2,642	25	S

N/A = No data available.

a) (USCB. 2016b)

b) One-year 2015 estimates were used for Virginia independent cities (USCB. 2016a)

c) (USDOT. 2016)

d) Distance and direction are approximate and measured from the SPS center point to the city center.

Table E3.11-2 County Populations Totally or Partially Included within a 50-Mile Radius of SPS

State, County and Independent City	2000 Population[(a)]	2010 Population[(a)]	2015 Population Estimate[(a)]	2053 Projected Permanent Population[(b)]	2053 Projected Total Population[(b)]
North Carolina (six counties)	**115,175**	**133,153**	**131,442**	**158,971**	**161,339**
Camden	6,885	9,980	10,309	10,309	10,463
Currituck	18,190	23,547	25,263	48,970	49,700
Gates	10,516	12,197	11,431	12,197	12,379
Hertford	22,601	24,669	24,184	24,735	25,103
Northampton	22,086	22,099	20,426	22,099	22,428
Pasquotank	34,897	40,661	39,829	40,661	41,267
Virginia (25 counties)	1,036,710	1,199,500	1,251,332	2,145,206	2,184,261
Accomack	38,305	33,164	32,973	33,817	35,259
Charles City	6,926	7,256	7,040	9,622	9,652
Chesterfield	259,903	316,236	335,687	721,984	729,518
Dinwiddie	24,533	28,001	27,852	32,439	32,561
Essex	9,989	11,151	11,130	13,748	14,038
Gloucester	34,780	36,858	37,143	48,846	49,298
Greensville	11,560	12,243	11,885	12,807	12,941
Hanover	86,320	99,863	103,227	196,894	200,078
Henrico	262,300	306,935	325,155	519,545	529,881
Isle of Wight	29,728	35,270	36,314	48,907	49,298
James City	48,102	67,009	73,147	179,957	187,584
King and Queen	6,630	6,945	7,158	8,000	8,031
King William	13,146	15,935	16,269	20,437	20,523
Lancaster	11,567	11,391	10,965	13,133	13,912
Mathews	9,207	8,978	8,862	10,577	10,870
Middlesex	9,932	10,959	10,606	13,620	14,517
New Kent	13,462	18,429	20,392	27,665	28,006

Table E3.11-2 County Populations Totally or Partially Included within a 50-Mile Radius of SPS

State, County and Independent City	2000 Population[a]	2010 Population[a]	2015 Population Estimate[a]	2053 Projected Permanent Population[b]	2053 Projected Total Population[b]
Northampton	13,093	12,389	12,155	12,389	12,977
Northumberland	12,259	12,330	12,232	13,703	14,214
Prince George	33,047	35,725	37,862	42,986	43,627
Richmond	8,809	9,254	8,908	11,152	11,440
Southampton	17,482	18,570	18,109	18,684	18,803
Surry	6,829	7,058	6,709	8,531	8,629
Sussex	12,504	12,087	11,715	12,578	12,655
York	56,297	65,464	67,837	113,184	115,949
Virginia (14 independent cities)	**1,652,364**	**1,712,717**	**1,766,333**	**2,041,694**	**2,080,081**
Chesapeake	199,184	222,209	235,429	364,806	368,705
Colonial Heights	16,897	17,411	17,820	22,503	22,876
Franklin	8,346	8,582	8,490	11,578	11,717
Hampton	146,437	137,436	136,454	142,639	144,505
Hopewell	22,354	22,591	22,378	27,221	27,444
Newport News	180,150	180,719	182,385	199,580	201,942
Norfolk	234,403	242,803	246,393	266,892	273,180
Petersburg	33,740	32,420	32,477	34,745	35,100
Poquoson	11,566	12,150	12,059	18,559	18,594
Portsmouth	100,565	95,535	96,201	102,649	103,303
Richmond	197,790	204,214	220,289	220,289	225,451
Suffolk	63,677	84,585	88,161	158,145	159,067
Virginia Beach	425,257	437,994	452,745	452,745	463,421
Williamsburg	11,998	14,068	15,052	19,343	24,776
Total	**2,804,249**	**3,045,370**	**3,149,107**	**4,345,872**	**4,425,681**

a) (USCB. 2016a)
b) (NCBM. 2016; USCB. 2016f; UVA. 2016; VNC. 2016; VTA. 2016)

Table E3.11-3 County Population Growth, 2010–2045

Virginia		2010	2015	2020	2025	2030	2035	2040	2045	2050	2053
Isle of Wight County	Population	35,270	36,314	38,828	40,387	41,946	43,434	44,922	46,469	47,993	48,907
	Average Annual Growth %		0.59	1.35	0.79	0.76	0.70	0.68	0.68	0.65	0.63
Newport News (City)	Population	180,719	182,385	185,196	187,543	189,890	191,864	193,838	196,123	198,283	199,580
	Average Annual Growth %		0.18	0.31	0.25	0.25	0.21	0.20	0.23	0.22	0.22
Surry County	Population	7,058	6,709	7,408	7,584	7,759	7,923	8,086	8,260	8,429	8,531
	Average Annual Growth %		-1.01	2.00	0.47	0.46	0.42	0.41	0.43	0.41	0.40
Williamsburg (City)	Population	14,068	15,052	15,510	16,120	16,729	17,275	17,820	18,419	18,996	19,343
	Average Annual Growth %		1.36	0.60	0.77	0.75	0.64	0.62	0.66	0.62	0.60

(USCB. 2016a; UVA. 2016)

Note: Projected population values based on population projection growth trend for the years reported by the University of Virginia.

Table E3.11-4 Minority Populations Evaluated Against Criterion

Geographic Area	North Carolina[a]			Virginia[a]			50-Mile Radius (Region)[b]		
Total Population	9,845,333			8,256,630			2,417,694		
Census Categories	State Population by Census Category[a]	Percent[c]	Criteria	State Population by Census Category[a]	Percent[c]	Criteria	Regional Population by Census Category[b]	Percent[c]	Criteria
Black or African American	2,115,338	21.5	41.5	1,589,345	19.2	39.2	835,785	34.6	50.0
American Indian or Alaska Native	116,143	1.2	21.2	22,570	0.3	20.3	8,956	0.4	20.4
Asian	244,076	2.5	22.5	492,973	6.0	26.0	74,676	3.1	23.1
Native Hawaiian/Other Pacific Islander	6,244	0.1	20.1	5,304	0.1	20.1	2,240	0.1	20.1
Some Other Race	292,310	3.0	23.0	183,124	2.2	22.2	34,621	1.4	21.4
Two or More Races	231,391	2.4	22.4	268,167	3.2	23.2	81,291	3.4	23.4
Aggregate of All Races	3,005,502	30.5	50.0	2,561,483	31.0	50.0	1,037,569	42.9	50.0
Hispanic or Latino	869,908	8.8	28.8	709,156	8.6	28.6	146,190	6.0	26.0
Aggregate and Hispanic[d]	3,520,960	35.8	50.0	3,018,782	36.6	50.0	1,125,422	46.5	50.0

a. (USCB. 2016f)

b. (USCB. 2016h)

c. Percent values were calculated by dividing each census category's population by the state's or region's total population values.

d. Includes everyone except persons who identified themselves as White, not Hispanic or Latino (NRC. 2013d).

Table E3.11-5 Minority Census Block Group Counts, 50-Mile Radius of SPS

Total Number of Block Groups with Population within 50-mi radius	Individual State Method		50-Mile Radius (Region)	
	Census Block Groups		Census Block Groups	
	1,636		1,636	
Census Categories	Number of Block Groups with Identified Minority and Low Income Category	Percent of Block Groups within 50 mi	Number of Block Groups with Identified Minority and Low Income Category	Percent of Block Groups within 50 mi
Black or African American	610	37.3	459	28.1
American Indian or Alaska Native	0	0	0	0
Asian	6	0.4	12	0.7
Native Hawaiian/Other Pacific Islander	1	0.1	1	0.1
Some other race	3	0.2	4	0.2
Two or more races	4	0.2	4	0.2
Aggregate of all races	598	36.6	598	36.6
Hispanic or Latino	25	1.5	33	2
Aggregate and Hispanic	683	41.7	683	41.7

(USCB. 2016d; USCB. 2016h)

Table E3.11-6 Low-Income Population Criteria Using Two Geographic Areas

Geographic Area	North Carolina[a]			Virginia[a]			50-Mile Radius (Region)[b]		
(Income) Total Population	9,592,619			8,008,050			2,321,289		
(Income) Total Families	3,775,581			3,062,783			897,390		
Census Categories	State Population by Census Category[a]	Percent[c]	Criteria	State Population by Census Category[a]	Percent[c]	Criteria	Regional Population by Census Category[b]	Percent[c]	Criteria
Low income – number of persons below poverty level	1,667,465	17.4	37.4	921,822	11.5	31.5	320,691	13.8	33.8
Low income – number of families below poverty level	602,058	15.9	35.9	338,744	11.1	31.1	115,602	12.9	32.9

a. (USCB. 2016f)

b. (USCB. 2016h)

c. Percent values were calculated by dividing each census category's population by the state's or region's total population values.

E3.12 WASTE MANAGEMENT

SPS has systems for managing radioactive and nonradioactive waste streams generated by plant operations. The following sections address radioactive and nonradioactive waste management.

E3.12.1 RADIOACTIVE WASTE MANAGEMENT

Section E2.2.6 describes the systems and controls used for the plant's liquid, gaseous, and solid radioactive waste streams including mixed waste. Section E2.2.6 also addresses the management of the waste and the facilities used by SPS for treatment and disposal.

E3.12.2 NONRADIOACTIVE WASTE MANAGEMENT

Section E2.2.7 describes the nonradioactive waste streams generated during plant operations, which includes nonhazardous waste, hazardous waste, and universal waste. As indicated in Section E2.2.7, SPS's municipal waste is disposed of in the local permitted solid waste management facility. Also, as indicated in Section E2.2.7, Dominion's corporate environmental services organization maintains a listing of approved waste vendors for the treatment and disposal of hazardous and nonhazardous waste streams. Section E2.2.7 also describes the waste management and waste minimization programs used at SPS and the offsite facilities used for treatment and disposal of SPS's nonradioactive waste.

Intentionally Blank

E4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

The environmental report must include an analysis that considers . . . the environmental effects of the proposed action . . . and alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]

The environmental report shall . . . discuss . . . the impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance. [10 CFR 51.45(b)(1)]

The information submitted . . . should not be confined to information supporting the proposed action but should also include adverse information. [10 CFR 51.45(e)]

The NRC has identified and analyzed 78 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated these issues as Category 1, Category 2, or NA (not categorized). The NRC designated an issue as Category 1 if the following criteria were met:

- The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.
- A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for offsite radiological impacts-collective impacts from other than the disposal of spent fuel and high-level waste).
- Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC concluded that one or more of the Category 1 criteria could not be met, the NRC designated the issue Category 2, which requires plant-specific analysis. The NRC designated one issue as not categorized (chronic effects of electromagnetic fields), signifying that the categorization and impact definitions do not apply to this issue. Until such time that this NA issue is categorized, applicants for license renewal are not required to submit information on this issue [10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 6]; therefore, this issue is not included in Tables E4.0-1, E4.0-2, or E4.0-3, nor is it addressed in Section E4.9. NRC rules do not require analyses of Category 1 issues that were resolved using generic findings [10 CFR 51, Subpart A, Appendix B, Table B-1] as described in the GEIS. Therefore, an applicant may reference the GEIS

findings for Category 1 issues, absent new and significant information. The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC. 2013b, pp. 7-8). In this guidance, new and significant information is defined as follows:

- Information that identifies a significant environmental issue not considered or addressed in the GEIS and, consequently, not codified in Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants, in Appendix B, Environmental Effect of Renewing the Operating License of a Nuclear Power Plant, to Subpart A, National Environmental Policy Act-Regulations Implementing Section 102(2), of 10 CFR 51; or
- Information not considered in the assessment of impacts evaluated in the GEIS, leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.
- Further, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

E4.0.1 CATEGORY 1 LICENSE RENEWAL ISSUES

> *The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(i)]*
>
> *[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal . . . . (*61 FR 28483*)*

Dominion has determined that, of the 60 Category 1 issues, seven are not applicable to SPS because they result from design or operational features that do not exist at the facility. Table E4.0-1 lists these seven issues and provides a brief explanation of why they are not applicable to the site. Table E4.0-2 lists the 53 issues which are applicable to the site. Dominion reviewed the NRC findings on these 53 issues and identified no new and significant information that would invalidate the findings for the site (Chapter 5). Therefore, Dominion adopts by reference the NRC findings for these Category 1 issues.

As stated above, the applicability of the Category 1 issues is based on SPS design or operational features as described for the proposed action. Potentially, renewal of the VPDES permit could require modifications to SPS's current cooling system. As authorized by CWA 316(b) regulations, a condition of renewal of the VPDES permit could include modifications to the existing once-through cooling system or installation of a closed-cycle cooling system (i.e., cooling tower). Should a modification such as cooling tower be required, detailed cost-benefit and environmental impacts

would be evaluated for comparison with the existing once-through mode. Implementation would include permitting and/or licensing changes to account for impacts to environmental resources. Under this circumstance, Dominion would seek any necessary NRC license amendments and evaluate the impacts of such modifications, including environmental impacts, prior to implementation.

E4.0.2 CATEGORY 2 LICENSE RENEWAL ISSUES

The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(ii)]

The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

The NRC designated 17 issues as Category 2. Dominion has determined that, of the 17 issues shown in Table E4.0-3, five issues are not applicable to SPS because they are applicable to plants with closed-cycle cooling system or specify that they are applicable to plants with cooling towers or cooling ponds.

As noted under Section E4.0.1, potential renewal of the VPDES permit could require modifications to the cooling system, including the installation of cooling towers. Under this circumstance, Dominion would seek any necessary NRC license amendments and evaluate the impacts of such modifications, including environmental impacts, prior to implementation.

For the 12 issues applicable to the site, the corresponding sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to renewal of the SPS Units 1 and 2 OLs and, when applicable, discuss potential mitigation alternatives to the extent appropriate. With the exception of threatened and endangered species/EFH, historic and cultural resources, and environmental justice, SPS has identified the significance of the impacts associated with each issue as SMALL, MODERATE, or LARGE, consistent with the criteria that the NRC established in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3 as follows:

SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource. For issues where probability is a key consideration (i.e., accident consequences), probability was a factor in determining significance.

Threatened and endangered species/EFH, historic and cultural resources, and environmental justice were not assigned a significance impact of SMALL, MODERATE, or LARGE in 10 CFR 51, Subpart A, Appendix B, Table B-1. Therefore, consistent with NRC guidance, SPS identified the significance of the impacts for these three Category 2 issues as follows:

- For threatened and endangered species (ESA), the significance of the effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, (1) would have no effect on federally listed species; (2) are not likely to adversely affect federally listed species; (3) are likely to adversely affect federally listed species; or (4) are likely to jeopardize a federally listed species or adversely modify DCH. For EFH (Magnuson Stevens Fishery Conservation and Management Act), the significance of effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, would have: (1) no adverse impact; (2) minimal adverse impact; or (3) substantial adverse impact to the essential habitat of federally managed fish populations. (NRC. 2013a)
- For historic and cultural resources (NHPA), the significance of the effects from license renewal can be characterized based on a determination that: (1) no historic properties are present (no effect); (2) historic properties are present, but would not be adversely affected (no adverse effect); or (3) historic properties are adversely affected (adverse effect). (NRC. 2013b)
- For environmental justice, impacts would be based on disproportionately high and adverse human health and environmental effects on minority and low-income populations. (NRC. 2013b)

In accordance with NEPA practice, SPS considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are SMALL receive less mitigation consideration than impacts that are LARGE).

E4.0.3 UNCATEGORIZED LICENSE RENEWAL ISSUES

The NRC determined that its categorization and impact-finding definitions did not apply to chronic effects of electromagnetic fields. Because the categorization and impact finding definitions do not apply as noted in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 5, applicants are not currently required to submit information on this issue.

E4.0.4 FORMAT OF ISSUES REVIEWED

The review and analysis of the Category 1 and 2 issues identified in NRC Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC. 2013b) are presented in the following sections. The format for the review of these issues is described below. Although Chapter 5 describes the process by which Category 1 issues have been evaluated for new and significant information, specific issues are also being listed in this chapter for consistency purposes with the recommended NRC Regulatory Guide 4.2, Supplement 1 format.

- *Issue: T*itle of the issue.
- *Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1: T*he findings for the issue from 10 CFR 51, Subpart A, Appendix B, Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants.
- *Requirement: R*estatement of the applicable 10 CFR 51.53 requirement.
- *Background: A* background excerpt from the applicable section of the GEIS. The specific section of the GEIS is referenced for the convenience of the reader.
- *Analysis: A*n analysis of the environmental impact, taking into account information provided in the GEIS and 10 CFR 51, Subpart A, Appendix B, as well as current site-specific information. If an issue is not applicable, the analysis lists the explanation. The analysis section also provides a summary conclusion of the environmental impacts and identifies, as applicable, either ongoing or additional planned mitigation measures to reduce adverse impacts. For Category 1 issues listed in this chapter, an analysis is not required absent new and significant information.

Table E4.0-1 Category 1 Issues Not Applicable to SPS

Issue	Comment
Land Use	
Offsite land use in transmission line rights-of-ways (ROWs)	All in-scope transmission lines subject to the evaluation of environmental impacts for license renewal are located completely within the SPS site.
Surface Water Resources	
Altered thermal stratification of lakes	SPS is not located on a lake.
Groundwater Resources	
Groundwater use conflicts (plants that withdraw less than 100 gallons per minute)	SPS withdraws greater than 100 gallons per minute of groundwater.
Groundwater quality degradation (plants with cooling ponds in salt marshes)	SPS is located on an estuarine body and does not utilize cooling ponds.
Terrestrial Resources	
Cooling tower impacts on vegetation (plants with cooling towers)	SPS is a once-through cooling plant and does not utilize cooling towers for condenser cooling purposes.
Aquatic Resources	
Impingement and entrainment of aquatic organisms (plants with cooling towers)	SPS is a once-through cooling plant and does not utilize cooling towers for condenser cooling purposes.
Thermal impacts on aquatic organisms (plants with cooling towers)	SPS is a once-through cooling plant and does not utilize cooling towers for condenser cooling purposes.

Table E4.0-2 Category 1 Issues Applicable to SPS

Resource	Issue
Land Use	Onsite land uses
	Offsite land uses
Visual Resources	Aesthetic impacts
Air Quality	Air quality impacts (all plants)
	Air quality effects of transmission lines
Noise	Noise impacts
Geologic Environment	Geology and soils
Surface Water Resources	Surface water use and quality (non-cooling system impacts)
	Altered current patterns at intake and discharge structures
	Altered salinity gradients
	Scouring caused by discharged cooling water
	Discharge of metals in cooling system effluent
	Discharge of biocides, sanitary waste, and minor chemical spills
	Surface water use conflicts (plants with once-through cooling systems)
	Effects of dredging on surface water quality
	Temperature effects on sediment transport capacity
Groundwater Resources	Groundwater contamination and use (non-cooling system impacts)
	Groundwater quality degradation resulting from water withdrawals

Table E4.0-2 Category 1 Issues Applicable to SPS

Resource	Issue
Terrestrial Resources	Exposure of terrestrial organisms to radionuclides
	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)
	Bird collisions with plant structures and transmission lines
	Transmission line right-of-way management impacts on terrestrial resources
	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)
Aquatic Resources	Entrainment of phytoplankton and zooplankton (all plants)
	Infrequently reported thermal impacts (all plants)
	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication
	Effects of nonradiological contaminants on aquatic organisms
	Exposure of aquatic organisms to radionuclides
	Effects of dredging on aquatic organisms
	Effects on aquatic resources (non-cooling system impacts)
	Impacts of transmission line right-of-way management on aquatic resources
	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses
Socioeconomics	Employment and income, recreation and tourism
	Tax revenues
	Community services and education
	Population and housing
	Transportation

Table E4.0-2 Category 1 Issues Applicable to SPS

Resource	Issue
Human Health	Radiation exposures to the public
	Radiation exposures to plant workers
	Human health impact from chemicals
	Microbiological hazards to plant workers
	Physical occupational hazards
Postulated Accidents	Design-basis accidents
Waste Management	Low-level waste storage and disposal
	Onsite storage of spent nuclear fuel
	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal
	Mixed-waste storage and disposal
	Nonradioactive waste storage and disposal
Uranium Fuel Cycle	Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste
	Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste
	Nonradiological impacts of the uranium fuel cycle
	Transportation
Termination of Nuclear Power Plant Operations and Decommissioning	Termination of plant operations and decommissioning

Table E4.0-3 Category 2 Issues Applicability to SPS

Resource Issue	Applicability	ER Section
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	Not applicable	E4.5.1
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute)	Applicable	E4.5.3
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	Not applicable	E4.5.2
Groundwater quality degradation (plants with cooling ponds at inland sites)	Not applicable	E4.5.4
Radionuclides released to groundwater	Applicable	E4.5.5
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts)	Applicable	E4.6.5
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not applicable	E4.6.4
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	Applicable	E4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	Applicable	E4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not applicable	E4.6.3
Special Status Species and Habitats		
Threatened, endangered, and protected species and EFH	Applicable	E4.6.6
Historic and Cultural Resources		
Historic and cultural resources	Applicable	E4.7
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)	Applicable	E4.9.1
Electric shock hazards	Applicable	E4.9.2

Table E4.0-3 Category 2 Issues Applicability to SPS

Resource Issue	Applicability	ER Section
Postulated Accidents		
Severe accidents	Applicable	E4.15
Environmental Justice		
Minority and low-income populations	Applicable	E4.10.1
Cumulative Impacts		
Cumulative impacts	Applicable	E4.12

E4.1 LAND USE AND VISUAL RESOURCES

E4.1.1 ONSITE LAND USE

E4.1.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Changes in onsite land use from continued operations and refurbishment associated with license renewal would be a small fraction of the nuclear power plant site and would involve only land that is controlled by the licensee.

E4.1.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.1.1.3 Background [GEIS Section 4.2.1.1]

Operational activities at a nuclear power plant during the license renewal term would be similar to those occurring during the current license term. Generally, onsite land use conditions would remain unchanged. However, additional spent nuclear fuel and low-level radioactive waste generated during the license renewal term could require the construction of new or expansion of existing onsite storage facilities. Should additional storage facilities be required, this action would be addressed in separate license reviews conducted by the NRC. Refurbishment activities, such as steam generator and vessel head replacement, have not permanently changed onsite land use conditions.

E4.1.1.4 Analysis

Onsite land use information is presented in Section E3.2.1 of this ER. No license renewal-related refurbishment activities have been identified as presented in Section E2.3. In addition, no license renewal-related construction activities have been identified. Therefore, no changes in onsite land use during the proposed SLR operating term are anticipated.

In the GEIS, the NRC determined that onsite land use impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.2.1.1). Based on Dominion's review, no new and significant information was identified as it relates to onsite land use, and further analysis is not required.

E4.1.2 OFFSITE LAND USE

E4.1.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Offsite land use would not be affected by continued operations and refurbishment associated with license renewal.

E4.1.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.1.2.3 Background [GEIS Section 4.2.1.1]

The impacts of continued plant operations during the license renewal term and refurbishment on offsite land use were evaluated separately in the 1996 GEIS. It was predicted that impacts associated with refurbishment and changes in population and tax revenue on offsite land use could range from SMALL to MODERATE. Subsequent license renewal reviews, however, have shown no power plant-related population changes or significant tax revenue changes due to license renewal. Non-outage employment levels at nuclear power plants have remained relatively unchanged or have decreased. With no increase in the number of workers, there has been no increase in housing, infrastructure, or demand for services beyond what has already occurred. Operational activities during the license renewal term would be similar to those occurring during the current license term and would not affect offsite land use beyond what has already been affected.

For plants that have the potential to impact a coastal zone or coastal watershed, as defined by each state participating in the national Coastal Zone Management Program, applicants for license renewal must submit to the affected state a certification that the proposed license renewal is consistent with the state Coastal Zone Management Program. Applicants must coordinate with the state agency that manages the state Coastal Zone Management Program to obtain a determination that the proposed nuclear plant license renewal would be consistent with the state program.

E4.1.2.4 Analysis

Offsite land use information is presented in Section E3.2.2 of this ER. As presented in Section E2.5, there are no plans to add workers to support plant operations during the SLR operating term and, as presented in Section E2.3, no license renewal-related refurbishment activities have been identified. Therefore, no changes in offsite land use during the proposed SLR operating term are anticipated.

In the GEIS, the NRC determined that offsite land use impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.2.1.1). Based on Dominion's review, a new offsite land use activity has been identified which is associated with the installation of an offsite DMMA. It has been determined that because the DMMA will be sited, designed, operated, and permitted in accordance with applicable federal, state, and local regulatory requirements, it is not significant and its impacts on the land use will be SMALL. No new and significant information was identified as it relates to offsite land use, and further analysis is not required.

E4.1.3 AESTHETICS IMPACTS

E4.1.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. No important changes to the visual appearance of plant structures or transmission lines are expected from continued operations and refurbishment associated with license renewal.

E4.1.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.1.3.3 Background [GEIS Section 4.2.1.2]

A case study performed for the 1996 GEIS found a limited number of situations where nuclear power plants had a negative effect on visual resources. Negative perceptions were based on aesthetic considerations (for instance, the plant is out of character or scale with the community or the viewshed), physical environmental concerns, safety and perceived risk issues, an anti-plant attitude, or an anti-nuclear orientation. It is believed that these negative perceptions would persist regardless of mitigation measures.

In addition, the visual appearance of transmission lines is not expected to change during the license renewal term. After the containment building and cooling towers, transmission line towers are probably the most frequently observed structure associated with nuclear power plants. Transmission lines from nuclear power plants are generally indistinguishable from those from other power plants. Because electrical transmission lines are common throughout the United States, they are generally perceived with less prejudice than the nuclear power plant itself. Also, the visual impact of transmission lines tends to wear off when viewed repeatedly.

E4.1.3.4 Analysis

The visual appearance of the plant and in-scope transmission lines is presented in Section E3.2.3 of this ER. As presented in Section E3.2.3, the SPS plant is in a rural area on Gravel Neck Peninsula surrounded by the James River, Hog Island WMA, and forest. Predominant visual features at SPS are the reactor containment buildings, the turbine buildings, and transmission lines. The site structures located within the protected area of the plant are set back from the shoreline of the James River and surrounded by forest, offering limited offsite viewing opportunities. Because of the wooded setting and remote location, SPS would have minimal visual impact on neighboring properties or from the viewpoint of the James River. As noted in Section E2.3, no refurbishment or construction activities have been identified that would change the aesthetics of the SPS facility during the proposed SLR operating term. Therefore, no changes in visual resources during the proposed SLR operating term are anticipated.

In the GEIS, the NRC determined that aesthetic impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.2.1.2). Based on Dominion's review, no new and significant information was identified as it relates to visual resources, and further analysis is not required.

E4.2 AIR QUALITY

E4.2.1 AIR QUALITY IMPACTS (ALL PLANTS)

E4.2.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Air quality impacts from continued operations and refurbishment associated with license renewal are expected to be small at all plants. Emissions resulting from refurbishment activities at locations in or near air quality nonattainment or maintenance areas would be short-lived and would cease after these refurbishment activities are completed. Operating experience has shown that the scale of refurbishment activities has not resulted in exceedance of the de minimis thresholds for criteria pollutants, and BMPs, including fugitive dust controls and the imposition of permit conditions in state and local air emissions permits, would ensure conformance with applicable state or tribal implementation plans.

Emissions from emergency diesel generators and fire pumps, and routine operations of boilers used for space heating, would not be a concern, even for plants located in or adjacent to nonattainment areas. Impacts from cooling tower particulate emissions, even under the worst-case situations, have been SMALL.

E4.2.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.2.1.3 Background [GEIS Section 4.3.1.1]

Impacts on air quality during normal plant operations can result from operations of fossil fuel-fired equipment needed for various plant functions. Each licensed plant typically employs emergency diesel generators for use as a backup power source. Emergency diesel generators and fire pumps typically require state or local operating permits. These diesel generators are typically tested once a month with several test burns of various durations (e.g., one to several hours). In addition to these maintenance tests, longer-running endurance tests are also typically conducted at each plant. Each generator is typically tested for 24 hours on a staggered test schedule (e.g., once every refueling outage).

In addition to the emergency diesel generators, fossil fuel (i.e., diesel-, oil-, or natural-gas-fired) boilers are used primarily for evaporator heating, plant space heating, and/or feedwater purification. These units typically operate at a variable load on a continuous basis throughout the year unless end use is restricted to one application, such as space heating. The utility boilers at commercial plants are relatively small when compared with most industrial boilers and are typically regulated through state-level operating permits.

As presented in Section 3.3 of the GEIS, cooling tower drift can increase downwind particulate matter (PM) concentrations, impair visibility, ice roadways, cause drift deposition, and damage vegetation and painted surfaces. Thus, although there is the potential for some air quality impacts to occur as a result of equipment and cooling tower operations, even in the worst-case situation (Hope Creek), the impacts have been SMALL, and licensees would be required to operate within state permit requirements.

In the 1996 GEIS, the NRC concluded that the impacts from plant refurbishment associated with license renewal on air quality could range from SMALL to LARGE, although these impacts were expected to be SMALL for most plants. However, findings from license renewal SEISs published since the 1996 GEIS have shown that refurbishment activities, such as steam generator and vessel head replacement, have not required the large numbers of workers and months of time, as well as the degree of land disturbance that was conservatively estimated in the 1996 GEIS. Presumed air pollutant emissions, including levels of fugitive dust, have therefore not been realized.

E4.2.1.4 Analysis

Air quality information is presented in Section E3.3.3 of this ER. No license renewal-related refurbishment activities have been identified, as presented in Section E2.3. As stated in the GEIS, BMPs, including fugitive dust controls and the imposition of permit conditions in VDEQ air emissions permits, would ensure conformance with applicable state implementation plans.

As presented in Section E3.3.3.1, Surry County is in attainment with the NAAQS for all criteria air pollutants. As presented in Section E3.3.3.2, no future upgrade or replacement activities (e.g., diesel generators, diesel pumps) that would increase or decrease air emissions over the SLR operating term were identified as necessary for plant operations.

SPS and GNCTS are jointly permitted under a 2018 Title V Air Permit PRO50336 (VDEQ. 2018). Dominion is in regular contact with the VDEQ and is aware of no significant issues that will significantly change the permit compliance of SPS.

As presented in Section E3.3.3.2, the SPS air permit contains conditions established by the VDEQ to protect Virginia's ambient air quality standards and ensure impacts are maintained at acceptable levels. Appropriate permit conditions would regulate any future SPS activities that may increase air pollutants or threaten the attainment status of Surry County. Compliance with current and future air emissions regulatory requirements, applicable emissions control measures, and reporting requirements will ensure continued SMALL impact on ambient air quality.

In the GEIS, the NRC determined that air quality impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.3.1.1). Based on Dominion's review, no new and significant information was identified as it relates to air quality, and further analysis is not required.

E4.2.2 AIR QUALITY EFFECTS OF TRANSMISSION LINES

E4.2.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.

E4.2.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.2.2.3 Background [GEIS Section 4.3.1.1]

Small amounts of ozone and substantially smaller amounts of oxides of nitrogen are produced by transmission lines during corona, a phenomenon that occurs when air ionizes near isolated irregularities on the conductor surface such as abrasions, dust particles, raindrops, and insects. Several studies have quantified the amount of ozone generated and concluded that the amount produced by even the largest lines in operation (765 kilovolt [kV]) is insignificant.

Ozone concentrations generated by transmission lines are therefore too low to cause any significant effects. The minute amounts of oxides of nitrogen produced are similarly insignificant. A finding of SMALL significance for transmission lines, within this scope of review is supported by the evidence that production of ozone and oxides of nitrogen are insignificant and does not measurably contribute to ambient levels of those gases.

E4.2.2.4 Analysis

Based on the GEIS, it was determined through several studies that the amount of ozone generated by even the largest lines in operation (765 kV) would be insignificant (NRC. 2013a, Section 4.3.1.1). As presented in Section E2.2.5, SPS' in-scope transmission lines are 230 kV and 500 kV. Therefore, the production of ozone and oxides of nitrogen would be de minimis.

In the GEIS, the NRC determined that air quality effects of transmission lines from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.3.1.1). Based on Dominion's review, no new and significant information was identified as it relates to air quality effects of transmission lines, and further analysis is not required.

E4.3 NOISE

E4.3.1 FINDINGS FROM 10 CFR 51, SUBPART A, APPENDIX B, TABLE B-1

SMALL. Noise levels would remain below regulatory guidelines for offsite receptors during continued operations and refurbishment associated with license renewal.

E4.3.2 REQUIREMENT [10 CFR 51.53(C)(3)(IV)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.3.3 BACKGROUND [GEIS SECTION 4.3.1.2]

Major sources of noise at operating nuclear power plants are cooling towers, turbines, transformers, large pumps, and cooling water system motors. Nuclear plant operations have not changed appreciably with time, and no change in noise levels or noise-related impacts are expected during the license renewal term. Because no change is expected in the amount of noise generated during the license renewal term, the only issue of concern is the number of people now living close to the nuclear power plant who are exposed to operational noise.

Given the industrial nature of the power plant and the number of years of plant operation, noise from a nuclear plant is generally nothing more than a continuous minor nuisance. However, noise levels may sometimes exceed 55 dBA, the EPA's threshold level for protection against excess noise during outdoor activities. However, according to the EPA, this threshold does "not constitute a standard, specification, or regulation," but was intended to provide a basis for state and local governments establishing noise standards. Nevertheless, noise levels at the site boundary are expected to remain well below regulatory standards for offsite residents.

Noise would also be generated by construction-related activities and equipment used during refurbishment. However, this noise would occur for relatively short periods of time (several weeks) and is not expected to be distinguishable from other operational noises at the site boundary nor create an adverse impact on nearby residents.

E4.3.4 ANALYSIS

Noise associated with plant operations is presented in Section E3.4 of this ER. No license renewal-related refurbishment activities have been identified, as presented in Section E2.3. As presented in Section E3.4, because SPS is located in a rural area, it is unlikely that noise levels from SPS would affect offsite residences. SPS exceeds the requirements set by Surry County's zoning ordinance for buffer zone distance between SPS and the nearest residence.

As presented in Section E3.4, SPS has received noise complaints (over the years) on an intermittent basis. SPS may make a public announcement for planned noise-generating activities when necessary and perform outreach to the public for an unplanned noise-generating activity. SPS also monitors noise at and around the plant site for occupational and ambient effects on an as-needed basis.

In the GEIS (NRC. 2013a, Section 4.3.1.2), the NRC determined that noise impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue. Based on Dominion's review, no new and significant information was identified as it relates to noise, and further analysis is not required.

E4.4 GEOLOGY AND SOILS

E4.4.1 FINDINGS FROM 10 CFR 51, SUBPART A, APPENDIX B, TABLE B-1

SMALL. The effect of geologic and soil conditions on plant operations and the impact of continued operations and refurbishment activities on geology and soils would be small for all nuclear power plants and would not change appreciably during the proposed license renewal term.

E4.4.2 REQUIREMENT [10 CFR 51.53(C)(3)(IV)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.4.3 BACKGROUND [GEIS SECTION 4.4.1]

The impact of continued operations and refurbishment associated with subsequent license renewal on geologic and soil resources would consist of soil disturbance, including sediment and/or any associated bedrock, for projects, such as replacing or adding buildings, roads, parking lots, and belowground and aboveground utility structures. Implementing BMPs would reduce soil erosion and subsequent impacts on surface water quality. These practices include, but are not limited to, minimizing the amount of disturbed land; stockpiling topsoil before ground disturbance; mulching and seeding disturbed areas; covering loose materials with geotextiles; using silt fences to reduce sediment loading to surface water; using check dams to minimize the erosive power of drainages; and installing proper culvert outlets to direct flows in streams or drainages.

Detailed geotechnical analyses would be required to address the stability of excavations, foundation footings, and slope cuts for building construction, road creation, or other refurbishment-related construction projects. Depending on the plant location and design, riverbank or coastline protection might need to be upgraded, especially at water intake or discharge structures if natural flows, such as storm surges, cause an increase in erosion. In addition, the FPPA [7 USC 4201 et seq.] requires federal agencies to consider agency actions affecting the preservation of farmland, including prime and other important farmland soils, as described in Section 3.4 of the GEIS.

E4.4.4 ANALYSIS

Geology and soils information is presented in Section E3.5 of this ER. Routine infrastructure, renovation, and maintenance projects would be expected during continued operation. As presented in Section E3.5.3.2 and Section E3.6.1.2.2, SPS maintains and implements an SWPPP that identifies potential sources of pollution that would reasonably be expected to affect the quality of stormwater, such as erosion, and identifies BMPs that will be used to prevent or reduce the pollutants in stormwater discharges.

In the GEIS, the NRC determined that geology and soil impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.4.1). Based on Dominion's review, no new and significant information was identified as it relates to geology and soils, and further analysis is not required.

E4.5 WATER RESOURCES

E4.5.1 SURFACE WATER USE CONFLICTS (PLANTS WITH COOLING PONDS OR COOLING TOWERS USING MAKEUP WATER FROM A RIVER)

E4.5.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts could be of small or moderate significance, depending on makeup water requirements, water availability, and competing water demands.

E4.5.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river . . . must be provided.

E4.5.1.3 Background [GEIS Section 4.5.1.1]

Nuclear power plant cooling systems may compete with other users relying on surface water resources, including downstream municipal, agricultural, or industrial users. Closed-cycle cooling is not completely closed, because the system discharges blowdown water to a surface water body and withdraws water for makeup of both the consumptive water loss due to evaporation and drift (for cooling towers) and blowdown discharge. For plants using cooling towers, the makeup water needed to replenish the consumptive loss of water to evaporation can be significant and is reported at 60% or more of the condenser flow rate. Cooling ponds will also require makeup water as a result of naturally occurring evaporation, evaporation of the warm effluent, and possible seepage to groundwater.

Consumptive use by plants with cooling ponds or cooling towers using makeup water from a river during the license renewal term is not expected to change unless power uprates, with associated increases in water use, are proposed. Such uprates would require an environmental assessment by the NRC. In the 1996 GEIS, application of this issue applied only to rivers with low flow to define the difference between plants located on "small" versus "large" rivers. However, any river, regardless of size, can experience low flow conditions of varying severity during periods of drought and changing conditions in the affected watershed such as upstream diversions and use of river water. The NRC subsequently determined that use of the term "low flow" in categorizing river flow is of little value, considering that all rivers can experience low flow conditions.

Population growth around nuclear power plants has increased demand on municipal water systems, including systems that rely on surface water. Municipal intakes located downstream from a nuclear power plant could experience water shortages, especially in times of drought. Similarly, water demands upstream from a plant could impact the water availability at the plant's intake.

Water use conflicts associated with plants with cooling ponds or cooling towers using makeup water from a river with low flow were considered to vary among sites because of differing site-specific factors, such as makeup water requirements, water availability (especially in terms of varying river flow rates), changing or anticipated changes in population distributions, or changes in agricultural or industrial demands.

E4.5.1.4 Analysis

As presented in Section E2.2.3 of this ER, SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers. Therefore, this issue is not applicable and further analysis is not required.

E4.5.2 GROUNDWATER USE CONFLICTS (PLANTS WITH CLOSED-CYCLE COOLING SYSTEMS THAT WITHDRAW MAKEUP WATER FROM A RIVER)

E4.5.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Water use conflicts could result from water withdrawals from rivers during low-flow conditions, which may affect aquifer recharge. The significance of impacts would depend on makeup water requirements, water availability, and competing water demands.

E4.5.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands . . . must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

E4.5.2.3 Background [GEIS Section 4.5.1.2]

In the case of plants with cooling towers or cooling ponds that rely on a river for makeup of consumed (evaporated) cooling water, it is possible water withdrawals from the river could lead to groundwater use conflicts with other users. This situation could occur because of the interaction between groundwater and surface water, especially in the setting of an alluvial aquifer in a river valley. Consumptive use of the river water, if significant enough to lower the river's water level, would also influence water levels in the alluvial aquifer. Shallow wells of nearby groundwater users

could therefore have reduced water availability or go dry. During times of drought, the effect would occur naturally, although withdrawals for makeup water would increase the effect.

E4.5.2.4 Analysis

As presented in Section E2.2.3 of this ER, SPS utilizes a once-through cooling system and does not utilize a closed-cycle cooling system for condenser cooling purposes. Therefore, this issue is not applicable and further analysis is not required.

E4.5.3 GROUNDWATER USE CONFLICTS (PLANTS THAT WITHDRAW MORE THAN 100 GPM)

E4.5.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Plants that withdraw more than 100 gpm could cause groundwater use conflicts with nearby groundwater users.

E4.5.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(C)]

If the applicant's plant pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater must be provided.

E4.5.3.3 Background [GEIS Section 4.5.1.2]

A nuclear plant may have several wells with combined pumping in excess of 100 gpm (378 liters per minute [L/min]). Overall site pumping rates of this magnitude have the potential to create conflicts with other local groundwater users if the cone of depression extends to the offsite well(s). Large offsite pumping rates for municipal, industrial, or agricultural purposes may, in turn, lower the water level at power plant wells. For any user, allocation is normally determined through a state-issued permit.

Groundwater use conflicts have not been observed at any nuclear power plants, and no significant change in water well systems is expected over the license renewal term. If a conflict did occur, it might be possible to resolve it if the power plant relocated its well or wellfield to a different part of the property. The siting of new wells would be determined through a hydrogeologic assessment.

E4.5.3.4 Analysis

The VDEQ (Permit No. GW0003901) allows a maximum withdrawal of a total of 154.7 mgy with a monthly maximum of about 15.89 mg (367.8 gpm) authorized for use as domestic, process, and cooling water (VDEQ. 2013a).

As presented in Section E3.6.3.2, the Dominion property has nine groundwater supply wells. Seven groundwater wells serve SPS and another two wells serve the GNCTS. Two wells (Wells D and F),

are currently out of service. The combined groundwater withdrawals from the remaining five wells on the SPS property is approximately 389,530 gpd (270.5 gpm). The two wells on the GNCTS complex have a combined estimated maximum groundwater withdrawal of approximately 34,500 gpd (23.9 gpm).

The VDEQ reviews all groundwater withdrawals/useage for the area when approving a groundwater withdrawal permit. In addition, SPS is required to submit monthly groundwater withdrawal reports on a monthly basis to the VDEQ. Combined groundwater withdrawals from both SPS and GNCTS (294.4 gpm) are 80% of the permitted groundwater withdrawal limit (367.8 gpm). As it is not anticipated that groundwater withdrawal increases above permitted quantities will be required during the SLR operating term, Dominion concludes that impacts from groundwater withdrawals are SMALL and do not warrant additional mitigation measures.

E4.5.4 GROUNDWATER QUALITY DEGRADATION (PLANTS WITH COOLING PONDS AT INLAND SITES)

E4.5.4.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Inland sites with closed-cycle cooling ponds could degrade groundwater quality. The significance of the impact would depend on cooling pond water quality, site hydrogeologic conditions (including the interaction of surface water and groundwater), and the location, depth, and pump rate of water wells.

E4.5.4.2 Requirement [10 CFR 51.53(c)(3)(ii)(D)]

If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided.

E4.5.4.3 Background [GEIS Section 4.5.1.2]

Some nuclear power plants that rely on unlined cooling ponds are located at inland sites surrounded by farmland or forest or undeveloped open land. Degraded groundwater has the potential to flow radially from the ponds and reach offsite groundwater wells. The degree to which this occurs depends on the water quality of the cooling pond; site hydrogeologic conditions (including the interaction of surface water and groundwater); and the location, depth, and pump rate of water wells. Mitigation of significant problems stemming from this issue could include lining existing ponds, constructing new lined ponds, or installing subsurface flow barrier walls. Groundwater monitoring networks would be necessary to detect and evaluate groundwater quality degradation. The degradation of groundwater quality associated with cooling ponds has not been reported for any inland nuclear plant sites.

E4.5.4.4 Analysis

As presented in Section E2.2.3 of this ER, SPS utilizes a once-through cooling system and does not utilize cooling ponds. Therefore, this issue is not applicable and further analysis is not required.

E4.5.5 RADIONUCLIDES RELEASED TO GROUNDWATER

E4.5.5.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Leaks of radioactive liquids from plant components and pipes have occurred at numerous plants. Groundwater protection programs have been established at all operating nuclear power plants to minimize the potential impact from any inadvertent releases. The magnitude of impacts would depend on site-specific characteristics.

E4.5.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(P)]

An applicant shall assess the impact of any documented inadvertent releases of radionuclides into groundwater. The applicant shall include in its assessment a description of any groundwater protection program used for the surveillance of piping and components containing radioactive liquids for which a pathway to groundwater may exist. The assessment must also include a description of any past inadvertent releases and the projected impact to the environment (e.g., aquifers, rivers, lakes, ponds, ocean) during the license renewal term.

E4.5.5.3 Background [GEIS Section 4.5.1.2]

The issue is relevant to license renewal because all commercial nuclear power plants routinely release radioactive gaseous and liquid materials into the environment. These radioactive releases are designed to be planned, monitored, documented, and released into the environment at designated discharge points. But over the years, there have been numerous events at nuclear power reactor sites which involved unknown, uncontrolled, and unmonitored releases of liquids containing radioactive material into the groundwater.

The majority of the inadvertent liquid release events involved tritium, which is a radioactive isotope of hydrogen. However, other radioactive isotopes, such as cesium and strontium, have also been inadvertently released into the groundwater. The types of events include leakage from spent fuel pools, buried piping, and failed pressure relief valves on an effluent discharge line.

In 2006, the NRC's executive director for operations chartered a task force to conduct a lessons learned review of these incidents. On September 1, 2006, the task force issued its report: Liquid Radioactive Release Lessons Learned Task Force Report.

The most significant conclusion dealt with the potential health impacts on the public from the inadvertent releases. Although there were numerous events during which radioactive liquid was

released to the groundwater in an unplanned, uncontrolled, and unmonitored fashion, based on the data available, the task force did not identify any instances where public health and safety were adversely impacted.

On the basis of the information and experience with these leaks, the NRC concludes that the impact to groundwater quality from the release of radionuclides could be SMALL or MODERATE, depending on the magnitude of the leak, the radionuclides involved, hydrogeologic factors, the distance to receptors, and the response time of plant personnel in identifying and stopping the leak in a timely fashion.

E4.5.5.4 Analysis

A description of the SPS groundwater protection program is presented in Section E3.6.2.4. Table E3.6-2 presents well construction details for the SPS groundwater monitoring wells, while Figure E3.6-7 shows the location of the wells. Table E3.6-5 presents information on registered water wells within a two-mile band around the SPS property boundary, while Figure E3.6-8 shows the locations of these registered wells.

As presented in Section E3.6.4.2.1, three inadvertent liquid radioactive releases have occurred at SPS, estimated to be greater than 100 gallons each.

The first release occurred due to a hole in a drain line which created a flow path to the ground. The second and third releases occurred due to the overflow of the Unit 2 turbine building heating steam drain receiver tank, which led to the damaged east storm drain line. The tritium concentrations in these releases ranged from 1,250 to 1,450 picocuries per liter. Remediation efforts for the first release on August 8, 2012, included sampling the No. 3 turbine building sump for radioactivity since the sump was known to discharge to the east storm drain line upstream of the hole discovered in the storm drain line. The discharge of the sump was redirected to prevent additional releases through the damaged storm drain line. Tritium was determined to be present in the sump water at a concentration of 1,250 picocuries per liter and the leak was voluntarily reported to county and state officials and the NRC. An exact volume of water that leaked through the storm drain could not be determined, but is estimated to be greater than 100 gallons. The causes of the damage to the storm drain line were related to the age of the line and the environmental conditions within the specific damaged area. (SPS. 2013a)

Remediation efforts for the second and third releases on September 17 and 23, 2012, included sampling the water in the tank, which confirmed the presence of tritium at a concentration of 1,450 picocuries per liter, and subsequently reporting these leaks to county and state officials and the NRC. The September 17, 2012, overflow event occurred due the failure of the tank discharge pump and the September 23, 2012, overflow event occurred due to the failure of the tank discharge pump to motor coupling. Each overflow was estimated to be greater than 100 gallons. The location of the leaks described above is within the protected area of SPS (Figure E3.1-1). Repairs to the

storm drain line have been completed and no tritium has been detected in monitoring wells in the vicinity of this previously degraded storm drain line nor in any monitoring wells outside the protected area. (SPS. 2013a)

As presented in Section E3.6.2.3, the groundwater flows from the west, south, and east towards SPS with the intake and discharge canals bounding the groundwater. In between the intake canal and discharge canal, the groundwater flows from the southeastern portion of the intake canal (groundwater surface elevation of 25 feet AMSL) to the northwestern corner of the discharge canal (groundwater surface elevation of two feet AMSL). The subsurface drain pumps stabilize site water design elevation, prevent infiltration of groundwater into subsurface structures, and capture tritium. At the center of SPS, the containment, fuel building, and alleyway subsurface drain pumps lower groundwater elevation. One groundwater model simulation shows an east-west groundwater divide in the immediate area of the boron recovery valve gallery. This divide shifts north and south depending on the relative elevation of the discharge canal to the surrounding groundwater elevation. A contour map of the shallow groundwater based on water level data collected on June 9-10, 2014, as part of the NEI GPI program is provided as Figure E3.6-6.

The unconfined aquifer is partially or fully exposed throughout the site and is therefore susceptible to contaminants at the surface. Furthermore, the water table aquifer is hydraulically connected to surface water. Figure E3.6-7 shows the location of shallow piezometers (P-02, 06, P-20, P-29, P-33, and P-37) in which water levels were monitored over time and compared to the water level in SPS's discharge canal, which is connected to the James River. Each of these piezometers is tidally influenced and the tidal influence increases with proximity to the discharge canal (the intake canal is not tidally influenced). (SPS. 2010) Piezometers located close to the canal, such as P-06, P29, and P-33, are more noticeably influenced by tidal-induced fluctuations than piezometers located further away, such as P-02, P20, and P-037 (MACTEC. 2008).

Given the strong tidal influence in these wells, large-scale pumping in the water table aquifer at the levels required by the station would lead to salt water intrusion from the James River into the water table aquifer over the long term. The water table aquifer in the vicinity of SPS is particularly susceptible to salt water intrusion as the facility is located on a peninsula at approximately two miles from the "mainland." The peninsula is also partially disconnected from the "mainland" by several tidal creeks. Therefore, over the long term the water table aquifer is likely to provide a similar water quality as the James River itself. (SPS. 2010)

SPS's groundwater monitoring (and protection) program (GPP) encompasses the existing quality of groundwater potentially affected by continued operations (as compared to the EPA primary drinking water standards), as well as the current and potential onsite and offsite uses and users of groundwater for drinking and other purposes. For 2016, groundwater beneath SPS had tritium levels ranging from non-detect 1,330 to 8,340 picocuries per liter, with short-lived Co-58 detected once. One 2017 tritium sample from a later-installed well (Piez-44) reported a concentration of

59,300 picocuries per liter. One 2018 follow-up sample for tritium reported a concentration of approximately 79,000 picocuries per liter. In addition, tritium measured as part of the ongoing GPP (see Sections E3.6.4.2 and E3.6.4.2.1) is tracked and trended for reporting and corrective or improvement actions, such as remedial pumping and additional monitoring, e.g., via new wells or detection capabilities. A subject matter expert team has benchmarked the industry, and working toward zero-leakage goals has become an integrated component of the GPP.

Therefore, since water from station uses continues to be processed and monitored in compliance with licensing and permitting, Dominion concludes that impacts from radionuclides to groundwater are SMALL and do not warrant additional mitigation measures beyond in accordance with Dominion's existing GPP.

E4.6 ECOLOGICAL RESOURCES

E4.6.1 IMPINGEMENT AND ENTRAINMENT OF AQUATIC ORGANISMS PLANTS WITH ONCE-THROUGH COOLING SYSTEMS OR COOLING PONDS

E4.6.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. The impacts of impingement and entrainment are small at many plants, but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems, depending on cooling system withdrawal rates and volumes and the aquatic resources at the site.

E4.6.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current CWA 316(b) determinations or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from impingement and entrainment.

E4.6.1.3 Background [GEIS Section 4.6.1.2]

Impingement occurs when organisms are held against the intake screen or netting placed within intake canals. Most impingement involves fish and shellfish. At some nuclear power plants, other vertebrate species may also be impinged on the traveling screens or on intake netting placed within intake canals.

Entrainment occurs when organisms pass through the intake screens and travel through the condenser cooling system. Aquatic organisms typically entrained include ichthyoplankton (fish eggs

and larvae), larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. Juveniles and adults of some species may also be entrained if they are small enough to pass through the intake screen openings, which are commonly 0.38 inches at the widest point.

The magnitude of the impact would depend on plant-specific characteristics of the cooling system (including location, intake velocities, screening technologies, and withdrawal rates) and characteristics of the aquatic resource (including population distribution, status, management objectives, and life history).

E4.6.1.4 Analysis

The two nuclear power generating units at SPS use a once-through cooling water system. Cooling water for both units is withdrawn from the James River through a common low-level intake structure oriented parallel to, and flush with, the western shore of the James River. Trash racks extend across each of the eight intake bays to prevent debris from entering the low-level intakes. Each trash rack has half-inch-wide steel bars with four-inch spacing, providing a three-inch clear opening. The trash racks have a 1H:12V slope and are 18 feet wide. A curtain wall extends down to elevation -8.5 feet, about 3.8 feet below the minimum water level, approximately six feet downstream of each trash rack. The low-level intake contains eight screen bays (15.3 feet wide), equipped with Ristroph traveling water screens located approximately 17 feet downstream from the bottom of each trash rack.

As presented in Section E3.7.7 and discussed below, impingement and entrainment have been studied in detail during three time periods: 1974-1983; 2005-2006; and 2015-2016. Between June 2005 and May 2006, entrainment sampling was coupled with ichthioplankton sampling in adjacent waters to determine the site-specific mortality resulting from entrainment relative to adjacent waters. During the 2005-2006 studies, the impingement mortality and entrainment baselines were calculated utilizing the representative species approach identified by the EPA in the 2004 Final Rule. The representative species for this study were derived through consultations with the VDGIF, Virginia Marine Resources Commission (VMRC), VDEQ, local universities, from peer review of fish catch data in the vicinity of SPS, and information in the technical literature on the presence and management of recreationally and commercially important species in the James River. (CH2MHill. 2006)

During the 2005-2006 studies, James River species sampling data were compared to the historical data taken during the 1974-1983 studies performed by Dominion. Seine data from 1974-1983 and 2005-2006 were compared using percent composition of the 16 species caught in the 2005-2006 seine collections. Ten of the 16 species showed similar catch levels. Three differences are evident between the two collections of ambient seine data. First, blueback herring and Atlantic menhaden comprised a larger percentage of the historic catch (6.25% for blueback herring and 10.42% for

Atlantic menhaden) than they did in the recent collections (0.22% for blueback herring and 0.0% for menhaden). This comparison tracks with recent data compiled for these species by the Atlantic States Marine Fisheries Commission, which also reports recent reductions in abundance for these two species. A second difference is the apparent increase in silversides (inland silversides and Atlantic silversides [*Menidia menidia*]) from historic catch levels. The 2005-2006 seining data show that the two species of silverside comprised 91.08% of the total seine catch. Historic percentage composition for the two silversides species was 10.42%. Third, blue crab and sand perch (Diplectrum formosum) were not recorded during the historical surveys. (CH2MHill. 2006)

Trawl data from 1974-1983 and 2005-2006 were compared using percent composition of 21 species caught in the 2005-2006 trawl collections. Fourteen of the 21 species showed similar catch levels. Three differences are evident between the two collections of ambient trawl data. First, white catfish, blue crab, sand perch, American harvestfish (Peprilus paru), and blue catfish were not recorded during the historical surveys. Second, the 2005-2006 trawl catch shows blue catfish as the dominant species (35.28% composition of total catch) caught in trawl samples near SPS, but not recorded in the historic catch. This difference is apparently due to the successful introduction to the Chesapeake Bay drainage as a sportfish in the James, Rappahannock, and Mattaponi rivers from 1974-1989. Third, hogchoker was the most dominant common species in the historical studies comprising 37.4% as compared to 14.5% in the 2005-2006 seining data. (CH2MHill. 2006)

During the 2005-2006 entrainment study, a total of 45 ichthyoplankton taxa were found in the 24 entrainment samples collected from June 2005 through June 2006. At design flow, the SPS CWIS would entrain an estimated 53,692 x 10^6 organisms annually. Invertebrates comprised 96.8% of the total entrainment estimate, while finfish comprised only 3.2% of the total entrainment estimate. Unidentified shrimp (66.5%) and unidentified crab zoea or first stage larvae (24%) were the most abundant taxa collected during the sampling, together comprising 90.5% of total entrainment estimate. Unidentified shrimp are believed to be primarily mysid shrimp, since this was the only shrimp taxa identified to species. Other crab zoea (24%) and bivalves (5.4%) were the only other invertebrate groups comprising more than 1% of the total entrainment estimate. Blue crab megalops (second stage larvae) and blue crab juveniles together comprised only 0.14% of the total entrainment estimate. (CH2MHill. 2006)

Seasonal variation in the entrainment of finfish in both species and life stage was evident. Post-yolk sac larval and juvenile bay anchovy were the only finfish species found in the entrainment samples throughout the year. Goby sp. (post-yolk sac) larvae were found in the entrainment samples from April-September, but naked goby (both post-yolk sac larvae and juveniles) were present only from June-September. No juveniles of the unidentified goby species were entrained, and the individuals entrained of this species were comprised of 99.9% post-yolk sac larvae, with 0.1% of an undetermined life stage. Juvenile Atlantic croaker were present in the entrainment samples from September-April, while post-yolk sac larvae of this species were present from August-February.

The overall entrainment estimates show that the bulk of the finfish species subject to entrainment are present between May and September. Relatively low entrainment of finfish eggs and larvae occurs from October-April. Entrainment densities were much higher during nighttime samples than daytime samples. (CH2MHill. 2006)

The historical impingement data adequately represent existing conditions based on the relatively high number of similar catch rates at SPS and was used to assess compliance with the 2006 impingement performance standard (CH2MHill. 2006).

Based on the impingement monitoring data collected by Dominion between May 1974 and May 1983, the annual total number of fish impinged ranged from 1,338,280 in 1980 to 5,932,031 in 1975. The estimated mean annual impingement at SPS from 1974-1983 was 3,397,075 fish. Based on the calculated estimates of total impinged fish by species, the most abundant species collected during the nine-year sampling period was spot, which accounted for 21.9% of the estimated total fish impinged. The top six species, including spot, comprised 76.7% of all fish impinged during the sampling period: Atlantic menhaden at 18.2%; white perch at 10.2%; bay anchovy at 9.4%; blueback herring at 9.2%; and threadfin shad (Dorosoma petenense) at 7.1%. (CH2MHill. 2006)

Baseline calculations to determine the impingement and entrainment were estimated using the following (CH2MHill. 2006):

- Historical impingement and entrainment from the facility, or another facility with comparable design, operational, and environmental conditions;
- The 2005-2006 biological data collected in the waterbody in the vicinity of the low-level intake structure; and/or
- The 2005-2006 impingement mortality (IM) and entrainment data collected at the facility.

The IM calculation baseline is based on historical impingement data (1974-1983) and the entrainment calculation baseline is based on the 2005-2006 entrainment data. (CH2MHill. 2006)

The 2005-2006 evaluation also utilized the following species as representative species in the evaluation: American shad, Atlantic croaker, Atlantic menhaden, bay anchovy, blueback herring, bluefish, summer flounder, spot, striped bass, weakfish, and blue crab (zoea, megalop, and juvenile life stages). Additionally, Dominion was able to demonstrate credit for the use of the use of Ristroph traveling water screens with a fish return and 1/8-inch by 1/2-inch fine mesh screens. (CH2MHill. 2006)

The IM performance standard for SPS is the reduction in IM of 80-95% from the IM calculation baseline of 2,112,485 fish per year. SPS's existing design and construction technologies reduce the annual IM from 2,112,485 fish to 215,473 fish, which results in an IM reduction of 1,897,012 fish. Therefore, the existing SPS design and construction technologies reduce IM by 89.8% from the IM calculation baseline; a reduction that meets the IM performance standard. (CH2MHill. 2006)

The entrainment performance standard for SPS is the reduction in entrainment of 60-90% from the entrainment calculation baseline of 878.2 x10^6 organisms per year. SPS's existing design and construction technologies reduce the annual entrainment from 878.2 x 10^6 organisms to 716.5 x 10^6 organisms, which results in a reduction in entrainment of 161.7 x 10^6 organisms. Therefore, the existing SPS design and construction technologies reduce entrainment by 18.4% from the entrainment calculation baseline. This leaves an entrainment reduction increment of 41.6% required to meet the 2004 rule's entrainment performance standard. (CH2MHill. 2006)

This information was submitted to the VDEQ in the form of a comprehensive demonstration study (CH2MHill. 2006). Acceptance of this study as a demonstration of compliance with 316(b) resulted in the issuance of a modified VPDES permit in June of 2008 (SPS. 2008).

As presented in Section E3.7.7, SPS began additional entrainment and impingement evaluation studies in 2015, as the result of the 2014 316(b) rule.

To meet the requirements of the new rule, entrainment sampling surveys were conducted twice a month over a 24-month interval from August 1, 2015-July 31, 2017. Each sample collection event is conducted over a 24-hour period with sample sets collected every six hours. The sample frequency selected for this entrainment study will provide finfish and invertebrate (shellfish) taxa, density distribution and seasonal/diel variation data over a two-year period. Shellfish, for the purposes of this study, are inclusive of shrimp, crabs (including horseshoe), crayfish, and motile stages of bivalves and gastropods.

This methodology includes the following significant changes relative to the June 2005-May 2006 entrainment study (HDR 2016a):

- Use of a pump to collect samples directly in front of the bar racks rather than a streamed net approximately 100 feet in front of the bar racks.
- Use of 335-µm mesh targeted for the 2005-2006 study rather than 505-µm mesh.
- Collection of detailed morphometric data is included to support alternative technology evaluations.
- Inclusion of methods and evaluations to maximize resolution of the taxonomic identifications with regard to Atlantic sturgeon and other species.
- Collection of 24 months of entrainment data rather than 12 months.

SPS performed additional impingement monitoring twice per month over a 12-month study period between August 1, 2015, and July 31, 2016. Impingement sample collections were conducted by diverting the screenwash water into the fish holding pen located in the existing housing designated for impingement study (i.e., impingement building hereafter) (HDR. 2017).

Based on the results of this impingement monitoring study, the SPS Ristroph traveling water screens, fish return system, and flow reduction measures reduce impingement and associated mortality at the facility by 84% for finfish, 91% for shellfish, and 87% overall (HDR. 2017).

The data for these combined studies will be utilized to determine if the current operational methods to prevent entrainment and impingement at SPS are sufficient to meet the requirements of the new rule. SPS must remain compliant with the final rule to maintain its existing VPDES permit. VDEQ will make the final determination of compliance.

The SPS facility has been issued a number of previous VPDES permits and has been withdrawing once-through, non-contact cooling water without any identified problems. Based on the information evaluated, there have been no past or current measurable impacts associated with the withdrawal of the applicable cooling water (Attachment B). In the 2008 VPDES permit issued by the VDEQ, the agency approved the SPS intake structures as being best technology available in accordance with Section 316(b) of the CWA. In 2012, VDEQ re-confirmed that the SPS low-level intake structure was also best technology available, based on best professional judgment (Attachment B).

Continuing studies performed at SPS will ensure that SPS continues to utilize best technology available to minimize entrainment and impingement to the fullest extent practicable to maintain compliance with the VPDES permit issued by VDEQ. Because of continued compliance with VDEQ requirements, Dominion concludes that impacts from impingement and entrainment of aquatic organisms during the proposed SLR operating term would be SMALL. Although additional mitigation measures may be implemented in the future as a result of the requirements in the final 316(b) rule (79 FR 48300), these measures would minimize the already existing SMALL impacts.

E4.6.2 THERMAL IMPACTS ON AQUATIC ORGANISMS (PLANTS WITH ONCE-THROUGH COOLING SYSTEMS OR COOLING PONDS)

E4.6.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Most of the effects associated with thermal discharges are localized and are not expected to affect overall stability of populations or resources. The magnitude of impacts, however, would depend on site-specific thermal plume characteristics and the nature of aquatic resources in the area.

E4.6.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of a 316(a) variance in accordance with 40 CFR 125, or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from thermal changes.

E4.6.2.3 Background [GEIS Section 4.6.1.2]

Because characteristics of both the thermal discharges and the affected aquatic resources are specific to each site, NRC classified heat shock as a Category 2 issue that required a site-specific assessment for license renewal. The NRC found the potential for thermal discharge impacts to be greatest at plants with once-through cooling systems, primarily because of the higher discharge temperatures and larger thermal plume area compared to plants with cooling towers.

The impact level at any plant depends on the characteristics of its cooling system (including location and type of discharge structure, discharge velocity and volume, and three-dimensional characteristics of the thermal plume) and characteristics of the affected aquatic resources (including the species present and their physiology, habitat, population distribution, status, management objectives, and life history).

E4.6.2.4 Analysis

Section 316(a) of the CWA establishes a process whereby a thermal effluent discharger can demonstrate that thermal discharge limitations are more stringent than necessary and, using a variance, obtain alternative facility-specific thermal discharge limits [33 USC 1326].

As presented in Section E2.2.3, SPS has a once-through heat dissipation system. At full power operation, SPS discharges 11.9 x 10^9 Btu per hour into the James River. The SPS discharge permit limits waste heat rejected to the James River from SPS to 12.6 x 10^9 Btu per hour, but does not require the reporting of discharge temperatures (Attachment B). The thermal effluent limit is based on successful 316(a) demonstration.

The maximum temperature elevation of the water as a result of passing through the condensers is approximately 14°F. Upon discharge, the heated water mixes with river water in a 1,100-foot discharge canal lined with concrete and surrounded by a rock-filled groin with a reduced-size exit that guarantees the water will be discharged with a jetting action of 5.9 fps at the end of the rock groin. The CWA Section 316(a) report produced by Dominion in 1977 stated the highest temperature recorded in the SPS discharge canal was 99.9°F. Temperatures between 92.8°F and 99.9°F are considered typical of those observed in the discharge canal in summer (June-September) when SPS is running at or near full power. Outside the discharge canal, however, the effluent loses approximately 1-2°F every 1,000 feet away from the mouth of the discharge canal, with thermal plume patterns dependent on the current flow regime of the estuary, and the associated water densities and temperature, wind velocity, ambient air temperature, and relative humidity. (NRC. 2002a, Section 4.1.3)

Dominion submitted a CWA Section 316(a) demonstration for SPS to the Virginia State Water Control Board on September 1, 1977 (SPS. 2001, Section 3.1.2.1). Part I.C.16 of the current SPS VPDES permit (Attachment B) refers to this submittal, indicating that effluent limitations more

stringent than the thermal limitations included in the permit are not necessary to assure the protection and propagation of a balanced indigenous community of shellfish, fish, and wildlife in the James River. The fact sheet that accompanies the permit provides the justification for the variance (VDEQ. n.d.).

The site layout for SPS is different from that of other nuclear plants with once-through cooling systems. At SPS, the heated water effluent is discharged approximately six miles upstream of the low-level intake structure. This design was implemented to protect oyster beds, located downstream from the low-level intake structure and in more saline water, from being affected by the thermal plume. (NRC. 2002a, Section 4.1.3)

SPS began preoperational field studies in 1969 to examine fish populations, benthic communities, fouling organisms, zooplankton, and phytoplankton. The studies continued through several years of station operation beginning in 1972, with sample frequency ranging from daily to annually, based on the trophic level investigated. The studies were designed to indicate if the thermal effluent from SPS caused appreciable harm to the fish, shellfish, and wildlife in the James River. During preoperational monitoring, fish were sampled monthly using beach seines and otter trawls. Post-operative studies also sampled fish at the low-level intake screens, usually five days per week between 1972 and 1976. Benthic macroinvertebrates, including shellfish, were sampled using a Van Veen grab. (NRC. 2002a, Section 4.1.3)

In addition, a comprehensive five-year study (two years preoperational and three years operational) was conducted by VIMS to document the thermal effects of SPS. Temperature distribution in the James River in the vicinity of SPS was measured with stationary recorders affixed to towers or buoys in the river and by a monthly boat survey that measured water temperatures just downstream of the low-level intake to the vicinity of Jamestown Island, located upstream of the discharge. The results indicated that the thermal plume stays close to shore and extends around Hog Point on an ebb tide, and moves upstream and offshore on flood tide. Excess temperatures (defined as 50°F or more above ambient) always covered less than 30% of the river surface in the survey area adjacent to the discharge point. All excess temperatures decreased rapidly with increased distance from the outfall, and temperatures outside the mixing zone (3,000 feet from the outfall) were rarely greater than this limit. (NRC. 2002a, Section 4.1.3)

The fisheries research conducted by VIMS concluded that the fish community around SPS is diverse and dynamic, changing monthly and seasonally between species and sizes of individuals within species. A nonparametric comparison between preoperational and post-operational diversity indices showed either no significant difference in the means or that preoperational means were significantly ($p < 0.05$) less than post-operational means. Over an extended period, natural and man-made disturbances resulted in relatively short-term changes to fish populations in the transition zone around SPS, and the young fish population has remained relatively diverse and stable. Thus, it was concluded that the operation of SPS, particularly the discharge of heated

effluent, caused no appreciable harm to the fish community in the area. (NRC. 2002a, Section 4.1.3)

Based on the results of post-operational studies, the brackish water clam was found in abundance in the James River near SPS. The American oyster was found downstream of the site in more saline waters, and the blue crab occurred only sporadically in the vicinity of the site. Consequently, these species were not significantly affected by thermal discharges resulting from operation of SPS Units 1 land 2. Studies by VIMS concluded that the brackish water clam showed no preference or avoidance of the cooling water discharge region, but instead revealed a preference for silty-clay substrates. (NRC. 2002a, Section 4.1.3)

In conclusion, the thermal plume associated with SPS discharge represents a small portion of the cross-sectional and vertical area of the James River. Because of the location of the plume, it does not block the movement of fish either upstream or downstream of the SPS plant. Because there are no planned operational changes during the proposed SLR operating term that would increase the temperature of SPS's existing thermal discharge, impacts are anticipated to be SMALL and mitigation measures are not warranted.

E4.6.3 WATER USE CONFLICTS WITH AQUATIC RESOURCES (PLANTS WITH COOLING PONDS OR COOLING TOWERS USING MAKEUP WATER FROM A RIVER)

E4.6.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on aquatic resources in stream communities affected by water use conflicts could be of moderate significance in some situations.

E4.6.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river, and related impacts on stream (aquatic). . . ecological communities must be provided.

E4.6.3.3 Background [GEIS Section 4.6.1.2]

Increased temperatures and/or decreased rainfall would result in lower river flows, increased cooling pond evaporation, and lowered water levels in the Great Lakes or reservoirs. Regardless of overall climate change, droughts could result in problems with water supplies and allocations. Because future agricultural, municipal, and industrial users would continue to share their demands for surface water with power plants, conflicts might arise if the availability of this resource decreased.

Water use conflicts with aquatic resources could occur when water to support these resources is diminished either because of decreased water availability due to droughts; increased demand for agricultural, municipal, or industrial usage; or a combination of such factors. Water use conflicts with biological resources in stream communities are a concern due to the duration of license renewal and potentially increasing demands on surface water.

E4.6.3.4 Analysis

As presented in Section E2.2.3 of this ER, SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers. Therefore, this issue is not applicable, and further analysis is not required.

E4.6.4 WATER USE CONFLICTS WITH TERRESTRIAL RESOURCES (PLANTS WITH COOLING PONDS OR COOLING TOWERS USING MAKEUP WATER FROM A RIVER)

E4.6.4.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on terrestrial resources in riparian communities affected by water use conflicts could be of moderate significance.

E4.6.4.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river, and related impacts on riparian (terrestrial) ecological communities must be provided.

E4.6.4.3 Background [GEIS Section 4.6.1.1]

Water use conflicts with terrestrial resources in riparian communities could occur when water that supports these resources is diminished either because of decreased availability due to droughts; increased water demand for agricultural, municipal, or industrial usage; or a combination of such factors. For future license renewals, the potential range of impact levels at plants with cooling ponds or cooling towers using makeup water from a river cannot be determined at this time.

E4.6.4.4 Analysis

As presented in Section E2.2.3 of this ER, SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers. Therefore, this issue is not applicable and further analysis is not required.

E4.6.5 EFFECTS ON TERRESTRIAL RESOURCES (NON-COOLING SYSTEM IMPACTS)

E4.6.5.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Impacts resulting from continued operations and refurbishment associated with license renewal may affect terrestrial communities. Application of BMPs would reduce the potential for impacts. The magnitude of impacts would depend on the nature of the activity, the status of the resources that could be affected, and the effectiveness of mitigation.

E4.6.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats.

E4.6.5.3 Background [GEIS Section 4.6.1.1]

Continued operations and refurbishment activities could continue to affect onsite terrestrial resources during the license renewal term at all operating nuclear power plants. Factors that could potentially result in impacts include landscape maintenance activities, stormwater management, and elevated noise levels. These impacts would, for the most part, be similar to past and ongoing impacts.

The characteristics of terrestrial habitats and wildlife communities currently on nuclear power plant sites have generally developed in response to many years of typical operations and maintenance programs. While some may have reached a relatively stable condition, some habitats and populations of some species may have continued to change gradually over time. Operations and maintenance activities during the license renewal term are expected to be similar to current activities. Because the species and habitats present on the sites (i.e., weedy species and habitats they make up) are generally tolerant of disturbance, it is expected that continued operations during the license renewal term would maintain these habitats and wildlife communities in their current state, or maintain current trends of change.

Terrestrial habitats and wildlife could be affected by ground disturbance from refurbishment-related construction activities. Land disturbed during the construction of new ISFSIs would range from about 2.5-10 acres. Other activities may include new parking areas for plant employees, access roads, buildings, and facilities. Temporary project support areas for equipment storage, worker parking, and material laydown areas could also result in the disturbance of habitat and wildlife.

Successful application of environmental review procedures, employed by the licensees at many of the operating nuclear plant sites, would result in the identification and avoidance of important terrestrial habitats. In addition, the application of BMPs to minimize the area affected; to control fugitive dust, runoff, and erosion from project sites; to reduce the spread of invasive nonnative plant

species; and to reduce disturbance of wildlife in adjacent habitats could greatly reduce the impacts of continued operations and refurbishment activities.

E4.6.5.4 Analysis

E4.6.5.4.1 Refurbishment Activities

As presented in Section E2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to important plant and animal habitats, and no further analysis is required.

E4.6.5.4.2 Operational Activities

Terrestrial resources are described in Section E3.7.2. No license renewal-related construction activities or changes in operational practices have been identified that would involve disturbing habitats. Dominion would continue to conduct ongoing plant operational and maintenance activities during the proposed SLR operating term. However, these activities are expected to have minimal impacts on terrestrial resources because activities are anticipated to occur within previously disturbed habitats.

Operational and maintenance activities that Dominion might undertake during the renewal term, such as maintenance and repair of plant infrastructure (e.g., roadways, piping installations, fencing, and other security infrastructure), would likely be confined to previously disturbed areas of the site. Furthermore, as presented in Section E9.6, Dominion has administrative controls in place at SPS to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs, permit modifications, or acquisition of new permits as needed. In addition, regulatory programs that the site is currently subject to, such as stormwater management, spill prevention, dredging, and herbicide usage, further serve to minimize impacts to terrestrial resources.

In summary, adequate management programs and regulatory controls are in place to ensure that important plant and animal habitats are protected during the proposed SLR operating term for SPS.

Therefore, Dominion concludes the impacts to the terrestrial ecosystems from the proposed SLR are SMALL and no additional mitigation measures beyond current management programs and existing regulatory controls are required.

E4.6.6 THREATENED, ENDANGERED, AND PROTECTED SPECIES, AND ESSENTIAL FISH HABITAT

E4.6.6.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

The magnitude of impacts on threatened, endangered, and protected species, critical habitat, and EFH would depend on the occurrence of listed species and habitats and the effects of power plant systems on them. Consultation with appropriate agencies would be needed to determine whether special status species or habitats are present and whether they would be adversely affected by continued operations and refurbishment associated with license renewal.

E4.6.6.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with federal laws protecting wildlife, including but not limited to, the ESA, and EFH in accordance with the Magnuson-Stevens Fishery Conservation and Management Act.

E4.6.6.3 Background [GEIS Section 4.6.1.3]

There are several federal acts that provide protection to certain species and habitats that are treated here under a single issue. The issue includes impacts to biological resources such as threatened and endangered species and their critical habitat under the ESA, EFH as protected under the Magnuson-Stevens Fishery Conservation and Management Act, and impacts to mammalian species protected under the Marine Mammal Protection Act.

Factors that could potentially result in impacts on listed terrestrial species include habitat disturbance, cooling tower drift, operation and maintenance of cooling systems, transmission line ROW maintenance, collisions with cooling towers and transmission lines, and exposure to radionuclides. The listed species on or in the vicinity of nuclear power plants also range widely, depending on numerous factors such as the plant location and habitat types present.

Potential impacts of continued operations and refurbishment activities on federally or state-listed threatened and endangered species, protected marine mammals, and EFH could occur during the license renewal term. Factors that could potentially result in impacts to these species and habitats include impacts of refurbishment, other ground-disturbing activities, release of contaminants, effects of cooling water discharge on dissolved oxygen, gas supersaturation, eutrophication, thermal discharges, entrainment, impingement, reduction in water levels due to the cooling system operations, dredging, radionuclides, and transmission line ROW maintenance.

E4.6.6.4 Analysis

E4.6.6.4.1 Refurbishment Activities

As presented in Section E2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to threatened, endangered, and protected species, or EFH, and no further analysis is required.

E4.6.6.4.2 Operational Activities

As presented in Section E3.7.8.1, there are 13 federally protected or listed species which are either threatened, endangered, or candidate species within Surry, Isle of Wright, York, and James City counties. In addition, as presented in Section E3.7.8.2, the VDGIF-FWIS and VNHP have designated 15 plant and animal species that do not have a federal listing status, but are state-listed as threatened or endangered.

Of the 13 federally protected or listed species, five species are listed as occurring in adjacent counties, and are not documented in Surry County: the roseate tern, Kemp's Ridley sea turtle, the leatherback sea turtle, the loggerhead sea turtle, and the small whorled pogonia. Preferred habitat for these species does not occur on the SPS site. Occurrences of these species at the SPS site are unlikely, and would be incidental.

As presented in Section E3.7.8.1, habitat for eight species-the piping plover, the red knot, the red-cockaded woodpecker, the roseate tern, Kemp's Ridley sea turtle, the leatherback sea turtle, the loggerhead sea turtle, and the small whorled pogonia-is not located on the SPS site. Occurrences of these species at the SPS site are unlikely, and would be in incidental.

Habitat for the following five federally protected or listed species does occur on or immediately adjacent to the SPS site: the bald eagle, the peregrine falcon, the Atlantic sturgeon, the northern long-eared bat, and sensitive joint-vetch.

The bald eagle is known to nest on the SPS site, and occurrence of peregrine falcon is likely. Activities on the SPS site are evaluated to ensure compliance under the BGEPA and MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. There are currently no MBTA permits associated with onsite SPS operations or in-scope transmission lines. Compliance with all regulatory requirements associated with this species will continue to be an administrative control practiced by Dominion for the life of the SPS facility. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to bald eagles and peregrine falcons. The continued operation of SPS is not likely to impact these species.

As presented in Section E3.7.8.1, the Atlantic sturgeon is known to utilize the James River adjacent to SPS. Atlantic sturgeon spawn in the James River, but the spawning grounds are approximately

52 miles upstream of the SPS low-level intake. A second area with seemingly suitable habitat is located approximately 25 miles upstream of the low-level intake. Larval Atlantic sturgeon tend to remain in the main channels of their freshwater habitats. Given these are miles upstream of the SPS intakes, and the intake is located along a shallow shoreline, it is unlikely Atlantic sturgeon larvae would be susceptible to entrainment. Similarly, as the larvae grow their swimming ability increases, and the combination of larger size and increased swimming ability make entrainment unlikely. No Atlantic sturgeon have been documented during any of the entrainment studies conducted at SPS, including the most recent studies conducted 2016-2017.

Assuming that Atlantic sturgeon have swimming capabilities at least equal to shortnose sturgeon, a species that is well documented, Atlantic sturgeon in the action area should also be able to avoid becoming impinged on the trash bars and intake screens. Atlantic sturgeon that would be present in the action area are at least of a similar size to the juvenile and adult shortnose sturgeon tested in previous studies, and these species have similar body forms. Therefore, the impingement or entrainment of any Atlantic sturgeon is extremely unlikely to occur. (NMFS. 2012) This species is not likely to be affected by continued plant operations. Further, Dominion's adherence to CWA regulations, including 316(a) and 316(b), USACE regulatory permit conditions, and agency consultation prior to new actions, will minimize effects on this species. The DCH for the Atlantic sturgeon in the James River will likely require ESA consultation for activities within the James River to ensure minimal impacts to the Atlantic sturgeon. Dominion will participate in all required agency consultations prior to conducting projects within the James River.

While there is potentially habitat for the northern long-eared bat on the SPS site, coordination with USFWS in 2015 confirms that there are no documented hibernacula or roost trees in Surry County (USFWS. 2015c). Actions requiring the removal of trees by Dominion would require adherence to the USFWS 4(d) rule which sets guidelines for incidental take, and consultation with federal wildlife agencies, to ensure that no impacts to this species occur from any future activities. Dominion's compliance with federal, state and local laws and regulations will minimize impacts to this species. Continued operations of the SPS facility are not likely to affect this species.

The sensitive joint-vetch may occur on portions of Gravel Neck Peninsula. Occurrences of this species would be restricted to tidally influenced fringes of the peninsula, however, and is not likely to occur on portions of the SPS site utilized for plant operations. This species has not been recorded to occur at the SPS site, and is not likely to be affected by continued plant operations.

As presented in Section E3.7.8.2, optimal habitat for the following seven state-listed species is not located within the portions of the SPS site utilized for operations: the barking tree frog, Mabee's salamander; the eastern tiger salamander; the black banded sunfish; the eastern chicken turtle; the northern diamond-backed terrapin; and the spotted turtle. Occurrences of these species within these areas would be incidental. Due to the lack of available suitable habitat, and the unlikely

probability of these species to occur on the SPS site, the continued operation of SPS is not likely to affect these species.

Habitat for seven state-listed species is either located on the SPS site or the species are highly mobile, and may occur on the site and warrant further discussion. These species are: Bachman's sparrow; the black rail; Henslow's sparrow, the loggerhead shrike; the little brown bat; Rafinesque's eastern big-eared bat; and the tri-colored bat.

Migratory movements or local flight patterns may result in the occurrence of Bachman's sparrow, the black rail, Henslow's sparrow, or the loggerhead shrike to the SPS site. Habitat for these species may be located on portions of the SPS site not utilized for operations. However, activities on the SPS site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Additionally, Dominion maintains policies and procedures for addressing every avian incident associated with Dominion facilities. These procedures include an investigation process, required reporting of each incident to the USFWS, and procedures for implementing corrective actions following each incident. This administrative practice is designed to identify and correct potential sources of injury or mortality to avian species (Dominion. 2009a). Compliance with all regulatory requirements associated with this species will continue to be an administrative control practiced by Dominion for the life of the SPS facility. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to this species. The continued operation of SPS is not likely to impact these species.

Substandard habitat for the little brown bat; Rafinesque's eastern big-eared bat; and the tri-colored bat may be located on portions of the SPS site not utilized for operations. However; continued operations of SPS are not likely to impact bat species utilizing these areas. Dominion's compliance with federal, state and local laws and regulations will minimize impacts to these species, should tree clearing occur on the SPS property. Continued operations of the SPS facility are not likely to affect these species.

Dominion is not aware of any adverse impacts regarding threatened, endangered, and protected species attributable to the site. Maintenance activities necessary to support SLR likely would be limited to previously disturbed areas onsite, and no additional land disturbance has been identified for the purpose of SLR. In addition, there are no plans to alter plant operations during the proposed SLR operating term which would affect threatened, endangered, and protected species.

As presented in Section E9.6, Dominion has administrative controls in place at SPS to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs. In addition, regulatory programs, such as those presented in Chapter 9 that the site is subject to, further serve to minimize impacts to any threatened, endangered, and protected species.

In an effort to obtain an independent review, letters requesting consultation have been submitted to the USFWS, VDGIF-FWIS, VNHP, and NMFS. Responses to these requests have not yet been received. Copies of the consultation letters to the USFWS, VDGIF-FWIS, VNHP, and NMFS are included in Attachment C.

In summary, no license renewal-related refurbishment activities have been identified. As presented above, the continued operation of the site would have no adverse effects to any federally protected or state-listed species. Therefore, Dominion concludes that impacts from the proposed SLR on threatened, endangered, and protected species in the vicinity of SPS are not likely to affect federally protected or listed species and EFH, and mitigation measures beyond Dominion's current management programs and existing regulatory controls are not warranted.

E4.7 HISTORIC AND CULTURAL RESOURCES

E4.7.1 FINDINGS FROM 10 CFR 51, SUBPART A, APPENDIX B, TABLE B-1

Continued operations associated with license renewal are expected to have no license renewal-related impacts as no refurbishment or construction activities have been identified; administrative procedure ensures protection of historic properties in the event of excavation activities. The NHPA requires the federal agency to consult with the state historic preservation officer (SHPO) and appropriate Native American tribes to determine the potential effects on historic properties and mitigation, if necessary.

E4.7.2 REQUIREMENT [10 CFR 51.53(C)(3)(II)(K)]

All applicants shall identify any potentially affected historic or archaeological properties and assess whether any of these properties will be affected by future plant operations and any planned refurbishment activities in accordance with the NHPA.

E4.7.3 BACKGROUND [GEIS SECTION 4.7.1]

The NRC will identify historic and cultural resources within a defined APE. The license renewal APE is the area that may be impacted by ground-disturbing or other operational activities associated with continued plant operations and maintenance during the license renewal term and/or refurbishment. The APE typically encompasses the nuclear power plant site, its immediate environs, including viewshed, and the transmission lines within this scope of review. The APE may extend beyond the nuclear plant site and transmission lines when these activities may affect historic and cultural resources.

Continued operations during the license renewal term and refurbishment activities at a nuclear power plant can affect historic and cultural resources through (1) ground-disturbing activities associated with plant operations and ongoing maintenance (e.g., construction of new parking lots or

buildings), landscaping, agricultural, or other use of plant property; (2) activities associated with transmission line maintenance (e.g., maintenance of access roads or removal of danger trees); and (3) changes to the appearance of nuclear power plants and transmission lines. Licensee renewal environmental reviews have shown that the appearance of nuclear power plants and transmission lines has not changed significantly over time; therefore, additional viewshed impacts to historic and cultural resources are not anticipated.

E4.7.4 ANALYSIS

E4.7.4.1 Refurbishment Activities

As presented in Section E2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license renewal-related refurbishment impacts to historic and cultural resources, and no further analysis is required.

E4.7.4.2 Operational Activities

As presented in Section E3.8.5, there have been three previous cultural resource surveys conducted either on the SPS property or within the vicinity. The single cultural resource recorded on the SPS property was the Lawnes Creek Church site (44SY2), which has not been assessed for NRHP listing. There are no additional recorded cultural resources on the 840-acre SPS property. No structures on the SPS property have been evaluated for documentation through the HABS or HAER programs.

As presented in Section E3.8.6, although no license renewal-related ground-disturbing activities have been identified, Dominion has guidance in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These consist of a historic resources consultation guidance document that protects known cultural resources (e.g., the Lawnes Creek Church site), as well as unknown cultural resources. Established processes for all activities that require a federal permit or use federal funding address the potential for impact to cultural resources by establishing procedures for all activities that require a federal permit or use federal funding and that have the potential to impact historic resources. Therefore, no adverse effects are anticipated to these sites during the SPS proposed SLR operating term.

The area within a six-mile radius of the site, consisting of land on both banks of the James River, is archaeologically sensitive (Table E3.8-1). Adverse impacts, however, would only occur to such sites as a result of soil-intrusive activities. Because Dominion has no plans to conduct such soil-intrusive activities at any location outside of the property boundary under a renewed license, no adverse effects to these archaeological sites would occur.

There are also NRHP-listed aboveground historic properties within a six-mile radius of the site (Table E3.8-1). Because the aboveground historic properties are located at distances ranging from

2.2-6 miles away from SPS, and SPS is surrounded by a heavily wooded area (Figure E3.8-12), aesthetic and noise impacts to these resources as a result of the continued operations of SPS are not expected, and no adverse effects to the physical or historical integrity of these sites are anticipated.

As presented above, no license renewal-related refurbishment or construction activities have been identified. No offsite NRHP-listed historic properties will be adversely impacted as a result of continued operations of SPS, and there are no plans to alter operations, expand existing facilities, or disturb additional land for the purpose of SLR. In addition, administrative procedural controls are in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. Finally, the Virginia SHPO concurred that the subsequent license renewal of SPS will have no effect on historic properties (Attachment D). Therefore, Dominion concludes that there will be no adverse effects as a result of continued operation of SPS during the proposed SLR operating term, and additional mitigation measures beyond Dominion's existing procedural administrative controls are not warranted.

E4.8 SOCIOECONOMICS

E4.8.1 EMPLOYMENT AND INCOME, RECREATION, AND TOURISM

E4.8.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Although most nuclear plants have large numbers of employees with higher than average wages and salaries, employment, income, recreation, and tourism impacts from continued operations and refurbishment associated with license renewal are expected to be SMALL.

E4.8.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.8.1.3 Background [GEIS Section 4.8.1.1]

Employees receive income from the nuclear power plant in the form of wages, salaries, and benefits. Employees and their families, in turn, spend this income on goods and services within the community, thereby creating additional opportunities for employment and income. In addition, people and businesses in the community receive income for the goods and services sold to the power plant. Payments for these goods and services create additional employment and income opportunities in the community. The measure of a community's ability to support the operational demands of a power plant depends on the ability of the community to respond to changing socioeconomic conditions.

Some communities experience seasonal transient population growth due to local tourism and recreational activities. Income from tourism and recreational activities creates employment and income opportunities in the communities around nuclear power plants.

Nevertheless, the effects of nuclear power plant operations on employment, income, recreation, and tourism are ongoing and have become well established during the current license term for all nuclear power plants. The impacts from power plant operations during the license renewal term on employment and income in the region around each nuclear power plant are not expected to change from what is currently being experienced. In addition, tourism and recreational activities in the vicinity of nuclear plants are not expected to change as a result of license renewal.

E4.8.1.4 Analysis

Information related to employment and income, and recreational facilities is presented in Sections E3.9.1and E3.9.7.In addition, as presented in Section E2.5, there are no plans to add permanent workers to support plant operations during the license renewal term. Because the site is situated in a heavily forested area, it does not visually impact areas that have a high degree of visitor use or recreational areas locally. No license renewal-related refurbishment activities have been identified, as presented in Section E2.3. Therefore, no changes in employment and income, and recreation and tourism during the proposed SLR operating term are anticipated.

In the GEIS, the NRC determined that employment and income, and recreation and tourism impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.8.1.1). Based on Dominion's review, no new and significant information was identified as it relates to employment and income, and recreation and tourism, and further analysis is not required.

E4.8.2 TAX REVENUES

E4.8.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Nuclear plants provide tax revenue to local jurisdictions in the form of property tax payments, payments in lieu of tax (PILOT), or tax payments on energy production. The amount of tax revenue paid during the license renewal term as a result of continued operations and refurbishment associated with license renewal is not expected to change.

E4.8.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.8.2.3 Background [GEIS Section 4.8.1.2]

Nuclear power plants and the workers who operate them are an important source of tax revenue for many local governments and public school systems. Tax revenues from nuclear power plants mostly come from property tax payments or other forms of payments such as payments in lieu of (property) taxes, or PILOT payments, although taxes on energy production have also been collected from several nuclear power plants. County and municipal governments and public school districts receive tax revenue either directly or indirectly through state tax and revenue-sharing programs.

Counties and municipal governments in the vicinity of a nuclear power plant also receive tax revenue from sales taxes and fees from the power plant and its employees. Changes in the number of workers and the amount of taxes paid to county, municipal governments, and public schools can affect socioeconomic conditions in the counties and communities around the nuclear power plant.

A review of license renewal applications received by the NRC since the 1996 GEIS has shown that license renewal-related refurbishment activities, such as steam generator and vessel head replacement, have not had a noticeable effect on the assessed value of nuclear plants, thus changes in tax revenues are not anticipated from future license renewal-related refurbishment activities.

The primary impact of license renewal would be the continuation or change in the amount of taxes paid by nuclear power plant owners to local governments and public school systems. The impact of nuclear plant operations on tax revenues in local communities and the impact that the expenditure of tax revenues has on the region are not expected to change appreciably from the amount of taxes paid during the current license term. Tax payments during the license renewal term would be similar to those currently being paid by each nuclear plant.

E4.8.2.4 Analysis

Information related to tax revenues is presented in Section E3.9.5. No license renewal-related refurbishment activities have been identified. Dominion's annual property taxes are expected to remain relatively constant throughout the license renewal term.

In the GEIS, the NRC determined that tax revenue impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.8.1.2). Based on Dominion's review, no new and significant information was identified as it relates to tax revenues, and further analysis is not required.

E4.8.3 COMMUNITY SERVICES AND EDUCATION

E4.8.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to local community and educational services would be small. With little or no change in employment at the licensee's plant, value of the power plant, payments on energy production, and PILOT payments expected during the license renewal term, community and educational services would not be affected by continued power plant operations.

E4.8.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.8.3.3 Background [GEIS Section 4.8.1.3]

Any changes in the number of workers at a nuclear plant will affect the demand for public services from local communities. Environmental reviews conducted by NRC since the 1996 GEIS have shown, however, that the number of workers at relicensed nuclear plants has not changed significantly because of license renewal, so demand-related impacts on community services, including public utilities, are no longer anticipated from future license renewals.

In addition, refurbishment activities, such as steam generator and vessel head replacement, have not required the large numbers of workers and the months of time that were conservatively analyzed in the 1996 GEIS, so significant impacts on community services are no longer anticipated. Because of the relatively short duration of refurbishment-related activities, workers are not expected to bring families and school-age children with them; therefore, impacts from refurbishment on educational services are also no longer anticipated.

Taxes paid by nuclear power plant owners support a range of community services, including public water, safety, fire protection, health, and judicial, social, and educational services. In some communities, tax revenues from power plants can have a noticeable impact on the quality of services available to local residents. Although many of the community services paid for by tax revenues from power plants are used by plant workers and their families, the impact of nuclear plant operations on the availability and quality of community services and education is SMALL and is not expected to change as a result of license renewal.

E4.8.3.4 Analysis

Information related to community services and education is presented in Section E3.9.4. No license renewal-related refurbishment activities have been identified. In addition, as presented in Section E2.5, there are no plans to add workers to support plant operations during the proposed

SLR operating term. As stated in Section E4.8.2.4, Dominion's annual property taxes are expected to remain relatively constant through the proposed SLR operating term, and no change is anticipated that would impact local community services and education.

In the GEIS, the NRC determined that community services and education impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.8.1.3). Based on Dominion's review, no new and significant information was identified as it relates to community services and education, and further analysis is not required.

E4.8.4 POPULATION AND HOUSING

E4.8.4.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to regional population and housing availability and value would be small. With little or no change in employment at the licensee's plant expected during the license renewal term, population and housing availability and values would not be affected by continued power plant operations.

E4.8.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.8.4.3 Background [GEIS Section 4.8.1.4]

Socioeconomic impact analyses of resources (e.g., housing) affected by changes in regional population are based on employment trends at nuclear power plants. Population growth from increased employment and spending at a nuclear power plant is important because it is one of the main drivers of socioeconomic impacts. As previously discussed, however, employment levels at nuclear power plants are expected to remain relatively constant with little or no population growth or increased demand for permanent housing during the license renewal term. The operational effects on population and housing values and availability in the vicinity of nuclear power plants are not expected to change from what is currently being experienced, and no demand-related impacts are expected during the license renewal term.

The increased number of workers at nuclear power plants during regularly scheduled plant refueling and maintenance outages does create a short-term increase in the demand for temporary (rental) housing units in the region around each plant. However, because of the short duration and the repeated nature of these scheduled outages and the general availability of rental housing units (including portable trailers) in the vicinity of nuclear power plants, employment-related housing impacts have had little or no long-term impact on the price and availability of rental housing.

Refurbishment impacts would be similar to what is experienced during routine plant refueling and maintenance outages.

E4.8.4.4 Analysis

Information related to population and housing is presented in Section E3.9.2. No license renewal-related refurbishment activities have been identified. As presented in Section E2.5, there are no plans to add permanent workers to support plant operations during the proposed SLR operating term.

In the GEIS, the NRC determined that population and housing impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.8.1.4). Based on Dominion's review, no new and significant information was identified as it relates to population and housing needs, and further analysis is not required.

E4.8.5 TRANSPORTATION

E4.8.5.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to traffic volumes would be small.

E4.8.5.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.8.5.3 Background [GEIS Section 4.8.1.5]

Transportation impacts depend on the size of the workforce, the capacity of the local road network, traffic patterns, and the availability of alternate commuting routes to and from the plant. Because most sites have only a single access road, there is often congestion on these roads during shift changes.

Transportation impacts are ongoing and have become well established during the current licensing term for all nuclear power plants. As previously presented, it is unlikely that the number of permanent operations workers would increase at a nuclear power plant during the license renewal term. In addition, refurbishment activities, such as steam generator and vessel head replacement, have not required the numbers of workers and the months of time conservatively estimated in the 1996 GEIS. Consequently, employment at nuclear power plants during the license renewal term is expected to remain unchanged.

E4.8.5.4 Analysis

Information related to transportation is presented in Section E3.9.6. No license renewal-related refurbishment activities have been identified. As presented in Section E2.5, there are no plans to add permanent workers to support plant operations during the SLR operating term. In addition, as presented in Section E3.9.6, roads in the immediate vicinity of the SPS plant site would operate at acceptable LOSs.

In the GEIS, the NRC determined that transportation impacts from continued plant operations over the license renewal term would be SMALL for all nuclear plants, and designated this as a Category 1 issue (NRC. 2013a, Section 4.8.1.5). Based on Dominion's review, no new and significant information was identified as it relates to transportation, and further analysis is not required.

E4.9 HUMAN HEALTH

E4.9.1 E4.9.1MICROBIOLOGICAL HAZARDS TO THE PUBLIC (PLANTS WITH COOLING PONDS OR CANALS, OR COOLING TOWERS THAT DISCHARGE TO A RIVER)

E4.9.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals, or that discharge into rivers. Impacts would depend on site-specific characteristics.

E4.9.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(G)]

If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river, an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.

E4.9.1.3 Background [GEIS Section 4.9.1.1.3]

N. fowleri, which is the pathogenic strain of the free-living amoebae Naegleria spp., appears to be the most likely microorganism that may pose a public health hazard resulting from nuclear power plant operations. Increased populations of N. fowleri may have significant adverse impacts.

Since Naegleria concentrations in freshwater can be enhanced by thermal effluents, nuclear power plants that use cooling lakes, canals, ponds, or rivers experiencing low-flow conditions may enhance the populations of naturally occurring thermophilic organisms.

Changes in microbial populations and in the public use of water bodies might occur after the operating license is issued and the application for license renewal is filed. Other factors could also change, including the average temperature of the water, which could result from climate change that affected water levels and air temperature. Finally, the long-term presence of a power plant might change the natural dynamics of harmful microorganisms within a body of water.

E4.9.1.4 Analysis

The James River in the vicinity of SPS is approximately 2.5 miles wide (Figure E3.1-3), and is a tidally influenced freshwater river upstream of the Gravel Neck Peninsula and a saline estuary downstream (Section E3.6).

Studies show the discharges associated with SPS outfall would be of sufficient temperature for the survival of thermophilic organisms during the late summer months. Field investigations of water quality and aquatic biota, field measurements of water temperatures, electronic measurements of water temperatures in the SPS low-level intake and discharge canals, demonstrated temperatures greater than 90°F at the discharge normally occur only in June, July, August, and September when SPS is operating at or near full capacity (SPS. 2001, Section 3.1.2.1). Thermophilic microorganisms thrive at temperatures of 122°F or more, with a tolerance minimum of 68°F and a maximum of 158°F (NRC. 2013a).

The current SPS discharge permit (VPDES Permit No. VA0004090) limits waste heat rejected to the James River estuary from SPS operations, but does not mandate the reporting of discharge temperatures. Thermal effluent dispersion occurs rapidly and reduces outfall temperatures to or near ambient levels. Excess temperatures covered less than 30% of the river surface adjacent to the discharge point, and the thermal plume remained close to shore. (NRC. 2002a, Section 4.1.3)

As presented in Section E3.10, the discharge outfall is surrounded by rock jetties projecting 1,100 feet into the James River estuary. Virginia Code 20-1060-10 ET SEQ §28.2-106.2 delineates a restricted access area encompassing the entire discharge canal from the jetties at its discharge pipe outlet back to the plant canal. No one may enter this restricted area without prior authorization from the marine police. (VMRC 2011)

Given the size of the river, the saline and tidal influence of the estuary, the documented reduction in water temperatures surrounding the effluent discharge point, and regulatory restrictions placed on public access to the waters adjacent to the discharge structures, human health impacts from microbiologic hazards during the proposed SLR operating term would be SMALL.

E4.9.2 ELECTRIC SHOCK HAZARDS

E4.9.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Electrical shock potential is of small significance for transmission lines that are operated in adherence with the National Electrical Safety Code (NESC). Without a review of conformance with NESC criteria of each nuclear power plant's in-scope transmission lines, it is not possible to determine the significance of the electrical shock potential.

E4.9.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(H)]

If the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.

E4.9.2.3 Background [GEIS Section 4.9.1.1.5]

Design criteria for nuclear power plants that limit hazards from steady-state currents are based on the NESC, adherence to which requires that utility companies design transmission lines so that the short-circuit current to ground produced from the largest anticipated vehicle or object is limited to less than 5 mA. With respect to shock safety issues and license renewal, three points must be made. First, in the licensing process for the earlier licensed nuclear plants, the issue of electrical shock safety was not addressed. Second, some plants that received operating licenses with a stated transmission line voltage may have chosen to upgrade the line voltage for reasons of efficiency, possibly without reanalysis of induction effects. Third, since the initial NEPA review for those utilities that evaluated potential shock situations under the provision of the NESC, land use may have changed, resulting in the need for a reevaluation of this issue. The electrical shock issue, which is generic to all types of electrical generating stations, including nuclear plants, is of SMALL significance for transmission lines that are operated in adherence with the NESC. Without a review of the conformance of each nuclear plant's transmission lines, within this scope of review with NESC criteria, it is not possible to determine the significance of the electrical shock potential generically.

E4.9.2.4 Analysis

As presented in Section E2.2.5 and depicted on Figure E2.2-5, all in-scope transmission lines are located completely within the SPS property boundary. Thus, no induced shock hazards would exist for the general public due to restricted site access.

As presented in Section E3.10, an analysis of the transmission lines distributing Units 1 and 2 generation to the grid conducted to support the current license renewal term showed the induced

short-circuit current for four of the nine transmission lines marginally exceeded the NESC 5-mA standard with a result of approximately 5.07 mA. This study did not include the transmission lines feeding SPS Units 1 and 2 from the grid during outages. The NRC determined electric shock potential for the evaluated lines was SMALL and did not warrant mitigation measures because the calculated currents were larger than the amount that the limiting-case induced currents exceeded the NESC limits (NRC. 2002a, Section 4.2.1).

The transmission lines considered in-scope for this ER are limited to those within the SPS site boundary and connect the plant (Units 1 and 2) to the first switchyard, where electricity is fed into the regional power distribution system at the substation, as well as the transmission lines that feed the plant from the grid during outages (Figure E2.2-5). Dominion adheres to NESC code compliance requirements for shock hazard avoidance through utilization of the Dominion engineering manual (Dominion. 2017c), the 2017 Dominion Blue Book, which establishes safety and efficiency requirements for commercial and residential connections to the system that must be followed by contractors, builders, engineers, etc. (Dominion. 2017d), and various training materials addressing proper construction utilizing NESC measurements. These guidance documents ensure all necessary mitigation measures are incorporated for maintaining worker and visitor safety through design ground clearances and other shock prevention measures applicable to the in-scope transmission lines.

Given that: (1) for current license renewal term, the NRC determined that the human health impact from electric shock hazards was SMALL; (2) the in-scope transmission lines are NESC compliant (Dominion. 2017c); (Dominion. 2017d); and (3) routine maintenance, surveillance, and training procedures for the in-scope transmission lines provide assurance design ground clearances will not change, the human health impact from electric shock hazards during the proposed SLR operating term would be SMALL.

E4.10 ENVIRONMENTAL JUSTICE

E4.10.1 MINORITY AND LOW-INCOME POPULATIONS

E4.10.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

Impacts to minority and low-income populations and subsistence consumption resulting from continued operations and refurbishment associated with license renewal will be addressed in plant-specific reviews. See the NRC's policy statement on the treatment of environmental justice matters in NRC regulatory and licensing actions (69 FR 52040).

E4.10.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(N)]

Applicants shall provide information on the general demographic composition of minority and low-income populations and communities (by race and ethnicity) residing in the immediate vicinity of the plant that could be affected by the renewal of the plant's operating license, including any planned refurbishment activities, and ongoing and future plant operations.

E4.10.1.3 Background [GEIS Section 4.10.1]

Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. Minority and low-income populations are subsets of the general public residing around the site and all are exposed to the same risks and hazards generated from operating a nuclear power plant.

Continued reactor operations and other activities associated with license renewal could have an impact on air, land, water, and ecological resources in the region around each nuclear power plant site, which might create human health and environmental effects on the general population. Depending on the proximity of minority and low-income populations in relation to each nuclear plant, the environmental impacts of license renewal could have a disproportionate effect on these populations.

The location and significance of environmental impacts may affect population groups that are particularly sensitive because of their resource dependencies or practices (e.g., subsistence agriculture, hunting, or fishing) that reflect the traditional or cultural practices of minority and low-income populations. The analysis of special pathway receptors can be an important part of the identification of resource dependencies or practices. Special pathways take into account the levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the power plant sites in order to assess the risk of radiological exposure through subsistence consumption of fish, native vegetation, surface water, sediment, and local produce; the absorption of contaminants in sediments through the skin; and the inhalation of airborne particulates.

E4.10.1.4 Analysis

E4.10.1.4.1 Refurbishment Activities

As presented in Section E2.3, no license renewal-related refurbishment activities have been identified. Therefore, there would be no license-renewal-related refurbishment impacts to minority and low-income populations, and no further analysis is applicable.

E4.10.1.4.2 Operational Activities

The consideration of environmental justice is required to assure that federal programs and activities will not have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Dominion's analyses of the Category 2 issues defined in 10 CFR 51.53(c)(3)(ii) determined that environmental impacts from the continued operation of SPS during the proposed SLR operating term would either be SMALL or non-adverse. Therefore, high or adverse impacts to the general human population would not occur.

As described in Section E3.10, Dominion maintains an REMP. With this program, Dominion monitors important radiological pathways and considers potential radiation exposure to plant and animal life in the environment surrounding SPS. The results of the program indicate SPS has created no adverse environmental effects or health hazards. Therefore, no environmental pathways have been adversely impacted and are not anticipated to be impacted during the SPS proposed SLR operating term.

Section E3.11.2 identifies the locations of minority and low-income populations as defined by NRR Office Instruction LIC-203 (NRC. 2013d). Section E3.11.3 describes the search for subsistence-like populations near SPS, of which none were found. The figures accompanying Section E3.11.2 show the locations of minority and low-income populations within a 50-mile radius of SPS. None of those locations, when considered in the context of impact pathways described in this chapter, are expected to be disproportionately impacted.

Therefore, no disproportionately high and adverse impacts or effects on members of the public, including minority, low-income, or subsistence populations, are anticipated as a result of SLR.

E4.11 WASTE MANAGEMENT

E4.11.1 LOW-LEVEL WASTE STORAGE AND DISPOSAL

E4.11.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment would remain small during the license renewal term.

E4.11.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.11.1.3 Background [GEIS Section 4.11.1.1]

The NRC believes that the comprehensive regulatory controls in place and the low public doses achieved at reactors ensure that the radiological impacts on the environment will remain SMALL during the license renewal term. The maximum additional onsite land that may be required for low-level waste storage during the license renewal term and associated impacts would be SMALL. Nonradiological impacts on air and water would be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are SMALL. In addition, the NRC concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

E4.11.1.4 Analysis

Dominion will continue to manage and store LLRW onsite as described in Section E2.2.7, in accordance with NRC regulations, and dispose of LLRW in NRC-licensed treatment and disposal facilities during the proposed SLR operating term. As presented above, there are comprehensive regulatory controls in place and Dominion's compliance with these regulations and use of only licensed treatment and disposal facilities would allow the impacts to remain SMALL during the proposed SLR operating term. As presented in Section E3.10, Dominion's annual reports for 2010-2015 indicate that doses to members of the public were negligible and in accordance with NRC and EPA radiation protection standards. No new and significant information has been identified for this issue. The issue was also considered in the initial license renewal's new and significant review, and no new and significant information was found at that time (SPS. 2001, Table 4-2 and Section 5.1). Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.11.2 ONSITE STORAGE OF SPENT NUCLEAR FUEL

E4.11.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

During the license renewal term, SMALL. The expected increase in the volume of spent nuclear fuel from an additional 20 years of operation can be safely accommodated onsite during the license renewal term with small environmental impacts through dry or pool storage at all plants.

For the period after the licensed life for reactor operations, the impacts of onsite storage of spent nuclear fuel during the continued storage period are presented in NUREG-2157 and as stated in § 51.23(b), shall be deemed incorporated into this issue.

E4.11.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.11.2.3 Background [GEIS Section 4.11.1.2 and NUREG-2157]

Spent nuclear fuel is currently stored at reactor sites either in spent fuel pools or in ISFSIs. The storage of spent fuel in spent fuel pools was considered for each plant in the safety and environmental reviews at the construction permit and operating license stage. This onsite storage of spent fuel and high-level waste is expected to continue into the foreseeable future.

Interim storage needs vary among plants, with older units likely to lose pool storage capacity sooner than newer ones. Given the uncertainties regarding the final disposition of spent fuel and high-level waste, it is expected that expanded spent fuel storage capacity will be needed at all nuclear power plants.

NUREG-2157, Generic EIS for Continued Storage of Spent Nuclear Fuel (NRC. 2014a, ES.12 and Table ES-3), concluded on a generic basis for all nuclear power plants that spent fuel can be stored onsite for 60 years following the license term with small environmental effects.

E4.11.2.4 Analysis

The additional 20 years of spent nuclear fuel generated during the proposed SLR operating term would be stored in the spent fuel pools until adequately cooled and then transferred to dry storage at an ISFSI. The NRC-licensed design and operation of each of these storage options ensures that the increased volume in onsite storage can be safely accommodated with SMALL environmental effects. The issue was also considered in the initial license renewal's new and significant review, and no new and significant information was found at that time (SPS. 2001, Table 4-2 and Section 5.1). Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.11.3 OFFSITE RADIOLOGICAL IMPACTS OF SPENT NUCLEAR FUEL AND HIGH-LEVEL WASTE DISPOSAL

E4.11.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

For the high-level waste and spent-fuel disposal component of the fuel cycle, the EPA established a dose limit of 0.15 mSv (15 millirem) per year for the first 10,000 years and 1.0 mSv (100 millirem)

per year between 10,000 years and 1 million years for offsite releases of radionuclides at the proposed repository at Yucca Mountain, Nevada.

The NRC concluded that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR 54 should be eliminated. Accordingly, while the commission has not assigned a single level of significance for the impacts of spent fuel and high-level waste disposal, this issue is considered Category 1.

E4.11.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.11.3.3 Background [GEIS Section 4.11.1.3]

As a result of the New York v. NRC decision, and pending the issuance of a generic EIS and revised waste confidence decision and rule, the NRC has revised the Category 1 issue, "Offsite radiological impacts of spent nuclear fuel and high-level waste disposal." This issue pertained to the long-term disposal of spent nuclear fuel and high-level waste, including possible disposal in a deep geologic repository. Although the waste confidence decision and rule did not assess the impacts associated with disposal of spent nuclear fuel and high-level waste in a repository, it did reflect the Commission's confidence, at the time, in the technical feasibility of a repository and when that repository could have been expected to become available. Without the analysis in the waste confidence decision, the NRC cannot assess how long the spent fuel will need to be stored onsite. Therefore, the NRC reclassifies this GEIS issue from a Category 1 issue with no assigned impact level to an uncategorized issue with an impact level of "uncertain." Moreover, the ultimate disposal of spent nuclear fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of license renewal.

E4.11.3.4 Analysis

As indicated in Section E4.11.3.3, the NRC's GEIS analysis of the issue was tied to rulemaking for the waste confidence decision, which was pending in 2013 when the license renewal GEIS was issued. As part of NRC's NEPA actions associated with the waste confidence decision, the NRC reviewed the environmental impacts of away-from-reactor storage and the technical feasibility of disposal in a geologic repository in NUREG-2157, Generic EIS for Continued Storage of Spent Nuclear Fuel (NRC. 2014a, Section ES.7 and ES.16). In the final continued storage of nuclear spent fuel rulemaking, the listing and classification of license renewal issues found in 10 CFR 51, Subpart A, Appendix B, Table B-1 was revised to reclassify the impact determination for this issue as a Category 1 issue with no impact level assigned. This re-classification was upheld in May 2016 against petitions (81 FR 31532).

In the NRC's August 2016 LR EIS prepared for LaSalle County Station, it was indicated that the NRC is aware of no new and significant information on this issue (NRC. 2016a, Section 4.13.1). Based on review of recent NRC documents and that SPS spent nuclear fuel will be disposed of offsite, Dominion found no new and significant information and further analysis is not required. Offsite radiological impacts of spent nuclear fuel and high-level waste disposal were also considered in the initial license renewal's new and significant review, and no new and significant information was found at that time (SPS. 2001, Table 4-2 and Section 5.1).

E4.11.4 MIXED WASTE STORAGE AND DISPOSAL

E4.11.4.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. The comprehensive regulatory controls and the facilities and procedures in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal would not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small.

E4.11.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.11.4.3 Background [GEIS Section 4.11.1.4]

Mixed waste is regulated both by the EPA or the authorized state agency under RCRA and by the NRC or the agreement state agency under the Atomic Energy Act (AEA; Public Law 83-703). The waste is either treated onsite or sent offsite for treatment, followed by disposal at a permitted landfill. The comprehensive regulatory controls and the facilities and procedures in place at nuclear power plants ensure that the mixed waste is properly handled and stored and that doses to and exposure to toxic materials by the public and the environment are negligible at all plants. License renewal will not increase the small but continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts from the long-term disposal of mixed waste at any individual plant at licensed sites are considered SMALL for all sites.

E4.11.4.4 Analysis

Management of radioactive waste is presented in Section E2.2.6. Dominion has developed guidance documents for managing its hazardous waste streams, including mixed waste. In addition, Dominion inspects its waste management areas for compliance with applicable

regulations and permits on a weekly basis using a facility waste inspection checklist. Addressed in Sections E9.3 and E9.5, Dominion's management of its waste streams is in compliance with applicable regulatory standards and has not resulted in any notices of violation for the 2012-2016 time frame. Dominion would continue to store and dispose of hazardous and nonhazardous wastes in accordance with EPA and state regulations and dispose of the wastes in appropriately permitted treatment and disposal facilities during the proposed SLR operating term. As indicated in the 2013 GEIS, continuation of existing systems and procedures to ensure proper storage and disposal would allow the impacts to be of small magnitude. This issue was evaluated as a Category 1 issue in the initial license renewal's new and significant review and found to be bound by the GEIS conclusion of a SMALL impact (SPS. 2001, Table 4-2 and Section 5.1). Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.11.5 NONRADIOACTIVE WASTE STORAGE AND DISPOSAL

E4.11.5.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. No changes to systems that generate nonradioactive waste are anticipated during the license renewal term. Facilities and procedures are in place to ensure continued proper handling, storage, and disposal, as well as negligible exposure to toxic materials for the public and the environment at all plants.

E4.11.5.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.11.5.3 Background [GEIS Section 4.11.1.5]

The management of hazardous wastes generated at all of these facilities, both onsite and offsite, is strictly regulated by the EPA or the responsible state agencies per the requirements of RCRA.

As does any industrial facility, nuclear power plants and the rest of the uranium fuel cycle facilities also generate nonradioactive nonhazardous waste. These wastes are managed by following good housekeeping practices and are generally disposed of in local landfills permitted under RCRA Subtitle D regulations.

In the 1996 GEIS, the impacts associated with managing nonradioactive wastes at uranium fuel cycle facilities, including nuclear power plants, were found to be SMALL. It was indicated that no changes to nonradioactive waste generation would be anticipated for license renewal, and that systems and procedures are in place to ensure continue proper handling and disposal of the wastes at all plants.

E4.11.5.4 Analysis

Management of nonradioactive waste is presented in Section E2.2.7. Dominion has developed guidance documents for managing its nonradioactive waste streams including hazardous and nonhazardous wastes. In addition, Dominion inspects its waste management areas for compliance with applicable regulations and permits on a weekly basis using a facility waste inspection checklist. As presented in Sections E9.2 and E9.5, Dominion's management of its waste streams is in compliance with applicable regulatory standards and has not resulted in any notices of violation for the 2012-2016 time frame. Dominion would continue to store and dispose of hazardous and nonhazardous wastes in accordance with EPA and state regulations and dispose of the wastes in appropriately permitted treatment and disposal facilities during the proposed SLR operating term. As indicated in the 2013 GEIS, continuation of existing systems and procedures to ensure proper storage and disposal would allow the impacts to be of small magnitude. This issue was evaluated as a Category 1 issue in the initial license renewal's new and significant review and found to be bound by the GEIS conclusion of a SMALL impact (SPS. 2001, Table 4-2 and Section 5.1). Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.12 CUMULATIVE IMPACTS

Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

Cumulative impacts of continued operations and refurbishment associated with license renewal must be considered on a plant-specific basis. Impacts would depend on regional resource characteristics, the resource-specific impacts of license renewal, and the cumulative significance of other factors affecting the resource.

Requirement [10 CFR 51.53(c)(3)(ii)(O)]

Applicants shall provide information about other past, present, and reasonably foreseeable future actions occurring in the vicinity of the nuclear plant that may result in a cumulative effect.

Background [GEIS Section 4.13]

Actions to be considered in cumulative impact analyses include new and continuing activities, such as license renewal, that are conducted, regulated, or approved by a federal agency. The cumulative impacts analysis takes into account all actions, however minor, since impacts from individually minor actions may be significant when considered collectively over time. The goal of the analysis is to identify potentially significant impacts to improve decisions and move toward more sustainable development.

For some resource areas (e.g., water and aquatic resources), the contributions of ongoing actions within a region to cumulative impacts are regulated and monitored through a permitting process (e.g., NPDES) under state or federal authority. In these cases, it may be assumed that cumulative

impacts are managed as long as these actions (facilities) are in compliance with their respective permits.

Analysis

Cumulative impacts analysis involves determining if there is an overlapping or compounding of the anticipated impacts of the continued operation of SPS Units 1 and 2 during the proposed SLR operating term and past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. For the purposes of this analysis, present actions are those related to current operation of SPS Units 1 and 2 and those actions that are included in firm or funded plans or funded for implementation from now through the end of the current license term in 2032. Future actions are those actions that will continue into the proposed SLR operating term, and that are reasonably foreseeable firm plans with funding or funding to allow implementation during the 20-year proposed SLR operating term (generally plans that have moved beyond the conceptual phase).

The assessment first determines if the impacts of the continued operation of SPS Units 1 and 2 during the proposed SLR operating term and any refurbishment activities could temporally and/or spatially combine with the impacts of other actions. Impacts that are for a limited duration, such as those that result from construction activities, would have to overlap in time for the impacts to combine. Impacts that require proximity to combine would have to be close enough to combine and occur at the same time to combine. The required proximity is resource-area dependent and would involve an overlapping of regions of influence. Next, the assessment determines if any combined impacts would be significant. Significant cumulative impacts could stem from an impact that may be SMALL by itself but could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. If a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

Section E3.1.4 describes other (non-SPS Units 1 and 2) projects at and in the vicinity of SPS. The first of these is the existing GNCTS oil/natural gas-fired generating plant located on the SPS site. No major changes to operations or plans for future expansion of GNCTS have been announced by Dominion. Furthermore, GNCTS shares air, wastewater, and groundwater withdrawal permits with SPS Units 1 and 2, so the impacts of GNCTS are accounted for within the impacts presented for SPS in Sections E4.2 and E4.5.

The second project mentioned in Section E3.1.4 is the expansion of the separately licensed ISFSI located on the SPS site. Installation of the fourth pad within the current ISFSI area is scheduled to be completed by the end of 2020, so this would be a present action as explained above. The operation of the Pad 4 will be considered for the proposed SLR operating term. The ISFSI's emissions are limited to direct radiation and the facility is included in the annual radiological

environmental monitoring for SPS; thus, contribution from the ISFSI is accounted for within the SMALL radiological impacts anticipated for SPS.

The addition of a fifth spent fuel storage pad to the current SPS ISFSI area is in the conceptual stage. Because of conceptual planning, it does not qualify for consideration in the cumulative impact analysis.

The Surry-Skiffes Creek 500-kV transmission line would be constructed and operated within the vicinity of SPS. Although no start date for the transmission line project construction phase has been finalized, permitting efforts are ongoing, and this project is considered a present action for the cumulative analysis.

Continuing activities for the area surrounding the SPS site would be its rural, agricultural, and residential activities; existence and maintenance of cultural resources; Hog Island WMA activities; commerce and recreational activities on the James River; point and non-point discharges into the James River; surface and groundwater withdrawals; and air emissions from stationary sources and vehicles. These ongoing activities were considered as present and future actions for the cumulative analysis. As indicated in Section E3.1.4, no new business developments or current business expansions have been announced for the vicinity of SPS. Beyond the six-mile vicinity, the city of Newport News is experiencing some economic development and is competing for a U.S. Department of Energy collider project whose decision is anticipated for 2019 (NNEDA. 2017; VB. 2016).

The following sections address the potential for cumulative impacts by resource area.

E4.12.1 LAND USE AND VISUAL RESOURCES

The land use impact of SPS was characterized as SMALL in Section E4.1, and the only land use changes anticipated were those associated with the Surry-Skiffes Creek 500-kV transmission project. Its land use conversion would be a current action and its operation a current and future action. Because no new development is anticipated for the six-mile vicinity and the Surry-Skiffes Creek transmission line would be in operation during the SLR period, only the ongoing land use would apply to the proposed SLR operating term. The SPS vicinity is described in Section E3.2 as having a rural nature on the south bank of the James River where SPS is located, and more urban on north bank of the James River with the cities of Newport News and Williamsburg. The cumulative land use impact would be SMALL.

E4.12.2 AIR QUALITY AND NOISE

Air Quality

As presented in Section E3.3, the regional air quality where SPS is located has improved since the initial license renewal when SPS's air quality control region was nonattainment for one-hour ozone.

As of March 2017, all of the counties (Charles City, Chesterfield, Dinwiddie, Goochland, Greensville, Hanover, Henrico, New Kent, Powhatan, Prince George, Surry, Sussex) within the State Capital Intrastate Air Quality Control Region are in attainment of the NAAQSs [40 CFR 81.347]. SPS Units 1 and 2 air pollutant emissions are minimal and stem from intermittent use and testing of auxiliary boilers and diesel generators. Section E4.2 concluded that the impact to air quality from the continued operation of SPS Units 1 and 2 during the proposed SLR operating term is anticipated to be SMALL, as generically determined by NRC for all nuclear power plants. The improved air quality rating for the area reflects cumulative air quality for past and present actions. The pending present actions and anticipated future actions along with continued operation of SPS would not reverse that trend and would have a SMALL impact on cumulative air quality.

Climate Change

The VIMS Center for Coastal Resources Management (CCRM) identified air temperature and carbon dioxide concentrations as two environmental factors that could reflect shifts in global climate (CCRM. 2016). The CCRM analyzed mean annual air temperatures in Williamsburg, Virginia, from the early 1970s through 2009, and found no obvious trend in either warming or cooling. The same was true for its analysis of precipitation for the same time frame. The thermal discharge to the James River could potentially indirectly contribute to increased air temperature and precipitation, but as presented below in Section E4.12.4, the CCRM's analysis did not find an increase in maximum temperature of the James River downstream of SPS.

With regard to carbon dioxide concentrations as a factor contributing to climate change, because the fuel source for SPS Units 1 and 2 do not produce carbon dioxide emissions or other GHG emissions, the continued operation of SPS Units 1 and 2 would avoid millions of tons of GHGs from a fossil fuel-fired alternative such as the NGCC presented in Chapter 7.

Given that the cumulative trends in air temperature, precipitation, and water temperature for near SPS monitoring points are not showing obvious trends that reflect climate change and continued operation would contribute small emissions of GHG from minor air emission sources, the cumulative impact on climate change from present and future actions would be SMALL. Moreover, continued operation of SPS Units 1 and 2 avoids millions of tons of carbon dioxide from alternative fossil-fuel generation, positively impacting the climate change factor of carbon dioxide concentrations.

Noise

SPS operations have a SMALL impact on the noise environment as described in Section E4.3. The surrounding land use presented above in Section E4.12.1 influences the noise sources and characterizes the noise environment as well. No new development is anticipated for the six-mile vicinity and the Surry-Skiffes Creek transmission line would be in operation during the SLR period,

only the current noise sources would apply to the proposed SLR operating term. The cumulative noise impact would be SMALL.

E4.12.3 GEOLOGY AND SOILS

Impacts to geology and soils could result from ground-disturbing activities and stormwater runoff. Through application of the SPS site SWPPP, Section E4.4 concluded that SPS's impact on geology and soils would be SMALL. Any ground-disturbing activities onsite during the proposed SLR operating term would be governed by a stormwater construction permit and/or the SWPPP. The Surry-Skiffes Creek transmission line would be in operation during the SLR period, and the transmission maintenance plan would ensure that BMPs to minimize soil disturbance would be implemented as needed. No new development is anticipated for the six-mile vicinity and any new development of at least one acre would be subject to VPDES stormwater management requirements. Given ground disturbances at the SPS site and the surrounding area would be subject to VPDES stormwater permitting and applicable BMPs, the cumulative land use impact would be SMALL.

E4.12.4 WATER RESOURCES

Surface Water

Surface water use impacts for once-through cooling were generically determined to be SMALL [10 CFR 51, Subpart A, Appendix B, Table B-1], and Dominion did not identify any new and significant information for this environmental issue. Modifications for CWA 316(b) compliance are anticipated for the current license renewal term, and, depending on the required modifications, could result in changes to water withdrawal volumes and consumption. Any modifications would be under a VDPES permit issued by the VDEQ, and water use impacts would be considered by VDEQ prior to issuance of the permit. There are no plant operations or modifications planned for the proposed SLR operating term that would alter current patterns at the intake and discharge structures.

The projects that could also impact surface water resources include nearby projects that withdraw from or had point or non-point discharges to the James River. As a once-through cooling plant, SPS's consumption of surface water is minimal and given the size of the James River, SPS would have a negligible contribution to cumulative impacts due to consumption of surface water. No new or additional water withdrawal is associated with SLR.

As for surface water quality cumulative impacts, SPS complies (see Chapter 9) with its VPDES discharge limits and the discharge rapidly mixes with the James River. As discussed in Section E3.6.4.1, the water quality at the segments of the river where SPS is located is impaired; however, SPS operations do not contribute to these impairments. The water quality assessment would indicate that the cumulative impact of water quality is noticeable, but has not been identified

as a priority for establishing a TMDL (see Section E3.6.4.1), therefore, the cumulative impact to surface water quality would be MODERATE. Given SPS compliance with its VPDES permit and compliance with stormwater permits and regulations and lack of contribution to the specific impairment cause, SPS would have only a small contribution to the surface water quality cumulative impact.

Groundwater

As indicated in Section E4.5.3.4, VDEQ granted Permit No. GW0003901 for water withdrawals in 2013, allowing a maximum withdrawal of a total of 154.7 mgy with a monthly maximum of about 15.89 mg (367.8 gpm) authorized for use as domestic, process, and cooling water. VDEQ also conducted a technical evaluation modeling the potential impacts of the permitted withdrawal on aquifers and concluded that the modeling did not indicate changes to regional flow patterns that would lead to reduced water quality (VDEQ. 2013b). The VDEQ's study considered the current groundwater conditions and withdrawals, and as such would be a cumulative impact study for current conditions. As presented above, development in the SPS vicinity is not anticipated and the pending and future actions would not involve new groundwater withdrawals. SPS will continue to maintain and implement its spill prevention, control, and countermeasures (SPCC) plan to prevent spills that would contaminate soils, groundwater, and surface water during the proposed SLR operating term. Therefore, the cumulative impact to groundwater resources would be SMALL.

Climate Change

The VIMS CCRM identified water temperature as an environmental factor that could reflect shifts in global climate (CCRM. 2016). The CCRM analyzed water temperature from 1980-2009 at Swann's Point at the eastern end of the James City peninsula (VDEQ. 2013c), approximately six miles from SPS, and did not find an increase in maximum temperature, but did find an indication of warmer early summer months. Extensive pre- and post-operational studies on thermal effects of SPS on the James River indicate that the thermal discharge leaving the discharge canal rapidly mixes with the waters of the James River, decreasing 1-2°F with every 1,000 feet from the mouth of the discharge canal and temperatures were rarely more than 5°F above ambient river temperatures at distances of 3,000 feet from the outfall (SPS. 2001, Section 3.1.2.1).

Given that the cumulative trend in water temperature did not show an increase in maximum temperature and SPS's studies show rapid mixing of its thermal discharge, the cumulative impact of climate change from present and future actions would be SMALL. Moreover, continued operation of SPS Units 1 and 2 avoids millions of tons of carbon dioxide from alternative fossil-fuel generation, positively impacting the climate change factor of carbon dioxide concentrations.

E4.12.5 ECOLOGICAL RESOURCES

Terrestrial

The impacts on terrestrial species during the proposed SLR operating term are described as SMALL in the GEIS, and no new and significant information for Category 1 terrestrial resource environmental issues was identified (Section E5.2). The continued operation of SPS Units 1 and 2, as well as the offsite DMMA, would be governed by SPS procedures and plans. As presented in Section E9.6, Dominion has administrative controls in place at SPS to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs, permit modifications, or acquisition of new permits as needed. In addition, regulatory programs that the site is currently subject to, such as stormwater management, spill prevention, dredging, and herbicide usage, further serve to minimize impacts to terrestrial resources. With continued application of these programs and procedures, the land-based impacts would largely be confined to SPS property and would have minimal opportunity to contribute to cumulative impacts. The construction of ISFSI Pad No. 4 would also be confined to the SPS site, and management of the Surry-Skiffes Creek transmission line would be governed by transmission line management plans and procedures that address cutting and trimming of trees and shrubs and herbicide use. Therefore, cumulative impacts to terrestrial ecological resources would be SMALL.

As presented in Sections E3.7.8 and E4.6.6, habitat for federally and state-listed terrestrial species does occur on or immediately adjacent to the SPS site. Adherence to regulatory and permit requirements to avoid take of protected species and Dominion administrative controls such as those regarding response to avian collisions with transmission lines will minimize or avoid impact to these species. Dominion is not aware of any adverse impacts regarding threatened, endangered, and protected species attributable to the site. Maintenance activities necessary to support the proposed SLR likely would be limited to previously disturbed areas onsite and within the operational areas of the SPS site rather than within the forested area or other habitat on the SPS site. Development in the areas adjacent to the SPS site is not anticipated. Therefore, cumulative impacts on protected species would be SMALL.

Overall, the cumulative impacts to terrestrial ecological resources is anticipated to be SMALL.

Aquatic

Aquatic resource impacts during the proposed SLR operating term were concluded to be SMALL in Section E4.6. The aquatic ecological communities could be impacted through surface water discharges that are governed by SPS's VPDES permit. In addition, aquatic ecological communities could be impacted by impingement and entrainment of species in SPS surface water intake. Impingement and entrainment impacts are addressed through CWA 316(b) compliance implemented through the VDPES system. In response to new CWA 316(b) regulatory requirements, Dominion is conducting impingement and entrainment studies to determine whether

the current operational methods to prevent entrainment and impingement are sufficient to meet the new requirements. SPS must remain compliant with CWA 316(b) regulations to maintain its existing VPDES permit. VDEQ will make the final determination of compliance and could require modifications of the intake structures and/or the cooling system. Any modifications would be designed to reduce entrainment and impingement impacts and any in-stream or near shore construction activities would be completed prior to the proposed SLR operating term. Continued compliance with VPDES permit conditions during the proposed SLR operating term (the permit is subject to renewal every five years) would ensure that SPS's direct and indirect impacts to aquatic ecological communities are minimized. Dominion meets its VPDES permit conditions and the temperature quickly returns to ambient temperatures, minimizing the potential for ongoing activities to combine with impacts from other actions and lead to cumulative impacts.

As presented in Sections E3.7.8 and E4.6.6, the federally listed Atlantic sturgeon is likely to be present near SPS' low-level intake area would be mature enough to avoid impingement or entrainment, so this species is not likely to be affected by continued plant operations. Further, Dominion's adherence to CWA regulations, the VPDES permit, and USACE regulatory permit conditions, and agency consultation prior to new actions will minimize effects to this species. Occurrences of the other protected aquatic species (i.e., Kemp's Ridley sea turtle, leatherback sea turtle, and the loggerhead sea turtle) adjacent to SPS site are unlikely. (NMFS. 2012)

Given: (1) Dominion's adherence to CWA regulations, the SPS VPDES permit, and the USACE dredge permit conditions; (2) agency consultation with regard to protected species; (3) that the anticipated present and future actions would not have surface water discharges other than stormwater runoff; and (4) no new industry and developments were identified for the six-mile vicinity, the cumulative impacts to aquatic ecological communities would be SMALL.

Climate Change

The National Wildlife Federation conducted a species vulnerability study specific to Virginia, modeling climate change to project impacts to classes of species and specific species. The study's modeling showed species at the southern extent of their range shifting northward out of Virginia, species at the northern edge of their range could expand their presence in Virginia, and species in the heart of their geographic range in Virginia having expanded ranges. (NWF 2013) For the amphibians studied, their ranges were projected to contract severely due to their extreme vulnerability to temperature and precipitation changes. Other species such as the northern bobwhite and several of tree species studied were also vulnerable to climate change (NWF 2013). This study indicates that species' vulnerability due to climate change is tied to changes in temperature and precipitation.

As presented above in Section E4.12.2, the Center for Coastal Resources Management analyzed mean annual air temperatures in Williamsburg, Virginia, from the early 1970s through 2009, and

found no obvious trend in either warming or cooling. The same was true for its analysis of precipitation for the same time frame. As presented in Section E4.12.4, the Center for Coastal Resources Management's analysis did not find an increase in maximum temperature of the James River downstream of SPS. Given that the cumulative trends in air temperature, precipitation, and water temperature at monitoring points near SPS are not showing obvious trends that reflect climate change, cumulative impacts to ecological communities from climate change are also anticipated to be SMALL.

E4.12.6 HISTORIC AND ARCHEOLOGICAL RESOURCES

As presented in Section E4.7, Dominion has administrative controls in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These consist of a historic resources consultation guidance document that protects known cultural resources (e.g., the Lawnes Creek Church site), as well as unknown cultural resources. Established processes for all activities that require a federal permit or use federal funding address the potential for impact to cultural resources by establishing procedures for all activities that require a federal permit or use federal funding and that have the potential to impact historic resources. Therefore, no adverse effects are anticipated to these sites during the proposed SLR operating term. Section E4.7 also presented the potential for continued operation of SPS to affect cultural resources in the surrounding area and concluded that no adverse effects to the physical or historical integrity of these sites are anticipated. Therefore, SPS is not anticipated to contribute cumulative impacts to historic and cultural resources.

E4.12.7 SOCIOECONOMICS

The proposed SLR does not include additional workers (Section E4.8), so the SMALL adverse impacts that are the result of workers' impact on community services, education, and infrastructure including transportation would continue. The tax payments from the operating plant (Section E4.8) would continue along with the economic contributions of the plant's workers. The tax payments attributable to SPS are more than 60% of the overall tax revenues of Surry County (Section E3.9.5) and SPS employs approximately 941 permanent full-time workers (see Table E2.5-1). Thus, significant beneficial socioeconomic impacts would also continue during the proposed SLR operating term.

As mentioned above, in Section E4.12, the city of Newport News has announced some new economic development opportunities and is currently competing for a DOE project. However, given that Newport News is an urban area with 123,464 employed persons in 2015 (Section E3.9), new development job creation would cause a very small percentage increase in overall employment. In addition, given its location across the James River from SPS and the existing transportation

infrastructure and housing patterns, any development, if realized, would not be expected to overlap with the socioeconomic impacts of continuing operations at SPS.

Therefore, the socioeconomic conditions presented in Section E3.9 are expected to continue. The current socioeconomic conditions reflect the cumulative impacts of SPS and the surrounding area. Thus, given that the current conditions along with the planned projects presented in Section E3.9 are designed to meet the community's needs and additional workers at SPS or development in the vicinity are not anticipated, adverse cumulative impacts would be SMALL. The significant beneficial economic impact of SPS as described in Section E3.9 would continue, contributing to the overall economy of the surrounding area.

E4.12.8 HUMAN HEALTH

Radiological dose limits for protection of the public and workers have been developed by the EPA and the NRC to address the cumulative impacts of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 10 CFR 20 and 40 CFR 190. For this analysis, the region of influence is the surrounding 50-mile region.

As presented in Section E3.10, Dominion prepares annual radiological environmental operating reports and annual radiological effluent reports. The reports for 2012-2015 indicate that doses to members of the public were negligible and in accordance with NRC and EPA radiation protection standards, and radionuclides attributable to SPS were not detected in the various environmental media and food products from the surrounding 20-mile area. Also, the direct radioactivity measured by thermoluminescent dosimetry, which also accounts for the ISFSI located on the SPS site, has remained relatively constant over the years. The 2015 annual radiological environmental operating report concluded that "During 2015, as in previous years, the operation of Surry Power Station has created no adverse environmental effects or health hazards." (SPS. 2016d) The three-year (2012-2014) average annual occupational dose [total effective dose equivalent (TEDE)] was 0.108 rem (NRC. 2016b, Table 4.6). The annual TEDE limit is five rems [10 CFR 20.1201(a)(1)].

There are no other NRC-licensed operating nuclear power plants, fuel cycle facilities, or radiological waste treatment and disposal facilities within the 50-mile region of SPS. There are, however, within the 50-mile region, naval bases at Newport News and Norfolk, where nuclear-powered ships or submarines can be stationed, and a U.S. Navy-operated shipyard at Norfolk for the repair of nuclear-powered ships and submarines (U.S. Navy. 2017a; U.S. Navy. 2017b; NAVSEA. 2017). In addition, a non-military shipbuilding facility for nuclear-powered submarines, Huntington Ingalls Newport News Shipbuilding, is located in Newport News (Military.com. 2016). The U.S. Navy's radiation protection standards are consistent with or more stringent than those of EPA, NRC, and the Occupational Safety and Health Administration (OSHA) (U.S. Navy. 2011).

Operating SPS for an additional 20-year period would not cause an increase in annual radioactive effluent releases. The cumulative impact of SPS Units 1 and 2 operation, operation of the expanded

ISFSI, and the U.S. Navy-related operations in the region, would be expected to be SMALL, because all routine releases and occupational exposure would be subject to federal or military regulations.

As for nonradiological human health impacts, SPS operations occur in areas restricted from the public and are carried out by SPS workers under a comprehensive occupational safety program. As discussed in Section E4.9.1.4, the discharge point for SPS is restricted from public access and the water temperature and saline content does not contribute to production of microbiological organisms that pose a threat to human health (e.g., thermophilic organisms). As with the discharge point, SPS's in-scope transmission lines are also restricted from public access and do not pose a public human health risk. Compliance with NESC and SPS procedures minimize occupational risk from electrical shock hazards (Section E4.9.2.4). SPS's comprehensive occupational safety program addresses occupational hazards and SPS's recordable injury and illness rate is comparable to the nuclear electric power generation industry's rate. Therefore, cumulative impacts to human health from nonradiological hazards are not expected.

E4.12.9 WASTE MANAGEMENT

As presented in Section E4.11, the comprehensive regulatory controls in place for management of radiological waste and Dominion's compliance with these regulations and use of only licensed treatment and disposal facilities would allow the impacts to remain SMALL during the proposed SLR operating term. As presented in Section E3.10, Dominion's annual reports for 2010-2015 indicate that radiological doses to members of the public were negligible and in accordance with NRC and EPA radiation protection standards. There are no other operating nuclear power plants, fuel cycle facilities, or radiological waste treatment and disposal facilities within the 50-mile region of SPS.

Dominion has programs in place to manage its hazardous and nonhazardous waste streams. Dominion also ensures that only licensed or permitted facilities are used for treatment and disposal of its waste streams. Continuation of existing systems and procedures to ensure proper storage and disposal during the proposed SLR operating term would allow the impacts to be SMALL. The other facilities within the 50-mile region of SPS are also required to comply with appropriate EPA and state requirements for the management of radioactive and nonradioactive wastes. Thus, the cumulative waste management impact would be SMALL.

E4.13 IMPACTS COMMON TO ALL ALTERNATIVES: URANIUM FUEL CYCLE

E4.13.1 OFFSITE RADIOLOGICAL IMPACTS-INDIVIDUAL IMPACTS FROM OTHER THAN THE DISPOSAL OF SPENT FUEL AND HIGH-LEVEL WASTE

E4.13.1.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. The impacts to the public from radiological exposures have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts to individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99, would remain at or below the NRC's regulatory limits.

E4.13.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.13.1.3 Background [GEIS Section 4.12.1.1]

The primary indicators of impact are the concentrations of radionuclides in the effluents from the fuel cycle facilities and the radiological doses received by a maximum exposed individual (MEI) on the site boundary or at some location away from the site boundary. The basis for establishing the significance of individual effects is the comparison of the releases in the effluents and the MEI doses with the permissible levels in applicable regulations. The analyses performed by the NRC in the preparation of Table S-3 and found in the 1996 GEIS indicate that as long as the facilities operate under a valid license issued by either the NRC or an agreement state, the individual effects will meet the applicable regulations. On the basis of these considerations, the NRC has concluded that the impacts on individuals from radioactive gaseous and liquid releases during the license renewal term would remain at or below the NRC's regulatory limits. Accordingly, the NRC concludes that offsite radiological impacts of the uranium fuel cycle (individual effects from sources other than the disposal of spent fuel and high-level waste) are SMALL.

E4.13.1.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in Dominion's new and significant review as described in Chapter 5, and no new and significant information was identified as it relates to offsite radiological impacts-individual impacts from other than the disposal of spent fuel and high-level waste. The issue was also considered in the initial license renewal's new and significant review and no new

and significant information was found at that time (SPS. 2001, Table 4-2 and Section 5.1). Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.13.2 OFFSITE RADIOLOGICAL IMPACTS-COLLECTIVE IMPACTS FROM OTHER THAN THE DISPOSAL OF SPENT FUEL AND HIGH-LEVEL WASTE

E4.13.2.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

There are no regulatory limits applicable to collective doses to the general public from fuel-cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The Commission concludes that the collective impacts are acceptable.

The Commission concludes that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective impacts of the uranium fuel cycle, this issue is considered Category 1.

E4.13.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.13.2.3 Background [GEIS Section 4.12.1.1]

There are no regulatory limits applicable to collective doses to the general public from fuel cycle facilities. All regulatory limits are based on individual doses. All fuel cycle facilities are designed and operated to meet the applicable regulatory limits.

As presented in the 1996 GEIS, despite the lack of definitive data, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. The Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue was considered Category 1.

E4.13.2.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in Dominion's new and significant review and no new and significant information was identified as it relates to offsite radiological impacts-collective impacts

from other than the disposal of spent fuel and high-level waste. The issue was also considered in the initial license renewal's new and significant review and no new and significant information was found at that time (SPS. 2001, Table 4-2 and Section 5.1). Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.13.3 NONRADIOLOGICAL IMPACTS OF THE URANIUM FUEL CYCLE

E4.13.3.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant would be SMALL.

E4.13.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.13.3.3 Background [GEIS Section 4.12.1.1]

Data on the nonradiological impacts of the fuel cycle are provided in Table S-3. These data cover land use, water use, fossil fuel use, and chemical effluents. The significance of the environmental impacts associated with these data was evaluated in the 1996 GEIS on the basis of several relative comparisons. It was noted that the impacts associated with uses of the above resources would be SMALL. Any impacts associated with nonradiological liquid releases from the fuel cycle facilities would also be SMALL. As a result, the aggregate nonradiological impact of the uranium fuel cycle resulting from the renewal of an operating license for a plant would be SMALL, and it was considered a Category 1 issue in the 1996 GEIS.

E4.13.3.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in Dominion's new and significant review and no new and significant information was identified as it relates to nonradiological impacts of the uranium fuel cycle. The issue was also considered in the initial license renewal's new and significant review and no new and significant information was found at that time (SPS. 2001, Table 4-2 and Section 5.1). Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.13.4 TRANSPORTATION

E4.13.4.1 Findings from 10 CFR 51, Subpart A, Appendix B, Table B-1

SMALL. The impacts of transporting materials to and from uranium-fuel-cycle facilities on workers, the public, and the environment are expected to be SMALL.

E4.13.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.13.4.3 Background [GEIS Section 4.12.1.1]

The impacts associated with transporting fresh fuel to one 1,000 MWe model light-water reactor and with transporting spent fuel and radioactive waste (low-level waste and mixed waste) from that light water reactor are provided in Table S-4 in 10 CFR 51.52. Similar to Table S-3, and as indicated in 10 CFR 51.52, every environmental report prepared for the construction permit stage of a commercial nuclear power plant must contain a statement concerning the transport of fuel and radioactive waste to and from the reactor. A similar statement is also required in LRAs. Table S-4 forms the basis of such a statement.

In 1999, the NRC issued an addendum to the 1996 GEIS in which the agency evaluated the applicability of Table S-4 to future license renewal proceedings, given that the spent fuel is likely to be shipped to a single repository (as opposed to several destinations, as originally assumed in the preparation of Table S-4) and given that shipments of spent fuel are likely to involve more highly enriched fresh fuel (more than 4%, as assumed in Table S-4) and higher-burnup spent fuel (higher than 33,000 MWd/MTU, as assumed in Table S-4). In the addendum, the NRC evaluated the impacts of transporting the spent fuel from reactor sites to the candidate repository at Yucca Mountain and the impacts of shipping more highly enriched fresh fuel and higher-burnup spent fuel. On the basis of the evaluations, the NRC concluded that the values given in Table S-4 would still be bounding, as long as the (1) enrichment of the fresh fuel was 5% or less; (2) burnup of the spent fuel was 62,000 MWd/MTU or less; and (3) higher burnup spent fuel (higher than 33,000 MWd/MTU) was cooled for at least five years before being shipped offsite.

E4.13.4.4 Analysis

The NRC did not revisit the radiological impact analysis of transporting spent nuclear fuel to away-from-reactor storage locations in the 2014 GEIS for continued storage of spent nuclear fuel, and again stated that the radiological impact analysis can be found in Table S-4 (NRC. 2014a, ES.16.2.16).

As stated above, the NRC considered the impacts of this issue to be SMALL, provided three conditions were met. Dominion reviewed its plans and protocols for future fuel enrichment specifications, fuel loading plans, and spent fuel cooling with regard to the three Table S-4 conditions. Dominion anticipates the maximum enrichment of fuel to be used at SPS during the proposed SLR operating term to be 5% and the average burnup level of the peak rod to not exceed 62,000 MWd/MTU unless an exemption is granted for special circumstances such as testing and demonstration programs.

Furthermore, as presented in Section E2.2.6, spent fuel is stored onsite in each of the units' spent fuel pools for adequate cooling prior to transfer to onsite dry storage. Prior to being shipped offsite, spent fuel would have cooled at least five years or whatever cooling duration is required to meet NRC and DOT transportation criteria in effect at that time. Given that the three conditions are met and that the NRC's recent review of away-from-reactor storage of spent nuclear fuel indicated that the impacts continued to be considered SMALL, no further analysis is needed. Dominion's new and significant review included compliance with the criteria of Table S-4, and concludes that there is no new and significant information related to transportation impacts of the uranium fuel cycle. The issue was also considered in the initial license renewal's new and significant review and no new and significant information was found at that time (SPS. 2001, Table 4-2 and Section 5.1). Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.14 TERMINATION OF NUCLEAR POWER PLANT OPERATIONS AND DECOMMISSIONING

E4.14.1 FINDINGS FROM 10 CFR 51, SUBPART A, APPENDIX B, TABLE B-1

SMALL. License renewal is expected to have a negligible effect on the impacts of terminating operations and decommissioning on all resources.

E4.14.2 REQUIREMENT [10 CFR 51.53(C)(3)(IV)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

E4.14.3 BACKGROUND [GEIS SECTIONS 4.12.2 AND 4.12.2.1]

The impacts of decommissioning nuclear plants were evaluated in the Generic Environmental Impact Statement for Decommissioning Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors (NUREG-0586).

This section describes and presents the environmental consequences of terminating nuclear power plant operations and decommissioning, but the only impacts attributable to the proposed action (license renewal) are the effects of an additional 20 years of operations on the impacts of decommissioning. The majority of the impacts associated with plant operations would cease with reactor shutdown; however, some impacts would remain unchanged, while others would continue at reduced or altered levels. Some new impacts might also result directly from terminating nuclear power plant operations.

Terminating nuclear power plant operations would result in the cessation of actions necessary to maintain the reactor, as well as a significant reduction in the workforce. The NRC presumes that terminating nuclear power plant operations would not immediately lead to the dismantlement of the reactor or other infrastructure, much of which would still be in use to support other units onsite that continued to operate. Even for sites with just one unit, some facilities would remain in operation to ensure that the site was maintained in safe shutdown condition.

E4.14.4 ANALYSIS

Only the incremental increase in the impacts of termination of plant operations and decommissioning attributable to continued operation during the proposed SLR operating term is within the scope of this issue. The additional operating years would generate additional spent nuclear fuel to be managed during the decommissioning period as well as potentially greater volumes of radioactive waste or radioactive materials. The proposal to continue operation during an SLR operating term does not include construction of additional plant structures that would require decommissioning and additional workers are not anticipated for the license term that would incrementally increase socioeconomic impacts of termination of plant operations.

Dominion would plan and conduct decommissioning activities in accordance with NRC-reviewed methods and evaluate anticipated environmental impacts to ensure that they are bounded by previously issued environmental assessments or are SMALL. Site restoration activities would be conducted in accordance with state and local regulations and permits, ensuring that environmental impacts would be SMALL.

The decommissioning impacts component of this issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (SPS. 2001, Table 4-2 and Section 5.1). The 2013 GEIS combined several Category 1 decommissioning issues in the 1996 GEIS and added consideration of termination of plant operations. No new and significant information has been identified for this issue. Based on Dominion's finding of no new and significant information, further analysis is not required.

E4.15 POSTULATED ACCIDENTS

E4.15.1 CATEGORY 1 ISSUE-DESIGN-BASIS ACCIDENTS

The following Category 1 issue related to postulated accidents was reviewed for new and significant information that could make the generic finding as described in the GEIS (NRC. 2013a) inapplicable to SPS: Issue 65-Design-basis accidents.

The GEIS concluded that because a licensee is required to maintain the plant within acceptable design and performance criteria, including during any license renewal term, impacts from design-basis accidents would not be affected by changes in plant environment because such impacts (1) are based on calculated radioactive releases that are not expected to change; (2) are not affected by plant environment because they are evaluated for the hypothetical maximally exposed individual; and (3) have been previously determined to be acceptable (NRC. 2013a).

The SPS review of N&S information for the issue of design basis accidents did not identify any N&S information, and hence, no additional analysis is needed.

E4.15.2 CATEGORY 2 ISSUE-SEVERE ACCIDENTS

In 2001, SPS submitted an application for OL renewal, which the NRC approved in 2003. The original 40-year licensed operating period for SPS was thereby extended out to 60 years. As part of the initial license renewal process, a detailed evaluation of potential severe accident mitigation alternatives (SAMAs) was performed. Of the 160 potential SAMAs identified in the initial license renewal, 107 were qualitatively screened from further evaluation (e.g., those that are only applicable to BWRs), and a detailed cost-benefit analysis was performed on the 53 SAMAs that could not be screened (Virginia Power. 2000). The cost-benefit analysis included development of a Level 3 probabilistic risk assessment (PRA) for SPS, which was used to calculate conditional offsite doses and property damage for each of the PRA source term categories (STCs). By calculating the reduction in STC frequencies for each potential SAMA, the present value dollar benefit of each was determined, utilizing the guidance of NUREG/BR-0184 (NRC. 1997). The benefit was then compared to a cost estimate for each to complete the cost-benefit comparison. The analysis concluded that none of the proposed SAMAs was cost beneficial to SPS.

As part of the SLR process to renew the SPS OL for another 20 years, the SPS PRA is again examined for insights. The purpose is to determine if there is any new and significant information regarding the SAMA analyses that were prepared to support issuance of the initial renewed OL for SPS. Over the course of plant operation, changes are made to the plant design, operation, and maintenance practices. Periodic updates to the SPS PRA have ensured that the PRA includes the relevant changes and continues to reflect the current plant design and operation. PRA updates also include updates to the plant-specific initiating event and equipment data utilized, and improvements in state-of-the-art analysis of severe accidents. Therefore, the PRA provides valuable insights into the risk significance of the plant changes over time.

The analyses below follow the model approach in NEI 17-04 Rev. 0 (NEI. 2017), dated June 2017, for determination of whether there is new and significant information regarding the SAMA analyses. The NRC staff has reviewed the NEI 17-04 document and found it to be acceptable for interim use by the licensees that have communicated their intent to apply for SLR before December 31, 2019. The NRC expects to formally endorse NEI 17-04 through the revision process for Supplement 1 to Regulatory Guide 4.2 by December 2019. For the SPS SLR, the consideration of new and significant changes since the time of the initial license renewal is consistent with the GEIS (NRC. 2013a), Supplement 49 (NRC. 2014b). Section 5.3.9 of GEIS Supplement 49 states the following:

> *New information is significant if it provides a seriously different picture of the impacts of the Federal action under consideration. Thus, for mitigation alternatives such as SAMAs, new information is significant if it indicates that a mitigation alternative would substantially reduce an impact of the Federal action on the environment. Consequently, with respect to SAMAs, new information may be significant if it indicated a given cost-beneficial SAMA would substantially reduce the impacts of a severe accident or the probability or consequences (risk) of a severe accident occurring.*

The implication of this statement is that "significance" is not solely related to whether a SAMA is cost beneficial, but depends also on a SAMA's potential to significantly reduce risk to the public (NEI. 2017).

The following Category 2 issue (requirement) related to severe accidents has been defined by the NRC in 10 CFR 51.53(c)(3)(ii)(L):

> *If the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided.*

The NRC finding regarding severe accidents is stated in 10 CFR 51, Subpart A, Appendix B, Table B-1, as follows:

> *The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.*

The NRC has ruled that, when a plant qualifies for the exception from the requirement to consider SAMAs in 10 CFR 51.53(c)(3)(ii)(L), the exception operates to designate this Category 2 issue as the "functional equivalent" of a Category 1 issue (NRC. 2013e). Accordingly, using a review process similar to that used for other Category 1 issues, Dominion reviewed this issue for new and significant information that would cause the following generic conclusions in the GEIS concerning this issue to be inapplicable to SPS (NRC. 2013a).

1. The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants.
2. License renewal ERs for plants for which SAMAs have been previously considered need not consider SAMAs.

The assessment process for new and significant information related to the first conclusion included: (1) interviews with subject matter experts on the validity of the conclusions 2013 GEIS as they relate to SPS; and (2) review of documents related to predicted impacts of severe accidents at SPS. Consideration was given to developments in plant operation and accident analysis that could have changed the assumptions made concerning severe accident consequences after SAMAs were previously evaluated by the NRC for SPS during initial license renewal (SPS. 2001). Developments in the following areas included:

- New internal events information
- External events
- New source term information
- Power uprates
- Higher fuel burnup
- Other considerations including population increase and risk-beneficial plant changes implemented in response to recommendations from the Fukushima Daiichi Near Term Task Force.

No new and significant information was identified. Core damage frequency (CDF) from internal events has followed a decreasing trend at both SPS units since the previous SAMA analysis was performed (SPS. 2001). Physical changes in the plant (e.g., changes in the RCP seal design) have significantly reduced risk in all aspects of the PRA. Also, changes have been implemented at the site in response to Fukushima Daiichi Near Term Task Force recommendations and other plant-specific programs that are "risk-beneficial" but not credited in SPS PRA models. Therefore, the NRC conclusion in the 2013 GEIS that "the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small" is considered appropriate for the SPS SLR, is incorporated herein by reference, and no further analysis is needed.

Regarding the second conclusion, the subsections below describe the methodology and review of SAMAs to demonstrate there is no new and significant information.

E4.15.3 METHODOLOGY FOR EVALUATION OF NEW AND SIGNIFICANT SAMAS

E4.15.3.1 Overview

The evaluations of the SPS SLR SAMAs are consistent with the NEI 17-04 [Rev. 0] methodology (NEI. 2017), which describes a three-stage process for determining whether there is any "new and significant" information relevant to a previous SAMA analysis. In Stage 1, the SLR applicant uses PRA risk insights and/or risk model quantifications to estimate the percent reduction in the maximum benefit (MB) associated with (1) all unimplemented "Phase 2" SAMAs for the analyzed plant and (2) those SAMAs identified as potentially cost beneficial for other U.S. nuclear power plants and which are applicable to the analyzed plant. If one or more of those SAMAs are shown to reduce the MB by 50% or more, then the applicant must complete Stage 2 by developing updated averted cost-risk estimates for implementing those SAMAs. If the Stage 2 assessment confirms that one or more SAMAs reduce the MB by 50% or more, then the applicant must complete Stage 3 by performing a cost-benefit analysis for the "potentially significant" SAMAs identified in Stage 2. Applicants that are able to demonstrate through the Stage 1 screening process that there is no potentially significant new information are not required to perform the Stage 2 or Stage 3 evaluations. The application of the NEI 17-04 methodology is described in the following subsections.

E4.15.3.1.1 Definitions of New and Significant Information

"New" information pertains to data used in a SAMA analysis that have changed or become available since the time the preceding SAMA analysis was performed.

Some inputs to the SAMA analysis are expected to change, or to potentially change, for all plants. These inputs include the following:

- Updated Level 3 PRA model consequence results, which may be impacted by multiple inputs, including, but not limited to, the following:
  - Population, as projected within a 50-mile radius of the plant
  - Value of farm and non-farm wealth
  - Core inventory (e.g., due to power uprate)
  - Evacuation timing and speed
  - Level 3 PRA methodology updates
- NUREG/BR-0058 cost-benefit methodology updates (NRC. 2004).

In addition, other changes that could be considered "new information" are dependent on plant activities or site-specific changes. These types of changes include the following:

- Identification of a new hazard (e.g., a fault that was not previously analyzed in the seismic analysis).
- Updated plant risk model (e.g., a fire PRA that replaces the individual plant examination of external events [IPEEE] analysis).
  - Impacts of plant changes included in the plant risk models will be reflected in the model results and do not need separate assessment.
- Non-modeled modifications/changes to the plant.
  - Modifications determined to have no risk impact need not be included (e.g., replacement of the condenser vacuum pumps), unless they impact a specific input to SAMA (e.g., a new low-pressure turbine in the power conversion system that results in a greater net electrical output).

For risk model updates performed to reflect the latest PRA model state of the practice, it is noted that the actual physical plant risk may not have changed; however, because the best-estimate assessment or understanding of the risk (e.g., plant-specific risk profile) has changed, it is considered new information.

The SPS-R06 model was used to determine the level of significance of new information. Consistent with the NEI 17-04 methodology, this PRA Model reflected the most up-to-date understanding of plant risk at the time of analysis. (NEI. 2017) As noted above, the criterion established for new information being "potentially significant" is if the new information would cause the MB, as defined in Section 4.5 of NEI 05-01 [Rev. A] and calculated for any previously unimplemented, potentially cost beneficial SAMA for SPS to be reduced by a factor of two or more if the SAMA were implemented. If it can be shown that a particular SAMA would not reduce the core damage frequency (CDF) or any of the Level 2 release category frequencies in the model of record by more than a factor of two, then that particular SAMA could not reduce the MB by a factor of more than two. Therefore, that SAMA would not be considered evidence that new and potentially significant information exists, and would not be evaluated further in assessing the significance of new information. This criterion was applied to the SAMA screening evaluation presented in Section E4.15.4.

For SAMAs that are screened-in in Section E4.15.4, the Level 3 PRA developed for the initial SPS license renewal SAMA is updated (Section E4.15.4.4), and the MB calculated in detail using the current SPS PRA model of record in Section E4.15.5. Again, the criterion for a SAMA being potentially significant will be whether it reduces the total MB by at least a factor of two; i.e., by at least 50%.

For SPS, all SAMAs were found to not meet the criteria for "new and significant information" in Stage 2. If such a SAMA had been identified, the final determination of significance for the new information causing this result would have been made in a Stage 3 assessment. The Stage 3 assessment would have determined whether implementing the SAMA would be potentially cost beneficial. Existence of a SAMA that would reduce MB by 50% or more and also be potentially cost-beneficial, would indicate the existence of "new and significant' information relevant to the previous SAMA analysis.

E4.15.4 ANALYSIS

E4.15.4.1 Stage 1 Assessment: Step 1 - Identification and Qualitative Screening of SAMAs

The list of candidate SAMAs for the SPS SLR was developed from plant-specific and industry sources. For the plant-specific portion, the initial SPS license renewal SAMA evaluation was examined to identify all SAMAs that could not be qualitatively screened, and they were found not to be cost effective. Evaluating these items is appropriate for determining if there is any new and significant information for SPS and the PRA since the time of the initial license renewal in regard to the potential plant improvements.

For evaluation of the industry sources, the GEIS plant-specific supplements were examined for SAMAs found to be potentially cost effective at plants similar to SPS (NRC. 2013a). SAMAs found to be cost effective at similar plants (pressurized water reactors) were considered for their significance at SPS (NRC. 2014b).

The list of SAMAs collected was evaluated qualitatively to screen from further evaluation any that are not applicable to SPS, or that already have been implemented at SPS. In addition, two other screening criteria were applied to eliminate SAMAs that have excessive implementation costs. First, SAMAs were screened from further consideration if they were found to reduce the SPS MB by greater than 50% in the initial SPS license renewal, but also found not to be cost effective due to high estimated costs of implementation in the initial license renewal process. Second, one SAMA (filtered containment vent) was screened due to its excessive implementation cost, because this plant modification has been evaluated by the nuclear industry and explicitly found to not be cost effective in Westinghouse large/dry containments.

The remaining SAMAs were then grouped (if similar) based on similarities in mitigation equipment or risk-reduction benefits, and all were evaluated for the impact they would have on the SPS CDF and STC frequencies if they were implemented. If any of the SAMAs were found to reduce the CDF or at least one STC frequency by at least 50%, then the SAMA was retained for a full Level 3 PRA evaluation of the reduction in MB.

In terms of external event consideration, it is conservative to estimate the percentage reduction in total MB by utilizing the internal events models for the following reasons:

1. The dominant contributor to the IPEEE seismic CDF was severe seismic damage to the turbine building, contributing 3.6E-6 per year, or 36% of the total seismic CDF. This sequence would see little or no reduction in frequency by any of the proposed SAMAs and therefore, its inclusion in the total MB would reduce the percent reduction calculation of each SAMA as compared to calculating percent reduction by internal events alone.
2. The remaining significant seismic and fire IPEEE CDF contributors utilize the logic from the Level 1 PRA event trees. In most cases, the sequences result in the use of loss of offsite power (LOOP) and/or station blackout (SBO) logic. Therefore, the percentage reduction in MB achieved by each SAMA would be similar to that of the internal events LOOP and SBO analyses. While this would yield some change to the specific contribution on each STC, the changes are not expected to be significant because of the use of the same supporting event tree logic.

As presented in Section E4.15.5, the total MB calculated for the SPS internal events model receives a significant contribution from interfacing systems loss-of-coolant accident (ISLOCA) (15% of total internal events MB) and steam generator tube rupture (SGTR) (16% of total internal events MB). The external events analysis, however, does not have any contribution from ISLOCA or SGTR-initiating events, although some contribution from induced SGTR would still apply to external events. Therefore, if external events were included, the absolute value reduction in MB of some SAMAs would be larger; however, there is confidence that the methodology of percentage reduction in MB due to internal events results in a conservative analysis.

E4.15.4.2 Stage 1 Assessment: Step 2 - Evaluation of Risk Reduction of SAMAs

A total of 269 industry internal and external event SAMAs were collected for evaluation in the SPS SLR. Qualitative screening of each from further analysis in the SPS SLR resulted in elimination of all external events.

The list of industry potential SAMAs was qualitatively screened using the screening criteria that the SAMAs do not apply to the SPS design, are already implemented at SPS, or for which SPS already has a design feature that achieves the intent of the industry SAMA. The industry SAMAs that were not qualitatively screened were then merged with the SPS-specific SAMAs collected from initial license renewal, with similar SAMAs grouped together for further analysis. The combined SAMA list was quantitatively screened to determine if the CDF or any STC frequency would reduce at least 50% if the SAMA was implemented.

Table E4.15-1 presents the SAMAs that were neither qualitatively nor quantitatively screened (using the criterion of CDF or any STC frequency reducing by 50% or more). The first column presents number assigned to each SAMA for tracking purposes. The second column provides a summary

description of each potential SAMA; the third column provides additional detail about each SAMA; and the fourth column presents an assessment of each SAMA.

After performing the qualitative and quantitative Stage 1 screening on the complete list of potential improvements or groupings of improvements, 19 SAMAs remained for further evaluation. Therefore, a Stage 2 assessment was performed in which the Level 3 PRA was conservatively updated and calculations of reduction in MB were performed. The analyses of each SAMA are presented in Sections E4.15.4.4 and E4.15.5, respectively.

E4.15.4.3 Stage 2 Assessment

The following sections describe the assumptions made and the results of modeling performed to assess the risks and consequences of severe accidents (NRC Class 9) at SPS.

The severe accident consequence analysis was conducted using the MELCOR Accident Consequences Code System (MACCS2) code. MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment. The principal phenomena considered in MACCS2 are atmospheric transport, mitigating actions based on dose projection, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs. (NRC. 1998)

The purpose of this analysis is to calculate the risk to the surrounding population due to a severe accident involving SPS. The MACCS2 code is used to calculate the consequences to the population and corresponding property damage within a 50-mile radius of the SPS site as described in the NUREG-1150 risk analysis (NRC. 1990a). The MACCS2 output of interest includes the consequences reported in dose to the offsite population and the property damage in U.S. dollars ($). The resulting consequences are multiplied by the frequency to obtain the overall risk to the population per year. These consequence results are used for the SAMA new and significant information analysis supporting the SPS SLRA.

The initial SPS license renewal developed a full MACCS2 model, with site-specific inputs. For this subsequent SLR, the original MACCS2 model for SPS is again utilized, but with some updates. Specifically, the five input modules which include the ATMOS, CHRONC, EARLY, MET, and SITE were modified from the previous analysis done in 2000, as presented in the SPS initial license renewal ER (SPS. 2001, Section 4.20).

The MACCS2 code input modules include the ATMOS, CHRONC, EARLY, S2012Met, S2013Met, S2014Met, and SITE files. These input modules were partially or completely modified from the previous analysis done in year 2000 (SPS. 2001, Section 4.20). Meteorological data for years 1996, 1997, and 1998 are used here for sensitivity analysis. The modifications made to each MACCS2 input module are presented in more detail below. Inputs that have not changed since the initial license renewal are not repeated here.

E4.15.4.3.1 Population Inputs

The population data in the MACCS2 site file that were used in the initial license renewal ER (SPS. 2001, Section 4.20) were taken from SPS UFSAR Section 2.1 as a starting point. More recent draft population data extrapolated for the year 2053 were obtained (Dominion. 2017e). These data were used to make an approximation of the population growth in the surrounding locality sectors within a 50-mile radius of SPS. The previous total population within a 50-mile radius was projected to be 3,365,040 million for year 2030, which was used in the initial license renewal ER (SPS. 2001, Figure G.1-1). Recent data (Dominion. 2017e) show that the total population projected for the year 2053 is 4,425,681. These updated data show that the population is estimated to increase by a factor of 1.32 during this period (2030-2053), a factor which can be used as a multiplier for all the sectors within a 50-mile radius in the site file. A conservative population multiplier of 2.0 (as opposed to 1.32) was used in this consequence analysis, which bounds the projected 2053 year population data. The MACCS2 site input file contains the revised population data used in this analysis.

E4.15.4.3.2 Meteorological Inputs

Meteorological data were obtained from the Dominion meteorology department for the years 2012, 2013, and 2014. It was necessary to format the raw data into the format required by the MACCS2 code. Two values for mixing layer heights are required for each of the four seasons of the year. The data provided did not contain the mixing layer heights for all four seasons for the morning and afternoon. (Dominion. 2017e, Attachment C). Therefore, the previous mixing layer heights for the four seasons from the years 1996, 1997, and 1998 were used to complete the meteorological data format required. A comparison of the mixing layer heights for the three years selected reveals that the heights do not change significantly from year to year. Thus, use of these heights is considered acceptable, because the sensitivity analysis results in this calculation have shown that changes to the meteorological data have a minor impact on the estimated offsite consequences.

E4.15.4.3.3 Economic Inputs

The site-specific economic data used for this evaluation are similar to the data that were used for the year 2000 analysis (SPS. 2001, Section 2.7), but were adjusted to present-day values by using a consumer price index (CPI) multiplier. The multiplier is obtained by dividing the previous CPI value by the current-year CPI value. The previous CPI for year 1998 was 158.9, and the latest obtained CPI value for year 2015 is 237.017 (Dominion. 2017e). Thus, the ratio of (237.017/158.9) yields a 1.49 multiplier, which is used for the following MACCS2 economic input parameters:

- CHEVACST-Daily cost for a person who is evacuated ($ per person-day)
- CRELCST-Daily cost for a person who is relocated ($ per person-day)
- CHCDFRM0-Cost of farm decontamination per farmland unit area ($ per hectare)
- CHCDNFRM-Cost of nonfarm decontamination per resident person ($ per person)
- CHPOPCST-Population relocation cost ($ per person)
- CHDLBCST-Average cost of decontamination labor ($ per man-year)
- CHVALWF-Average farm wealth value ($ per hectare)
- CHVALWNF-Average non-farm wealth value ($ per person)

E4.15.4.3.4 Source Term Category Frequency Data

The STC frequency data for the baseline SPS PRA are provided in Table E4.15-1. Note that the STC frequencies for categories 2, 6, and 7 resulted in zero magnitude, which negates their use for the consequence analysis.

E4.15.4.3.5 Source Term Release Fraction Data

The fission product radioactive isotope release fraction data were obtained using the Modular Accident Analysis Program, Version 4 (MAAP4) code for the 13 STCs presented above (Dominion. 2017f).

The MAAP code produces 12 release fractions, but some related isotopes are consolidated into one group to generate the nine release fractions that the MACCS2 code requires. Specifically, the three MAAP isotopes of TeO2, Sb, and Te2 are combined into a single release fraction input parameter (Te-Sb) used by MACCS2 code. Secondly, the two MAAP isotopes of CeO2 and UO2 are combined into a single release fraction input parameter (Ce) used by the MACCS2 code. The mapping of the MAAP to MACCS2 source term release fractions is consistent with the prior license renewal analysis (SPS. 2001). These release fractions are all input into the MACCS2 ATMOS module as stacked files for all STCs.

The scaling factor (CORSCA = 1.1) was changed to accommodate a planned 10% future power uprate from the SPS core inventory current power level of 2,587 MWt. The core inventory was taken from an SPS dose consequence analysis (Dominion. 2010b) except for isotopes Co-58 and Co-60 data, which were taken from the inventory table used in the initial SPS license renewal analysis (SPS. 2001). This is considered a reasonable approximation.

Plume characteristic data are applied to all 16 release categories in a stacked format for each MACCS2 case.

For STCs 1 and 11, the plume energy parameter PLHEAT is chosen to be 1.0E4 watts, because the containment average temperature is 200°F, and it represents an intact containment with design leakage. For large containment releases with the containment average temperature of 400°F, the plume energy is selected to be 1.0E6 watts, which is representative of the values used in NUREG/CR-4551, a technical basis document for the NUREG-1150 study (NRC. 1990b). For the STC with the containment temperatures greater than 400°F, the plume energy is weighted corresponding to its containment temperature. The offsite alarm time (OALARM) and plume release time (PDELAY) values were obtained from the SPS MAAP analysis (Dominion. 2017f). The sensitivity of the OALARM and PDELAY values will be investigated by setting these values to zero to determine the magnitude of change on the final consequence results.

The source term release fractions, core inventory, and plume characterization data were revised in the MACCS2 SATMOS input module consistent with the above discussion.

E4.15.4.4 MELCOR Results

Using the updated input data described above, MACCS2 was used to estimate the following:

- The downwind transport, dispersion, and deposition of the radioactive materials released to the atmosphere from the postulated failed reactor containment.
- The short- and long-term radiation doses received by exposed populations via direct (cloudshine, plume inhalation, groundshine, and resuspension inhalation) and indirect (ingestion) pathways.
- The mitigation of those doses by protective actions (evacuation, sheltering, and post-accident relocation of people; disposal of milk, meat, and crops; and decontamination, temporary interdiction, or condemnation of land and buildings).
- The early fatalities and injuries expected to occur within one year of the accident (early health effects) and the delayed (latent) cancer fatalities and injuries expected to occur over the lifetime of the exposed individuals.
- The offsite economic costs of short-term emergency response actions (evacuation, sheltering, and relocation), of crop and milk disposal, and of the decontamination, temporary interdiction, or condemnation of land and buildings.

E4.15.5 EVALUATION OF MAXIMUM BENEFIT REDUCTION OF SCREENED-IN SAMAS

In Section E4.15.4, the candidate SAMAs for SPS were screened qualitatively and quantitatively. In this section, the screened-in SAMAs are evaluated further to calculate the reduction in MB resulting from implementation of each SAMA. The calculations of conditional dose and cost for each STC are derived from the Level 3 PRA results calculated in Section E4.15.4.4.

E4.15.5.1 SAMAs Considered for Calculation of Reduction in Maximum Benefit

The screened-in SAMAs from Section E4.15.4 were combined into groups if they were similar with regard to mitigation equipment and/or risk reduction benefits and could be represented by a single, bounding evaluation. Table E4.15-2 presents the grouping that was performed, and associates each screened-in SAMA with a case identifier. The final column of Table E4.15-2 presents the bounding percentage reduction in MB for each case.

E4.15.5.2 Calculation of SPS Maximum Benefit

The baseline risk result from the Level 3 PRA analysis is the maximum risk reduction that can be attained from any modification that can be devised; this risk value is the MB. It represents the benefit if the entire frequency of all STCs were reduced to zero (i.e., the risk is assumed to be completely eliminated by SAMA implementation).

The methodology used for this evaluation was based upon the NRC's guidance for the performance of cost-benefit analyses in NUREG/BR-0184 (NRC. 1997). This guidance involves determining the net value for each SAMA according to the following formula:

Net Value = (APE + AOC + AOE + AOSC) - COE

where

APE = present value of averted public exposure ($)

AOC = present value of averted offsite property damage costs ($)

AOE = present value of averted occupational exposure ($)

AOSC = present value of averted onsite costs ($)

COE = cost of enhancement ($)

If the net value of a SAMA is negative, then the cost of implementing the SAMA is larger than the benefit associated with the SAMA and the SAMA is not considered cost-beneficial. As noted above, for Stage 2 of the "new and significant information" assessment process for SAMA the cost element is not included because the Stage 2 assessment considers the percentage reduction in MB from

each SAMA. The cost element would only apply if a Stage 3 assessment was needed, which was not the case for SPS.

The derivation of each of these factors is described in below.

The following specific values were used for various terms in the analyses.

Present Worth

The present worth was determined by the following equation:

$$PW = \frac{1 - e^{-rt}}{r}$$

where

r is the discount rate = 7% (assumed throughout these analyses)

t is the duration of the license renewal = 20 years

PW is the present worth of a string of annual payments = 10.76

Dollars per REM

The conversion factor used for assigning a monetary value to onsite and offsite exposures was $5,100 per person-rem averted. This value differs from the initial license renewal, in which the NRC's guidance was $2,000 per person-rem averted, in Section 5.7.1.2 of NUREG/BR-0184 (NRC. 1997). The updated value of $5,100 per person-rem averted is taken from the draft NUREG-1530, Revision 1 report (NRC. 2015).

Onsite Person REM per Accident

The occupational exposure associated with severe accidents was assumed to be 23,300 person-rem per accident. This value includes a short-term component of 3,300 person-rem per accident and a long-term component of 20,000 person-rem per accident. These estimates are consistent with the "best estimate" values presented in Section 5.7.3 of NUREG/BR-0184 (NRC. 1997). In the cost-benefit analyses, the accident-related onsite exposures were calculated using the best-estimate exposure components applied over the onsite cleanup period.

Onsite Cleanup Period

In the cost-benefit analyses, the accident-related onsite exposures were calculated over a 10-year cleanup period.

Present Worth Onsite Cleanup Cost per Accident

The estimated cleanup cost for severe accidents was assumed to be $1.5E+09 per accident (undiscounted). This value was derived by the NRC in NUREG/BR-0184,

Section 5.7.6.1, Cleanup and Decontamination (NRC. 1997). This cost is the sum of equal annual costs over a 10-year cleanup period. At a 7% discount rate, the present value of this stream of costs is $1.1E+09.

E4.15.5.3 Results of Maximum Benefit Calculation

The formulae developed in Section E4.15.5.2 were applied to the SPS baseline Level 2 PRA STCs. The resulting dollar benefit of $1,135,942 is considered the MB from the internal events analysis. Table E4.15-2 summarizes the estimated bounding reductions in the MB (expressed as percentage) for the screened-in Stage 2 SAMAs, and indicates that they ranged from 0% to 41%. Because implementation of none of those 21 SAMAs results in a reduction in MB of at least 50%, complete Stage 3 cost-benefit analyses are not required for the SPS SLR, and external events are not factored into the total benefit.

The formulae developed in Section E4.15.5.2 were applied to the SPS baseline Level 2 PRA STCs. The resulting dollar benefit of $1,135,942 is considered the MB from the internal events analysis.

Table E4.15-2 presents the results of the benefit calculations for the 19 SAMAs that were evaluated in the Stage 2 assessment. For each, the SPS PRA model was revised to perform a bounding assessment of the frequency of each STC. The STC frequencies for each SAMA calculate a bounding MB using the formulae from Section E4.15.5.2. The last column of Table E4.15-2 presents the percentage reduction in MB if a SAMA were implemented [(baseline MB - MB (with SAMA implemented)) / baseline MB].

As presented in Table E4.15-2, all of the bounding SAMA benefit calculations yielded a reduction in MB of less than 50%. Because complete Stage 3 cost-benefit analyses were not required for the SPS SLR, external events are not factored into this total benefit. Table E4.15-2 summarizes the reduction in MB of screened-in SAMAs.

E4.15.6 CONCLUSIONS

A conservative, bounding update to the SPS Level 3 PRA was performed, yielding new consequence results for each STC. Following the methodology from NUREG/BR-0184 (NRC. 1997), and utilizing updated guidance for the cost per person-rem from draft NUREG-1530, Revision 1 (NRC. 2015), an updated MB was calculated for SPS. The percentage reduction in MB was then calculated for each SAMA in Stage 2. Utilizing conservative, bounding PRA evaluations to evaluate these cases, none of the proposed SAMAs resulted in a reduction in MB of at least 50%.

Therefore, it is concluded that there is no new and significant information that would alter the conclusions of the original SAMA analysis for SPS.

Table E4.15-1 Source Term Category Frequency Data

STC	Frequency (per year)	Description
1	3.53E-07	Intact containment, design leakage
2	0.0	Early containment leakage
3	1.29E-07	Late containment failure, continuous sprays
4	6.49E-09	Late containment leak, sprays operate early only
5	5.38E-09	Late containment rupture, sprays operate early only
6	0.0	Late containment leak, sprays operate late only
7	0.0	Late containment rupture, sprays operate late only
8	6.04E-07	Late containment leak, no sprays
9	3.72E-07	Late containment rupture, no sprays
10	1.76E-08	Containment basemat melt-through
11	6.98E-07	Debris cooled in-vessel
12	1.27E-08	Large containment isolation failure
13	1.03E-07	ISLOCA (Event V)
14	1.16E-07	SGTR large release
15	1.52E-08	SGTR small release
16	3.12E-07	Containment fails before core damage
Total	**2.74E-06**	

Table E4.15-2 Reduction in Maximum Benefit of Screened-In SAMAs

SAMA Number	Potential SAMA	Discussion	Assessment	Detailed Evaluation Case ID	Bounding Reduction in MB
11	Develop an enhanced containment spray system.	Would provide a redundant source of water to the containment to control containment pressure, when used in conjunction with containment heat removal.	These four SAMAs have the potential to eliminate containment overpressure failure mode, thus eliminating those release categories that result from containment overpressure failure.	Indep Cont Spray	26%
12	Provide a dedicated existing containment spray system.	Identical to the previous concept, except that one of the existing spray loops would be used instead of developing a new spray system.			
13	Use fire water spray pump for containment spray.	Redundant containment spray method without high cost.			
14	Install a passive containment spray system.	Containment spray benefits at a very high reliability, and without support systems.			
17	Install an unfiltered hardened containment vent.	Provides an alternate decay heat removal method (non-ATWS), which is not filtered.	This SAMA has the potential to eliminate containment overpressure failure before core damage (STC-16).	Unfilt Vt	22%
24	Create a reactor cavity flooding system.	Would enhance debris cool-ability, reduce core concrete interaction, and provide fission product scrubbing.	Implementation of these two SAMAs will help significantly reduce or eliminate release frequency due to basemat melt-through.	EXV Deb Cool	≤ 1%
25	Creating other options for reactor cavity flooding.	Flood cavity via systems such as diesel-driven fire pumps.			

Table E4.15-2 Reduction in Maximum Benefit of Screened-In SAMAs

SAMA Number	Potential SAMA	Discussion	Assessment	Detailed Evaluation Case ID	Bounding Reduction in MB
28	Provide a reactor vessel exterior cooling system.	Potential to cool a molten core before it causes vessel failure, if the lower head can be submerged in water.	This SAMA has the potential to quench the core from outside the vessel, and thus to eliminate all releases due to containment failure after core damage.	INV Cool	36%
39	Increase secondary side-pressure capacity such that a SGTR would not cause the relief valves to lift.	SGTR sequences would not have a direct release pathway.	This SAMA may minimize or eliminate release categories due to SGTR.	SGTR No ADV	5%
41	Ensure all ISLOCA releases are scrubbed.	Would scrub ISLOCA releases. One suggestion was to plug drains in the break area so the break point would cover with water.	This SAMA reduces releases from an ISLOCA event.	ISLOCA	15%
42	Add a check valve downstream of the LHSI pumps on the cold leg injection line.	The ISLOCA frequency is dominated by the LHSI lines to the cold legs, which have two check valves each. Adding another check valve in the common injection line would essentially eliminate the frequency of the ISLOCA sequence through these pathways. However, a single check valve in the common line would create a single failure point for the system. Either a redundant line would have to be added with a check valve in each, or add a check valve to each of the three cold leg injection paths.	Implementation of this SAMA, if feasible, will result will result in significant reduction in ISLOCA frequency, and thus ISLOCA release category STC-13 frequency will be significantly reduced. Therefore, this SAMA is screened in.	ISLOCA	

Table E4.15-2 Reduction in Maximum Benefit of Screened-In SAMAs

SAMA Number	Potential SAMA	Discussion	Assessment	Detailed Evaluation Case ID	Bounding Reduction in MB
48	Provide capability for diesel-driven, low-pressure vessel makeup.	Extra water source in sequences in which the reactor is depressurized, and all other injection is unavailable (e.g., firewater).	This SAMA will impact those release categories that include successful RCS depressurization but failed low-pressure injection/recirculation due to failure of equipment or loss of power.	Indep RV inj	≤ 1%
61	Provide procedural guidance to close the RCS loop stop valves to isolate the steam generator from the core and provide mechanical device to close (gag) a stuck-open steam generator safety valve.	Technically, these are two different plant modifications with the same goal of isolating a ruptured/faulted steam generator.	This SAMA significantly reduces or eliminates some SGTR release categories.	SGTR Isol	7%
73	Install an additional EDG.	Installing an additional EDG at SPS would be equivalent to making the swing EDG #3 permanently aligned to 1J emergency bus. This means 100% reliability of the operator action to align EDG #3 to U1 emergency bus 1J. Also, it makes failure of EDG #2 completely irrelevant for U1.	Evaluation determined that implementation of this SAMA reduces CDF by less than 50%, but could reduce releases for some late containment failures by approximately 50%, therefore was conservatively screened in.	Add EDG	21%

Table E4.15-2 Reduction in Maximum Benefit of Screened-In SAMAs

SAMA Number	Potential SAMA	Discussion	Assessment	Detailed Evaluation Case ID	Bounding Reduction in MB
84	Install additional pressure- or leak-monitoring instrumentation to reduce the frequency of ISLOCA.	Because SPS ISLOCA model is composed of failure of pair of check valves on each path, a pressure- or leak-monitoring system installed in between the check valves will help operators identify any potential leakage past the first check valve, and perform necessary actions to isolate the leak and bring the reactor into a safe shutdown condition.	Implementation of this SAMA at SPS will significantly reduce ISLOCA contribution to CDF and release category STC-13.	ISLOCA	15%
85	Route the discharge from the main steam safety valves through a structure where a water spray would condense the steam and remove fission products.	This would reduce releases from a SGTR and stuck open main steam safety valve.	Implementation of this SAMA at SPS will significantly reduce or eliminate releases due to SGTR.	SGTR all	16%

Table E4.15-2 Reduction in Maximum Benefit of Screened-In SAMAs

SAMA Number	Potential SAMA	Discussion	Assessment	Detailed Evaluation Case ID	Bounding Reduction in MB
94	RWST fill from firewater during containment injection-modify 6-inch RWST flush flange to have a 2½-inch female fire hose adapter with isolation valve.	Implementation of this SAMA will help prevent containment pressure buildup in the event of failure of recirculation spray. It will also provide continuous fission product scrubbing in the containment after core damage.	This SAMA reduces CDF by less than 50% power, but could minimize or eliminate release categories due to containment overpressure failure in LOCA scenarios (any loss of power scenarios are not relevant because the containment spray pumps would not be available).	Conservatively bounded by adding the benefit of the Indep Cont Spr case with the ISLOCA case	41%
95	High-volume makeup to the refueling water storage tank.	Implementation of this SAMA can help mitigate ISLOCA event by continuous safety injection.	Because this SMA can help minimize the ISLOCA contribution to CDF, and thus significantly reduce release frequency due to ISLOCA		
104	Install a gas turbine generator.	Similar to #73.	Similar to #73.	Add EDG	21%

Intentionally Blank

E5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware. [10 CFR 51.53(c)(3)(iv)]

License renewal applicants are required to analyze only those issues the NRC has not resolved generically. While NRC regulations do not require an applicant's ER to contain analyses of the impacts of those Category 1 environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require an applicant to identify any new and significant information of which the applicant is aware. [10 CFR 51.53(c)(3)(iv)]

E5.1 NEW AND SIGNIFICANT INFORMATION

The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC. 2013b). In this guidance, new and significant information is defined as follows:

(1) Information that identifies a significant environmental impact issue not considered or addressed in the GEIS and, consequently, not codified in Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants," in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act-Regulations Implementing Section 102(2)," of 10 CFR 51; or

(2) Information not considered in the assessment of impacts evaluated in the GEIS, leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.

(3) Further, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

Based on available guidance and the definitions of SMALL, MODERATE, and LARGE impacts provided by the NRC in 10 CFR 51, Appendix B, Table B-1, Footnote 3, Dominion considers any new information regarding Category 1 issues with MODERATE or LARGE impacts to be significant. Section E4.0.2 presents the NRC's definitions of SMALL, MODERATE, and LARGE.

E5.2 NEW AND SIGNIFICANT INFORMATION REVIEW PROCESS

The new and significant information assessment process described below meets or addresses regulatory guidance provided above.

Dominion's process is carried out through its ongoing environmental planning, assessment, monitoring, and compliance activities performed by the appropriate corporate and SPS management and staff and ER-specific reviews. Dominion's team for the review of new and significant information has collective knowledge of the license renewal process, the site, licensing and permitting, environmental issues, the initial license renewal of SPS, the NEPA process, and nuclear industry activities. This team has implemented the in-house process for reviewing and evaluating environmental issues which could potentially be new and significant information.

Dominion's new and significant information review included establishment of applicable and non-applicable Category 1 issues through:

- Review of the SPS initial license renewal ER, the NRC SEIS for the initial license renewal, and the GEIS Category 1 issues discussion;
- Identification and review of past or potential modifications to SPS, including environmental impacts; and
- Identification and assessment of equipment and operations with the potential to result in changes in emissions, releases, discharge points, land use, noise levels, etc., considering environmental reviews since initial licensing, and those anticipated during the proposed subsequent period of extended operations.

Dominion applied an investigative process to seek new information related to the applicable Category I environmental issues through:

- Environmental review team discussions with Dominion and SPS subject matter experts on the Category 1 issues as they relate to the plant;
- Review of permits and reference materials listed in Table E9.1-1 and Section E10.0 related to environmental issues at the plant, the environmental resource areas related to Category 1 issues, and information collected for regulatory compliance status;
- Review of recent publicly available information since issuance of the license renewal GEIS, or information held by Dominion, particularly data or reports from the past five years, related to the resource area and each applicable Category 1 impact issue, as summarized in the appropriate section of this ER in Section E3.0;
- Consultation with state and federal resource agencies to determine if there are concerns pertinent to specific resource areas and SPS operations;
- Review of environmental monitoring and reporting required by regulations related to the SPS site and operations;
- Review of Dominion environmental programs and procedures related to the SPS site and operations;
- Review of correspondence and permitting documentation related to oversight of SPS facilities and operations by state and federal regulatory agencies (activities that would bring significant issues to the plant's attention), to identify site-specific environmental concerns; and
- Review of recent LRAs for issues relevant to this SPS Units 1 and 2 SLR application.

In addition, Dominion is made aware of and stays informed of new and emerging environmental issues and concerns on an ongoing basis through:

- Reviews of nuclear industry publications, operational experience, and participation in nuclear industry organizations such as the Edison Electric Institute, EPRI, and NEI;
- Routine interface with non-nuclear Dominion Energy business units, such as Power Generation, Transmission, and Corporate Environmental Services;
- Contact with state and federal resource agencies with regulatory jurisdiction over environmental regulation; and
- Development and periodic review of regulatory guidance procedures that address ongoing and emergent issues.

Information resulting from the above-described process was assessed to determine if it is new, and significant, applying the following considerations:

- Was the information included in or available for the GEIS analysis of the Category issue?
- Was the information included in or available for the SEIS for SPS initial license renewal?
- Does the information identify an environmental issue not generically considered in the GEIS, and consequently, not codified in 10 CFR 51 Appendix B Table B-1?
- Does the information present a seriously different picture of the environmental consequences of the action than previously considered leading to an impact finding different (MODERATE or LARGE) from that included in the GEIS or codified in regulation?
- Does the information involve a new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity (MODERATE or LARGE impact) and/or scope (context) not previously recognized?

As a result of this review, Dominion is aware of no new and significant information regarding the environmental impacts of SLR associated with SPS. The findings in NUREG-1437, Revision 1, for the applicable Category 1 issues, are therefore incorporated by reference.

New and significant information review methodology and results applicable to the issue of severe accidents, which is the functional equivalent of a Category 1 issue for SPS (CLI-13-07, II.A, p. 15). Severe accident mitigation alternatives (SAMA) analysis is addressed separately in Section E4.15.

E6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

E6.1 LICENSE RENEWAL IMPACTS

Chapter 5 incorporates by reference NRC findings for the 53 Category 1 issues that apply to SPS (plus the one uncategorized issue for which the NRC came to no generic conclusion), all of which have SMALL environmental impacts. Chapter 4 presents site-specific analyses of the 17 Category 2 issues. Table E6.1-1 identifies the environmental impacts that subsequent renewal of the SPS OL would have on resources associated with Category 2 issues.

Dominion has reviewed the environmental impacts of renewing the SPS OL and concluded that further mitigation measures beyond those presented in Section E6.2 and listed in Table E6.1-1 of this ER to avoid, reduce the severity of, or eliminate adverse impacts are not warranted. This ER documents the basis for Dominion's conclusion.

Table E6.1-1 Environmental Impacts Related to Subsequent License Renewal at SPS

Resource Issue	ER Section	Environmental Impact
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	E4.5.1	No impact. Issue is not applicable because SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute) [10 CFR 51.53(c)(3)(ii)(C)]	E4.5.3	SMALL impact. SPS and GNCTS are permitted to withdraw a total of 154.7 mgy with a monthly maximum of about 15.89 mg (367.8 gpm) of groundwater for domestic, process, and cooling water. SPS and GNCTS currently withdraw 80 percent of the permitted monthly amount. Groundwater use is not expected to increase above permitted levels during the proposed SLR operating term.
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	E4.5.2	No impact. Issue is not applicable because SPS utilizes a once-through cooling system with cooling water supplied by the James River.
Groundwater quality degradation (plants with cooling ponds at inland sites) [10 CFR 51.53(c)(3)(ii)(D)]	E4.5.4	No impact. Issue is not applicable because SPS uses a once through cooling system and does not utilize cooling ponds.
Radionuclides released to groundwater [10 CFR 51.53(c)(3)(ii)(P)]	E4.5.5	SMALL impact. Tritium has been measured in the groundwater monitoring wells at SPS with Co-58 detected once since the groundwater program was initiated in 2006.
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts) [10 CFR 51.53(c)(3)(ii)(E)]	E4.6.1	SMALL impact. No license renewal-related refurbishment or other license renewal-related construction activities have been identified; adequate management programs and regulatory controls are in place to protect onsite important terrestrial ecosystems.
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	E4.6.4	No impact. Issue is not applicable because SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.

Table E6.1-1 Environmental Impacts Related to Subsequent License Renewal at SPS

Resource Issue	ER Section	Environmental Impact
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	E4.6.1	SMALL impact. Based on past and current impingement studies, no impacts have been identified. The low-level intake structure has been approved as the best technology available by the VDEQ (2008 and 2012).
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	E4.6.2	SMALL impact. While there is a small thermal plume associated with SPS discharge, it represents a portion of the cross-sectional and vertical area of the James River that is not significant. The location of the plume does not block the movement of fish, upstream or downstream of the SPS plant. Because there are no planned operational changes during the proposed SLR operating term that would increase the temperature of SPS's existing thermal discharge, impacts are anticipated to be SMALL and mitigation measures are not warranted.
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	E4.6.3	No impact. Issue is not applicable because SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat [10 CFR 51.53(c)(3)(ii)(E)]	E4.6.6	SMALL impact. No license renewal-related refurbishment or other license-renewal related construction activities have been identified. The continued operation of the site would have no adverse effects on any federally or state-listed species. SLR would have no effect on threatened, endangered, and protected species in the vicinity of SPS.
Historic and Cultural Resources		
Historic and cultural resources [10 CFR 51.53(c)(3)(ii)(K)]	E4.7	No adverse effects on historic properties. No license renewal-related refurbishment or other license renewal-related construction activities have been identified; administrative procedure ensures protection of these type resources in the event of excavation activities.

Table E6.1-1 Environmental Impacts Related to Subsequent License Renewal at SPS

Resource Issue	ER Section	Environmental Impact
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river) [10 CFR 51.53(c)(3)(ii)(G)]	E4.9.1	SMALL impact. The size of the river, the saline and tidal influence of the estuary, the documented reduction in water temperatures surrounding the effluent discharge point, and regulatory restrictions placed on public access to the waters adjacent to the discharge structures, reduces the human health impact from microbiologic hazards.
Electric shock hazards [10 CFR 51.53(c)(3)(ii)(H)]	E4.9.2	SMALL impact. The NRC determined electric shock potential for the transmission lines distributing Units 1 and 2 generation to the grid was small and did not warrant mitigation measures. All in-scope transmission lines are located completely within SPS property boundary and are NESC compliant.
Postulated Accidents		
Severe accidents [10 CFR 51.53(c)(3)(ii)(L)]	E4.15	Utilizing conservative, bounding PRA evaluations, none of the proposed potentially cost-effective SAMAs resulted in a reduction in maximum benefit of at least 50 percent. Therefore, it is concluded that there is no new and significant information that would alter the conclusions of the original SAMA analysis for SPS.
Environmental Justice		
Minority and low-income populations [10 CFR 51.53(c)(3)(ii)(N)]	E4.10.1	No disproportionately high and adverse impacts or effects on minority and low-income populations identified.
Cumulative Impacts		
Cumulative Impacts [10 CFR 51.53(c)(3)(ii)(O)]	E4.12	SMALL to no impacts are expected for the continued operation of SPS. SMALL for air quality and noise, geology and soils, socioeconomics, human health, and waste management, surface water and groundwater resources, aquatic and terrestrial resources due to climate change; and no effect on historic and cultural resources.

E6.2 MITIGATION

E6.2.1 REQUIREMENTS [10 CFR 51.45(C) AND 10 CFR 51.53(C)(3)(III)]

The environmental report must include an analysis that considers and balances . . . alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]

The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

E6.2.2 RESPONSE

NRC Regulatory Guide 4.2, Supplement 1, Revision 1, Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications, specifies that the applicant should identify any ongoing mitigation and should address the potential need for additional mitigation. Applicants are only required to consider mitigation alternatives in proportion to the significance of the impact. (NRC 2013b)

As presented in Section E6.1, impacts associated with SPS SLR do not require the implementation of additional mitigation measures. The permits and programs presented in Chapter 9 (i.e., VPDES permit; stormwater program; air permit; SPCC plan; hazardous waste management program; cultural resource description process; and environmental review programs) that currently mitigate the operational environmental impacts of SPS are adequate. Therefore, additional mitigation measures are not sufficiently beneficial as to be warranted.

E6.3 UNAVOIDABLE ADVERSE IMPACTS

E6.3.1 REQUIREMENT [10 CFR 51.45(B)(2)]

The environmental report shall . . . discuss . . . any adverse environmental effects which cannot be avoided should the proposal be implemented . . . . [10 CFR 51.45(b)(2)]

E6.3.2 RESPONSE

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit, because the facility is in existence at the license renewal stage and has operated for years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred.

As previously presented in Chapter 4 of this ER, Dominion does not anticipate the continued operations of SPS to adversely affect the environment. Dominion also does not anticipate any license renewal-related refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process. Therefore, the environmental impacts to be evaluated for SLR are those associated with continued operation during the renewal term.

Dominion adopts by reference NRC findings for the 53 Category 1 issues applicable to SPS, including discussions of any unavoidable adverse impacts (NRC. 2013a). In addition, Dominion identified the following site-specific unavoidable adverse impacts associated with SLR:

- The majority of the land use at SPS would continue to be designated as industrial until the plant is shut down and decommissioned (decommissioning can take up to 60 years after permanent shutdown of SPS). Uranium mining associated with the nuclear fuel cycle also has offsite land use implications.
- Aquatic organisms would continue to be impinged and entrained at the low-level intake structure, but as presented in E4.6.1, these impacts were determined to be SMALL.
- Normal plant operations result in industrial wastewater discharges containing small amounts of water treatment chemical additives to the James River at or below VDEQ approved concentrations. Compliance with the VPDES permit would ensure that impacts remain SMALL.
- Plant operation of SPS results in consumptive water use of James River. The water is considered low quality in the vicinity of SPS, and as stated in Section E3.6.3.1, SPS withdraws about 3 percent of the James River's tidal flow while 1 percent of that is lost to evaporation.
- Operation of SPS results in the generation of spent nuclear fuel and waste material, including LLRW, hazardous waste, and nonhazardous waste. Specific plant design features in conjunction with a waste minimization program, employee safety training programs and work procedures, and strict adherence to applicable regulations for storage, treatment, transportation, and ultimate disposal of this waste ensure that the impact is SMALL.
- Operation of SPS results in a very small increase in radioactivity in the air and water emissions. The incremental radiation dose to the local population resulting from SPS operations is typically less than the magnitude of the fluctuations that occur in natural background radiation. Doses to the public from SPS's gaseous releases would be well within the allowable limits of 10 CFR 20 and 10 CFR 50, Appendix I. Operation of SPS also creates a very low probability of accidental radiation exposure to inhabitants of the area.

E6.4 IRREVERSIBLE OR IRRETRIEVABLE RESOURCE COMMITMENTS

E6.4.1 REQUIREMENT [10 CFR 51.45(B)(5)]

The environmental report shall . . . discuss . . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

[10 CFR 51.45(b)(5)]

E6.4.2 RESPONSE

The term "irreversible" applies to the commitment of environmental resources (e.g., permanent use of land) that cannot by practical means be reversed to restore the environmental resources to their former state. In contrast, the term "irretrievable" applies to the commitment of material resources (e.g., irradiated steel, petroleum) that, once used, cannot by practical means be recycled or restored for other uses.

The continued operation of SPS for the period of extended operation will result in irreversible and irretrievable resource commitments, including the following:

- Uranium in the nuclear fuel consumed in the reactor that becomes high-level radioactive waste if the used fuel is not recycled through reprocessing.
- Land required for permanent storage or disposal of spent nuclear fuel, LLRWs generated as a result of plant operations, and sanitary waste generated from normal industrial operations.
- Elemental materials that will become radioactive.
- Materials used for the normal industrial operations of SPS that cannot be recovered or recycled, or that are consumed or reduced to unrecoverable forms.

Other than the above, no license renewal-related refurbishment activities have been identified that would irreversibly or irretrievably commit significant environmental components of land, water, and air.

If SPS ceases operations on or before the expiration of the current OL, the likely power generation alternatives would require a commitment of resources for construction of the replacement plant as well as for fuel to run the plant. Significant resource commitments would also be required if transmission lines are needed to connect a replacement generation plant to the electrical grid.

E6.5 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

E6.5.1 REQUIREMENT [10 CFR 51.45(B)(4)]

The environmental report shall . . . discuss . . . the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity . . . .

[10 CFR 51.45(b)(4)]

E6.5.2 RESPONSE

The current balance between short-term use and long-term productivity of the environment at the site has remained relatively constant since SPS began operations in 1972. The FES for SPS evaluated the relationship between the short-term uses of the environment and the maintenance and enhancement of the long-term productivity associated with the construction and operation of SPS (NRC. 1972, Section VIII). The period of extended operation will not alter the short-term uses of the environment from the uses previously evaluated in the SPS FES. The period of extended operation will postpone the availability of the site resources (land, air, water) for other uses. Denial of the application to renew the SPS OL would lead to the shutdown of the plant and would alter the balance in a manner that depends on the subsequent uses of the site. For example, the environmental consequences of turning the site area occupied by SPS into a park or an industrial facility after decommissioning are quite different. Extending SPS operations would not alter, but only postpone, the potential long-term uses of the site that are currently possible.

In summary, no license renewal-related refurbishment activities have been identified that would alter the evaluation of the SPS FES for the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity of these resources.

E7.0 ALTERNATIVES TO THE PROPOSED ACTION

E7.1 NO ACTION ALTERNATIVE

The proposed action as described in Section E2.1 is for the NRC to renew the OLs for SPS Units 1 and 2 for an additional 20 years. Therefore, the only other alternative under consideration by the NRC is the no-action alternative, which is their decision to not renew the SPS OLs. If the SPS OLs are not renewed, the 1,676 MWe of baseload power would not be available to meet Dominion's power generation needs during the proposed SLR operating term from 2032-2052 for SPS Unit 1 and from 2033-2053 for SPS Unit 2. Because Dominion is a regulated utility that must meet its customers' long-term power needs, the no-action alternative will identify replacement power sources for the loss of SPS generation.

In accordance with 10 CFR 51.53(b)(3), this ER will discuss a no-action alternative to the proposed license renewal and a range of alternatives for replacement baseload power sources. A reasonable alternative as described by the NRC must be technically feasible and commercially viable on a utility scale and operational prior to the expiration of the reactors' OLs, or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactors' OLs (NRC. 2013a). The replacement power alternative generation must also equal the baseload capacity previously supplied by the nuclear plant, and the alternative must reliably operate at or near SPS's demonstrated capacity factor.

The replacement power sources being considered under the no-action alternative are presented in Section E7.2.1. Section E7.2.2 will identify the no-action alternative power sources that were evaluated and were not considered reasonable power sources for the replacement of the SPS generation.

E7.1.1 DECOMMISSIONING IMPACTS

The NRC's definition of decommissioning as stated in 10 CFR 20.1003 is the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits the following:

- Release of the property for unrestricted use and termination of the license; or
- Release of the property under restricted conditions and termination of the license.

The NRC evaluated decommissioning options include the following:

- Immediate dismantling soon after the facility closes (DECON).
- Safe storage and monitoring of the facility for a period of time that allows the radioactivity to decay, followed by dismantling and additional decontamination (SAFSTOR).
- Permanent entombment on the site in structurally sound material such as concrete that is maintained and monitored (ENTOMB).

All the decommissioning options must be completed within a 60-year period following permanent cessation of operations and permanent removal of fuel.

Under the no-action alternative, Dominion would continue operating SPS until the existing OLs expire. Upon expiration of the OLs, Dominion would initiate decommissioning procedures in accordance with NRC requirements. The NRC GEIS evaluated decommissioning environmental impacts for land use, visual resources, air quality, noise, geology and soils, hydrology, ecology, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management and pollution prevention. Dominion considers the GEIS description of decommissioning impacts as representing the actions it would perform for the SPS decommissioning. Therefore, Dominion relies on the NRC's conclusions regarding the environmental impacts of decommissioning SPS.

Decommissioning and its associated impacts are not considered evaluation criteria used to proceed with the proposed action or select the no-action alternative. SPS will have to be decommissioned eventually, regardless of the NRC decision on license renewal; license renewal will only postpone decommissioning for another 20 years. The GEIS states the timing of the decommissioning does not change the environmental impacts associated with this activity. The NRC findings as described in 10 CFR 51, Subpart A, Appendix B, Table B-1 state that delaying decommissioning until after the renewal term would result in SMALL environmental impacts. Dominion relies on the NRC's findings. The primary criteria used to evaluate the proposed action and the no-action alternative are the power options available for replacement of SPS generation.

Dominion concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those following license renewal as identified in the GEIS. Decommissioning impacts would be SMALL and could overlap with operation of an SPS replacement.

E7.2 ENERGY ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

In accordance with 10 CFR 51.53(c)(2), Dominion considered a range of alternatives to replace generation if the SPS OLs are not renewed. The alternatives considered for replacement power were developed based on the following:

- Dominion considered each of the replacement alternatives identified in the NRC GEIS for license renewal (NRC. 2013a, Section 2.3). These alternatives were evaluated based on their ability to provide reliable baseload power, as well as other criteria such as the ability to be operational prior to the expiration of the current SPS OLs.
- The 2018 Dominion IRP provided direction on potential replacement power sources that Dominion is considering over the planning period from 2019-2033 (Dominion. 2018). The no-action alternatives analysis favored the generation sources that Dominion selected in the IRP for current and future power sources in their service area.

The power sources considered for the replacement of 1,676 MWe of SPS generation included both discrete sources, such as natural gas-fired combined cycle (NGCC) and new nuclear, as well as a combination of NGCC, solar PV, and demand-side management (DSM). Alternatives unable to replace SPS baseload power were considered unreasonable.

The following subsections will identify the power sources considered as reasonable (Section E7.2.1), and power sources considered as unreasonable (Section E7.2.2).

E7.2.1 ENERGY ALTERNATIVES CONSIDERED AS REASONABLE

A reasonable alternative as described by the NRC must be technically feasible and commercially viable on a utility scale and operational prior to the expiration of the reactors' OLs, or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactors' OLs. The replacement power alternative generation must also equal the baseload capacity previously supplied by the nuclear plant. The alternatives analysis identified the following power sources as meeting the NRC criteria for reasonableness in the replacement of SPS generation during the proposed SLR operating term:

- An NGCC plant sited at the SPS site.
- A new ALWR nuclear facility, which would be the proposed Unit 3 at NAPS.
- A new SMR nuclear facility at the SPS site.
- Alternative consisting of an NGCC unit sited at SPS, a solar PV facility sited at an alternate site with existing transmission, and DSM.

E7.2.1.1 Natural Gas-Fired Generation

The NGCC plant option would be sited on approximately 66 acres of the existing SPS and GNCTS site. This plant would consist of multiple combustion turbines, heat recovery steam generator, and a steam turbine generator assembled in appropriate power-train configurations. Based on a capacity factor of 87% (EIA. 2016), the replacement NGCC plant would be designed to generate approximately 1,743 MWe to replace the current 1,676 MWe (summer rating) produced at SPS. Dominion assumes the NGCC plant would utilize closed-cycle cooling with a mechanical draft cooling tower. The source of the cooling water would be the James River. The existing intake and discharge structures would be used, with some modifications, for the proposed NGCC plant. Dominion also assumed that the existing SPS and GNCTS transmission line infrastructure is adequate for the NGCC replacement alternative. Columbia Gas and Transmission Corporation has three pipelines crossing the southeastern corner of the SPS site (SPS. 2016a). A 12-inch spur pipeline branches from one of these pipelines to transport natural gas to GNCTS. Dominion assumes that an additional spur natural gas pipeline would be installed from the existing branch serving GNCTS to service the NGCC plant.

E7.2.1.2 New Nuclear

The new nuclear alternative involves two reactor type options, an ALWR and an SMR. The ALWR option is the proposed Unit 3 at NAPS. Dominion submitted a COLA for the facility initially on November 27, 2007, and submitted its most recent revision in June 2016. Dominion received the COL for NAPS Unit 3 on June 2, 2017. Unit 3 would provide 1,605 MWe of generation when in operation. This nuclear unit would provide additional baseload power for residential and industrial customers in the region. Dominion has not identified a construction start or operational date for NAPS Unit 3 (Dominion. 2018). However, Dominion will continue to maintain the Unit 3 combined operating license to provide an option for future development of a carbon-free source of baseload generation.

The SMR option would be a cluster of SMR units comparable to SPS' generation capacity. The facility would be located at the SPS site. The SMR units are assumed to utilize closed-cycle cooling from mechanical draft cooling towers connected to the existing intake and discharge structures. The existing transmission infrastructure is assumed to be sufficient.

E7.2.1.3 Combination of Natural Gas-Fired Generation and Solar

This combination of NGCC, solar PV, and DSM is proposed in the IRP as potential generation options (Dominion. 2018). The NGCC plant would be sited at the existing SPS site, and would consist of multiple combustion turbines, heat recovery steam generator, and a steam turbine generator assembled in appropriate power-train configurations. The NGCC plant capacity would be 1,743 MWe operating at an 87% capacity factor (EIA. 2016).

The solar PV component would be one 20-MW facility based on a 26% capacity (EIA. 2016).The solar PV would consist of ground-mounted tracking solar arrays and the site would require approximately 280 acres based on 1.6 acres per GWh per year (NREL. 2013).

The DSM component of the combination alternative will consist of Dominion energy efficiency programs that provide the equivalent 20 MW of generation.

E7.2.2 ENERGY ALTERNATIVES NOT CONSIDERED REASONABLE

The full range of energy alternatives as described in the GEIS include power sources that will require development of new generation and power alternatives that will not require new generation, such as purchased power (NRC. 2013a, Section 2.3). Dominion considered all the alternatives described in the GEIS for replacement of the SPS generation. This section will address the energy alternatives that were not considered reasonable for additional evaluation.

E7.2.2.1 Alternatives Not Requiring New Generating Capacity

E7.2.2.1.1 Purchased Power

Purchased power to replace the loss of SPS generation would likely be acquired from sources within the Dominion service territory. The purchased power would be generated from fossil sources or intermittent renewables. Both sources would result in environmental impacts that occur in facilities currently generating power or at recently constructed facilities, such as coal-fired facilities in the region.

Fossil generation, renewable energy, or a mix of fossil and renewable generation would be potential sources of purchased power to replace SPS generation. Dominion's focus with regards to purchasing power is the acquisition of renewable sources, primarily in the form of solar non-utility generation (NUG). Reliance on solar NUGs will not meet Dominion generation requirements if the SPS OLs are not renewed. If the SPS OLs are not renewed, Dominion could be required to contract for fossil fuel generation through additional NUGs or purchase power from a whole sale power generator. The environmental impacts associated with purchasing power could be substantial and exceed the impacts associated with the continued operation of SPS.

Potential environmental impacts associated with purchased power would include those associated with the source of the generation and the transmission of the power into the Dominion service area. Fossil generation results in air emissions, water use and quality issues, and land use impacts associated with the plant footprint. Renewable energy generation, specifically solar and wind, have a large development footprint that can convert natural habitats to an industrial site. The conversion of forest and even agricultural lands to an industrial site can result in impacts to wildlife habitat that may adversely impact wildlife and plant species. Additional transmission capacity may be required to transport renewable or fossil generation into the region and this may result in impacts to

communities and lands within and adjacent to the corridor. These impacts could include loss of sensitive habitat, visual and view shed impairment, wetlands and stream crossings. Purchasing power from NUGs or power generators is not considered a reasonable no-action alternative because Dominion would need to substantially increase its purchased power. This could potentially reduce the available baseload power from facilities owned and managed by Dominion, introducing uncertainties in energy reliability outside of Dominion's control.

E7.2.2.1.2 Plant Reactivation or Extended Service Life

Dominion's IRP evaluated its existing fossil fuel generation plants and determined that coal-fired and oil-fired units with limited environmental controls were at risk of closure. The environmental compliance options available to these units include:

- Retrofit with additional environmental control reduction equipment;
- Repower (including co-fire); or
- Retire the unit.

The IRP identified 399 MWe of coal-fired generation to be potentially retired between 2019 and 2033 (Dominion. 2018). There is also the potential of an additional 1,445 MW coal-fired generation being retired as a result of future integrated resource planning. Delaying retirement of coal-fired generation would result in the continued use of generation that has higher air emissions and it does not meet the goals identified in the 2018 IRP to lower emissions in the Dominion energy generation portfolio (Dominion. 2018). Therefore, extended service life or reactivation of existing fossil fuel plants would not be an environmentally preferable alternative because it would not continue the reduction in air emissions that has resulted from the increased use of renewable energy and new natural gas-fired plants.

From 2000 to 2017, carbon emissions have been reduced by 35% in the Dominion generation portfolio (Dominion. 2018). The reactivation or extending the service life of older fossil-fuel plants could stall the continued decrease in air emissions that have occurred with Dominion's transition to renewable energy and natural gas generation. Therefore, plant reactivation and extended service life is not considered a reasonable alternative because of the environmental issues associated with continued use of older generation sources.

E7.2.2.1.3 Conservation or Demand-Side Management

DSM includes demand response that shifts electricity from a peak-use period to times of lower demand, and energy efficiency or conservation programs that reduce the amount of electricity required for existing activities and processes. A DSM alternative would be required to reduce the baseload demand in Dominion's service area by 1,676 MWe to be considered a reasonable alternative.

Dominion has approved DSM programs in its Virginia and North Carolina service areas. Dominion has approved DSM programs that will reduce baseload demand by 304 MWe by 2033 (Dominion. 2018). This reduction of baseload demand assumes SPS is providing generation during this period when DSM programs are being expanded in the Dominion service area.

The Dominion DSM program does not reduce baseload generation enough to cover the loss of SPS generation. In addition, with the potential loss of 1,844 MWe of coal-fired generation between 2019 through 2033, DSM will not be able to cover baseload demand without development of new generation facilities. Therefore, DSM is not considered a reasonable alternative by itself.

E7.2.2.2 Alternatives Requiring New Generation Capacity

E7.2.2.2.1 Wind (Included Energy Storage)

Onshore wind resources are limited in the eastern portion of the United States to select sites, such as mountain ridges in the Appalachian Mountains. Dominion has looked at onshore wind as a source of clean energy, and has identified three potential locations on mountain ridges in western Virginia. (Dominion. 2018) Development of these sites would result in the building of roads and turbine tower support pads that would require tree and vegetation clearing. Environmental impacts to avian and bat species, fragmentation of forests, and streams and wetland areas would occur from the construction and operation of a wind facility in the Appalachian Mountains. Other construction and operation impacts would be sediment and erosion from the construction of road and tower pads, noise associated with construction activities and from the turbine blades during the operation of the wind facility, impacts to visual resources, and some short-term air quality impacts during construction from dust and equipment operations. Impacts on avian and bat species, forest habitats, land use, and visual resources from the development of a utility-scale wind power facility on a mountain ridge in western Virginia could range from MODERATE to LARGE.

The Virginia offshore wind resource is considered promising for the potential development of a large-scale offshore wind facility because of the shallow continental shelf that extends up to 40 miles off the coast in addition to proximity to large port facilities and load centers (Dominion. 2018).Construction and operation of an offshore wind facility would cost substantially more compared to an onshore wind facility. Impacts associated with the construction and operation of an offshore wind facility would be focused on marine ecology, avian species, economic impacts to commercial fishing and recreational boating, and potential impacts to coastal wetlands and bays from transmission line development. Most of the impacts associated with offshore wind will occur during the construction phase, and would continue into operation with potential impacts to marine avian and aquatic species. Environmental impacts associated with the construction and operation of a large utility-scale offshore wind facility could range from MODERATE to LARGE.

For wind power to be viable as a discrete source of large amounts of energy that is reliably available at the system peak hours, energy storage would need to be considered in the planning process. The current energy storage technologies are costly, no utility-scale energy storage facilities currently exist in the Dominion service area, and development of new energy storage facilities would need to address additional environmental impacts. Therefore, energy storage is not considered in this ER as a technology that would make discrete wind energy facilities a reliable source of generation.

Because of the limited onshore wind resources in the eastern United States, potentially large environmental impacts associated with development of the facility, and the inability of wind power to provide baseload generation, wind power (with or without energy storage) is not considered a reasonable alternative to replace the baseload generation of SPS.

Nonetheless, even if wind were considered to be reasonable, the impacts discussed above show that the impacts from wind (with or without energy storage) would be higher than the impacts for renewal of the SPS OLs, summarized in Table E8.0-1, and therefore, wind (with or without energy storage) would not be superior to continued operation of SPS.

E7.2.2.2.2 Solar (Includes Energy Storage)

Solar PV and concentrated solar power (CSP) are the two main types of solar technology used in electric power generation. Solar PV systems consist of interconnected PV cells that convert sunlight into electricity. CSP systems utilize mirrors to reflect and concentrate sunlight onto receivers to convert solar energy into thermal energy that in turn produces electricity. Solar generation is intermittent by nature, and the generation can fluctuate from hour to hour. This type of generation volatility on a large scale can create distribution and/or transmission instability.

Due to the amount of solar generating capacity needed to replace the SPS baseload generation and the lower efficiencies in producing electricity from solar power versus nuclear power, the amount of land required to install solar generation is larger than other alternatives being considered in this ER. The National Renewable Energy Laboratory (NREL) has estimated that current land use required for PV installations ranges from 1.6 to 5.8 acres/gigawatt hours per year (GWh/yr), with a generation-weighted average of 3.1 acres/GWh/yr. CSP installations are estimated to average 2.7 acres/GWh/yr. (NREL. 2013) Therefore, depending on the location of the solar facilities, the land use disturbances could result in moderate to large impacts on resources such as wildlife habitats, vegetation, land use, and aesthetics impacts.

For solar power to be viable as a discrete source of large amounts of energy that is reliably available at the system peak hours, energy storage would need to be considered in the planning process. The current energy storage technologies are costly, no utility-scale energy storage facilities currently exist in the Dominion service area, and development of new energy storage facilities would need to address additional environmental impacts. Therefore, energy storage is not

considered in this ER as a technology that would make discrete solar energy facilities a reliable source of generation.

Because a discrete solar generation alternative is not a source of large amounts of energy that is reliably available at the system peak hours, and because of the potential environmental impacts associated with the large land disturbances for this scale of solar power installation, this alternative, by itself or with energy storage, is not considered a reasonable alternative to replace the baseload generation of SPS.

Nonetheless, even if solar were considered to be reasonable, the impacts discussed above show that the impacts from solar (with or without energy storage) would be higher than the impacts for renewal of the SPS OLs, summarized in Table E8.0-1, and therefore, solar (with or without energy storage) would not be superior to continued operation of SPS.

E7.2.2.2.3 Hydropower

Currently, Dominion generates 318 MWe of hydroelectric power at four facilities. Dominion considers the construction of new large-scale hydroelectric facilities unlikely to occur because of environmental siting and regulatory restrictions in its service area (Dominion. 2018). The IRP states that while small-scale hydropower plants are feasible, they do not produce enough generation to be considered in the long-term planning from 2019-2033. The lack of potential for large hydroelectric power facilities and the environmental constraints associated with the development of a new hydropower facility make hydropower an unreasonable alternative to replace the SPS generation.

Construction of a new large-scale hydropower facility would require considerable siting considerations, such as the area that would be inundated to provide water storage for generation, as well as the overall environmental impacts associated with the development of the facility. The environmental impacts would be large for land use, water resources, socioeconomics, ecology, and cultural resources. As Dominion concludes in the IRP, the environmental constraints associated with hydropower are large, and this source of power is not being considered for development in the IRP planning period from 2019-2033. (Dominion. 2018)

Dominion is currently assessing sites in southwestern Virginia for pumped storage and considering the use of an abandoned coal mine as a pumped hydro plant. Dominion anticipates running the facility only during times of peak demand, usually during the summer and winter months. (Utility Dive. 2017) Because the facility would only run during times of peak demand, pumped storage hydropower would not be considered a reliable replacement source of SPS's large baseload generation.

Because the environmental impacts and constraints prevent development of hydropower in the Dominion service area, this power source is not considered a reasonable alternative.

E7.2.2.2.4 Geothermal

The National Renewable Energy Laboratory has not identified any viable sites for geothermal energy in the eastern United States (NREL. 2013). Therefore, geothermal energy is not considered a reasonable power source in the Dominion service area.

E7.2.2.2.5 Biomass

Biomass includes wood waste, municipal waste, manure, certain crops, and other types of waste residues used to create electricity. Dominion currently generates 153 MWe of baseload biomass electricity (Dominion. 2018). Most of the fuel used in this generation is wood waste. Wood-waste plants require a large land area for storage and processing, and, like coal generation, they produce ash that must be disposed of in a manner that does not pollute waterways and air. Therefore, environmental impacts associated with construction of a wood-waste plant would be MODERATE to LARGE, with the impact intensity level being dependent on the siting and proximity to a source of wood waste.

Biomass plants tend to be much smaller than nuclear or fossil fuel plants. To replace the SPS baseload generation, it would take the construction of several biomass plants located near reliable fuel sources that continuously produce enough biomass to fuel the plants.

Utilizing municipal solid waste for electricity is also dependent on being close to large population centers that generate large amounts of waste. The largest municipal waste plant in the United States produces 224 MWe of baseload generation (ERC. 2016). Therefore, as is the case with wood waste, it would take more than 16 of these facilities to match the current baseload generation of SPS. Air emissions are also an issue with municipal waste plants, and construction of a plant would require installation of maximum achievable control technology to comply with the CAA.

Overall, the construction and operation of a biomass plant of the size necessary to act as an alternative to SPS would result in MODERATE environmental impacts to land use, water quality, ecological resources, and air quality.

Generating baseload generation from biomass sources is limited because of the need to site facilities near substantial fuel sources and impacts to land from constructing and operating the facility. In addition, biomass plants are unable to produce the large baseloads of electricity that nuclear and fossil fuel plants generate, without the construction of multiple smaller facilities. Therefore, biomass is not considered a reasonable alternative to SPS's baseload generation.

E7.2.2.2.6 Fuel Cells

Fuel cells as a reliable generation alternative are not presently economically or technologically competitive with other alternatives. The EIA projects that fuel cells may cost $6,932 per installed kW (total overnight capital costs), which is higher than most generation technologies analyzed in this

ER (EIA. 2017). This high cost is associated with the durability of fuel cells and the technology to convert natural gas to hydrogen.

E7.2.2.2.7 Ocean Wave and Current Energy

A 2011 EPRI study estimated the potential for ocean energy each year in Virginia at 7 terrawatt hours (TWH) along the outer shelf and 5 TWH along the inner shelf (EPRI. 2011). The technology to harness ocean energy is in its early stages of development and would not be able to replace the SPS generation in a time frame needed comparable to SLR. In addition, the potential for ocean energy on the Virginia inner and outer shelves is marginal (EPRI. 2011). Only one pilot wave energy project is currently operating in the U.S. and the environmental impacts associated with these facilities has not yet been studied in any detail in the U.S. With very minimal information available regarding the implementation of this technology in the U.S., this alternative is not considered a reasonable alternative for replacement of the SPS generation. Therefore, ocean wave and current energy is not considered a reasonable alternative in the necessary time frame for power supply.

E7.2.2.2.8 Oil

Oil-fired generation does not fit into the Dominion policy to replace fuel sources with higher carbon emissions with generation that has a lower carbon footprint (Dominion. 2018). In the IRP, Dominion has committed to developing cleaner energy sources and for the 15-year planning period in the IRP has not proposed new oil generation. Oil-fired generation emits large amounts of carbon dioxide and hazardous air pollutants, making it undesirable for utilities looking to reduce air pollutants and comply with regulations.

Based on the greater environmental impacts and cleaner energy source policies and regulations, oil-fired generation is not a reasonable alternative.

E7.2.2.2.9 Coal

As presented in Section E7.2.2.1.2, Dominion proposes to possibly retire 399 MWe of existing coal-fired generation between 2019-2033. There is also the potential of an additional 1,445 MW coal-fired generation being retired as a result of future integrated resource planning. Dominion's program to reduce coal-fired baseload generation in its service area is based primarily on reducing carbon emissions and complying with probable carbon regulations. Because the IRP has identified the retirement of coal-fired generation, and no new coal-fired generation is proposed in the IRP, this source of generation is not considered a reasonable alternative.

E7.2.2.2.10 Coal-Fired Integrated Gasification Combined Cycle

Coal-fired IGCC is a gasification process that produces synthetic natural gas from coal to use as a fuel in the combined cycle process. In this process, heat pressure and steam pyrolyze coal to produce syngas. The syngas is processed to remove contaminants, and then used in a combustion turbine plant to produce electricity. Carbon dioxide can be removed from the syngas prior to its use as fuel in the plant. IGCC plants would remove a larger quantity of criteria air pollutants than coal units. However, emissions of criteria pollutants would be slightly higher than gas-fired plants (Argonne National Laboratory. 2013).

IGCC technologies may be increasingly employed in the future as carbon capture and sequestration (CCS) is developed to remove carbon dioxide from fossil fuel use. Since carbon dioxide is removed from the syngas before it is used as fuel, CCS technology would be more economical to employ with IGCC than with standard coal-fired generation where the carbon would be removed after combustion.

Currently, IGCC technologies have been installed on a very limited scale. The technology has had some operational problems, and it has not yet proven itself capable of providing reliable baseload power. Therefore, IGCC is not considered a reasonable alternative.

E7.2.3 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

The alternatives considered as reasonable replacement power sources are presented in this section. Three alternatives able to provide an approximate equivalent of 1,676 MWe of baseload generation to replace SPS's power are considered reasonable alternatives. This section presents the potential environmental impacts that may occur if these alternatives were developed.

E7.2.3.1 Natural Gas-Fired Generation

As identified in Section E7.2.1, an NGCC plant is considered a reasonable power alternative. This plant would consist of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator. Based on a capacity factor of 87% (EIA. 2016), the NGCC plant would be designed to produce 1,710 MWe of generation to provide the equivalent of SPS's 1,676 MWe (summer rating).

E7.2.3.1.1 Land Use

The NGCC plant would be sited on approximately 66 acres, based on a land use factor rate of 0.02 square meters per megawatt hour (NETL 2010a). The NGCC plant would be located entirely within the SPS property on forested land that has not been previously disturbed. Therefore, Dominion currently owns the land that will be used for the plant site. The NGCC site location on the western half of the SPS property is adjacent to the Hog Island WMA and forested, which would require clearing.

It is assumed that the NGCC plant natural gas spur pipeline would be installed in the existing pipeline corridor that supplies gas to GNCTS. This option for installing the pipeline would require less vegetation and soil disturbance. However, if a new pipeline corridor is required, it would require more vegetation removal, which would change the land use within the pipeline footprint. After installation of the pipeline, the corridor would be reclaimed with native vegetation. Therefore, the impact to land use from installation of the pipeline would be SMALL.

Because the NGCC plant alternative would be built at the SPS site and would require forest clearing, construction-related impacts on land use under the NGCC plant alternative are assumed to be MODERATE.

In addition to onsite land requirements, offsite land is typically required for natural gas wells and collection stations during operations. However, no new gas wells are assumed to be needed, because there is currently an abundant supply of natural gas in the United States with distribution in the northeast via four interstate pipelines. A large gas transmission pipeline, the Atlantic Coast Pipeline, could increase the availability of natural gas used by utilities for power plants in the future. Currently, a date when this natural gas would be available via this pipeline has not been determined (Dominion. 2018). This pipeline will increase the availability of natural gas used by utilities for power plants. Therefore, Dominion assumes the current and proposed regional natural gas supply will be sufficient for the operation of the NGCC plant at SPS.

No operations-related impacts to land use will occur under the NGCC plant alternative.

Because the existing SPS facility is an industrial site, the construction and operation of the NGCC plant would not change land use in the surrounding area. Overall, the land use impacts associated with the operation of an NGCC plant would be SMALL. Construction-related impacts to land use would be MODERATE.

E7.2.3.1.2 Visual Resources

During the construction phase of the project, the NGCC plant site would be cleared of trees and other vegetation. This portion of the SPS site is currently undeveloped and this clearing would make the other facilities present at the complex more visible from offsite locations. Because the site currently has two existing power plants, the ongoing construction activity associated with the NGCC plant would be similar in scope to the existing industrial character of the site. Therefore, construction visibility impacts under the NGCC plant alternative would be SMALL.

During operations, the tallest structures at an NGCC plant alternative would be the mechanical draft cooling towers and exhaust stacks. The facility would be visible, but not out of context with the developed site and the existing SPS and GNCTS facilities. The additional clearing of trees will make the overall property more visible during the daylight hours. Overall, the addition of an NGCC plant will not significantly alter the viewshed at the SPS and GNCTS complex. Visibility-related impacts associated with the operation of an NGCC plant would be SMALL.

E7.2.3.1.3 Air Quality

Air quality impacts associated with the construction of an NGCC plant alternative would result in the release of various criteria pollutants such as CO, nitrogen oxides (NO_x), sulfur oxides (SO_x), particulate matter (PM), and volatile organic compounds (VOCs). These criteria pollutants would be released from the use of construction vehicles and equipment. VOC releases would also result from the onsite storage and dispensing of vehicle and equipment fuels. Some GHGs would also be emitted from the use of construction equipment and vehicles during the construction of the plant. Onsite activities such as clearing and grubbing would generate fugitive dust. The air impacts associated with the construction of the NGCC plant alternative would be short-term, as gas-fired power plants are generally constructed rather quickly. The air impacts during construction would be minimized by the implementation of a fugitive dust control plan and adherence to mitigation practices such as limiting the idling of vehicles and construction equipment. It is asserted that construction-related impacts on air quality under the NGCC plant alternative would be SMALL.

The operational NGCC plant would be equipped with air pollution controls to ensure compliance with air quality regulations. The facility would consume approximately 125 billion cubic feet of natural gas annually. Emission estimates for the NGCC, based on EPA emission factors, are shown in Table E7.2-1.

The NGCC plant would qualify as a new major source of criteria pollutants and would be subject to the CAA prevention of significant deterioration (PSD) of air quality review. Therefore, the plant would have to comply with the new source performance standard for NGCC plants set forth in 40 CFR 60 Subpart KKKK and 40 CFR 60 Subpart TTTT. The plant would also qualify as a major source because its potential to emit is greater than 100 tons per year of criteria pollutants.

The NGCC plant would be subject to the national emission standards for hazardous air pollutants (HAPs) for stationary combustion turbines if the plant was a major source of HAPs (having the potential to emit 10 tons per year or more of any single HAP or 25 tons per year or more of any combination of HAPs) [40 CFR 63.6085(b)].

A new NGCC plant would also have to comply with Title IV of the CAA [42 USC 7651] reduction requirements for SO_2 and NOx, which are the main precursors of acid rain and the major causes of reduced visibility.

A new NGCC plant would be a major source of criteria pollutants and GHGs. Compliance with existing air quality regulations would ensure air quality impacts are minimized. Therefore, the operations-related impacts on air quality under the NGCC plant alternative would be MODERATE.

E7.2.3.1.4 Noise

Construction-related noise impacts would include the operation of vehicles, earthmoving equipment, and other equipment such as generators and compressors used in the construction of the facility. The NGCC plant alternative would be located on the existing SPS property, which is an isolated rural location with limited noise receptors. Construction noise impacts would be minimal and SMALL.

Noise impacts associated with plant operations would include noise from cooling towers, transformers, turbines, pumps, compressors, exhaust stack, combustion inlet filter house, condenser fans, and high-pressure steam piping. Dominion does not expect noise impacts from the operation of the NGCC plant to be greater than those associated with SPS. Operations-related noise impacts associated with the NGCC plant alternative would be SMALL.

E7.2.3.1.5 Geology and Soils

Construction-related impacts to geology would be minimal as the excavation associated with plant installation should not damage geologic formations at the site. In addition, materials such as stone and gravel used in the construction of the plant and associated infrastructure would be obtained from regional sources. Commercial stone and gravel sources typically sell material obtained from local quarries and sources. No non-native stone or gravel would be introduced to the site. Construction-related impacts to geology would be SMALL.

Construction-related impacts to soil would occur during land clearing and the construction of the plant. In addition, construction of a new natural gas pipeline to connect to one of the two pipelines crossing the site would disturb soil temporarily until installation of the pipeline is complete. The exposure of these soils during clearing and grubbing will increase the risk of erosion from precipitation events. Soils excavated and removed during clearing and construction would be stockpiled onsite for use as backfill after construction is completed. Because the ground

disturbance would exceed one acre, Dominion would obtain a stormwater construction general permit (SWCGP) from the VDEQ. This is a general permit for construction activities that would require the implementation of BMPs to minimize erosion and sediment loss resulting from precipitation. Overall, with the installation and implementation of BMPs, construction-related impacts to soils would be SMALL.

Land disturbance activities initiated during the operation of the NGCC plant would comply with applicable VDEQ regulations for stormwater permitting. SPS's SWPPP would be modified to address the NGCC plant, identifying proper BMPs to minimize sediment releases. Soil impacts related to the operation of the plant would be SMALL.

No geological impacts are expected during the operation of the plant.

E7.2.3.1.6 Hydrology (Surface Water and Groundwater)

The construction-related impacts to surface water include those related to construction of the plant and infrastructure that would alter surface drainage features. An additional approximately 66 acres of land would be deforested at the SPS site, and this could alter features that convey runoff from the site. These impacts would be minimized by the implementation of BMPs as identified in the SWCGP SWPPP. Adherence to the BMPs would also minimize stormwater runoff from the construction site, which would minimize sediment releases and provide protection to the James River and wetlands from accidental releases of oils or other chemicals being used during the construction of the facility.

Dominion assumes the existing SPS intake and discharge structures will be used, with some modifications, for the NGCC plant alternative. Currently, Dominion has 28 outfalls at SPS. These structures are permitted with a single VPDES permit. A new VPDES permit or modifications to the existing permit would need to be obtained for the NGCC plant discharge.

Overall, the NGCC plant construction-related impacts on surface water and water quality would be SMALL.

A new natural gas pipeline that connects to the Gravel Neck branch of the Columbia Gas Transmission Corporation pipelines would be required for the NGCC plant alternative. This spur pipeline would be a short segment that could cross streams or wetlands on the SPS site. If this pipeline crosses wetlands or streams, the impacts associated with these stream crossings are temporary and any impacts would be small. Typically, stream, river, and wetland impacts would be eliminated or minimized by installing the pipeline under these features via horizontal directional drilling. If permitting is required for the installation of the pipeline, it would be a USACE Section 404 permit. This permit would identify BMPs and other mitigation to minimize impacts to waterways and wetlands. Impacts associated with the construction and installation of a new natural gas pipeline would be SMALL.

Operating the NGCC plant would require water to be obtained from the James River for use in the mechanical draft cooling towers. This use of the James River water will not impact flows in the river. The cooling water treatment additives and discharge would be similar to those used by SPS, but the discharge volume from the NGCC plant would be less than the SPS discharge volume.

Maintenance dredging may be required in the James River intake channel to ensure the operation of an NGCC plant. Dredging to support SPS operations was conducted in 2017, within the existing intake channel in the James River. This dredging was completed under USACE and Virginia Marine Resources Commission permits. Additional dredging will be required in the future as part of ongoing maintenance of the channel, which currently occurs within the permitted five-year periods, based on need. These permits have conditions mandating the dredging be completed at times of the year that do not impact anadromous fish species.

Operations-related surface water impacts under the NGCC plant alternative would be SMALL.

E7.2.3.1.6.1 Groundwater

Dominion assumes water used for construction purposes such as dust suppression, equipment washing, sanitary systems, and potable water would be trucked in by the construction contractor. Excavations for facility foundations may intrude into groundwater zones and dewatering may be required. Surry County is in the Eastern Virginia Groundwater Management Area, which requires groundwater depletion permitting (9 VAC 25-610-10) if the amount extracted is 300,000 or more gallons a month. Dewatering activities associated with construction are not expected to exceed the 300,000 gallons per month that would require a permit from the VDEQ. Construction-related impacts to groundwater could also occur from spills which are not properly mitigated and thereby transport contaminants through the soil to the groundwater, and runoff that has contaminants generated from construction activities. These types of impacts associated with construction would be mitigated with adherence to the SWPPP. Therefore, construction-related impacts on groundwater use and quality under the NGCC plant alternative would be SMALL.

Operations-related impacts under the NGCC plant alternative would be mitigated through BMPs that collect stormwater and runoff from the industrial site. In addition, waste management and spill mitigation would minimize the spread of contaminants through soil to groundwater. Therefore, operations-related impacts on groundwater use and quality under the NGCC plant alternative would be SMALL.

E7.2.3.1.7 Ecological Resources (Terrestrial and Aquatic)

Terrestrial ecology impacts resulting from the construction of the NGCC plant would primarily result from the approximately 66 acres of forest clearing at the SPS site. The area proposed for construction is currently vegetated with trees and herbaceous plant species. This forested area acts as a buffer from the industrial character of the site, with both SPS and GNCTS co-located within the Dominion property. Therefore, impacts to wildlife using this forested portion of the site would occur during the construction of an NGCC plant. In addition, a branch from the natural gas pipeline serving GNCTS would be installed to provide gas to the NGCC plant. This pipeline corridor would be short and could result in clearing of trees and other vegetation. Following installation of the pipeline, the corridor would be revegetated with native grasses and forbs. Therefore, the pipeline's impact on terrestrial ecological resources would be SMALL.

With the clearing of the approximately 66 acres of forest for the NGCC plant, the remaining adjacent forested area would be much smaller, and the other forested areas on the site are on the periphery of the nuclear units. Wildlife using the NGCC site would disperse to these adjoining habitats during the construction activities or to the adjacent Hog Island WMA. In addition, wildlife using connected habitat may disperse because of the noise associated with construction activities. After completion of the NGCC plant, undeveloped land would be revegetated with native and non-native plant species. The revegetation plan would ensure sediment and precipitation runoff are minimized via implementation of BMPs. Because the installation of the NGCC plant would result in the loss of approximately 66 acres of forested habitat, the NGCC plant construction impacts would be SMALL to MODERATE.

Operational impacts on terrestrial resources would be similar to those occurring with the operation of the SPS plant. Air emissions associated with the plant may cause some impact to plants adjacent to the facility. However, this impact is expected to be SMALL. In addition, the cooling towers could result in some avian collisions. However, after installation of the cooling towers, avian species would likely avoid flying near the towers. Overall, the operation of the NGCC plant would result in SMALL impacts to terrestrial resources.

E7.2.3.1.7.1 Aquatic

Impacts on aquatic ecological resources during construction would be minimal because surface water discharges would be minimized through the implementation of BMPs. The BMPs would also eliminate or minimize potential spills and releases associated with the construction of the plant. Installation of the pipeline could require a USACE Section 404 permit depending on the location and the need to cross any wetlands. The permit would identify proper mitigation techniques for installation of the pipeline at aquatic crossings. Therefore, construction-related impacts on aquatic ecological resources under the NGCC plant alternative are anticipated to be SMALL.

During operations, the NGCC plant alternative would require less cooling water to be withdrawn from the James River than is required for once-through nuclear power plants (NETL. 2010a). Because of the withdrawal of James River water, fish and other aquatic life could be impacted by intake and discharge operations, such as entrainment, impingement, and thermal stress. The NGCC plant cooling system would have similar chemical discharges as SPS. The NGCC plant cooling system discharge would be regulated by the VPDES permit required for the structure(s). Overall, operations-related impacts on aquatic ecological resources under the NGCC plant alternative are anticipated to be SMALL.

E7.2.3.1.7.2 Special Status Species

Special status species addressed in this section include federally and state-listed species. Section 7 could be triggered if a USACE Section 404 permit is required for outlet modifications or some other infrastructure that would be placed in "waters of the U.S." In this scenario, the USACE would be the lead federal agency responsible for the Section 7 consultation with the USFWS. Pipeline construction activities could require a USACE Section 404 permit. In the case of pipeline construction, the USACE would be the agency responsible for the Section 7 consultation. If the construction of the plant or the pipeline do not trigger a federal permit, federally listed species would still be protected under the ESA.

State-listed threatened and endangered species are designated by the VDGIF, although the designation does not provide regulatory protection for the species. These species are addressed in Section E3.7.8.

A total of 13 federally listed species occur in Surry County. Of those species, the most likely to occur in the vicinity of the NGCC plant is the endangered Atlantic sturgeon, which is known to utilize the James River near SPS. Activities such as dredging in the James River are not allowed at certain times of the year to protect Atlantic sturgeon spawning. Adherence to CWA regulations and the permit conditions for activities such outfall modifications would eliminate or minimize impacts to the Atlantic sturgeon. No other federally listed species have been identified as occurring within the NGCC plant site. Therefore, impacts to federally listed species from construction of the NGCC plant alternative would be SMALL.

The spur pipeline required for the NGCC plant would not likely result in impacts to special status species because no federally listed terrestrial species have been identified as occurring on the SPS site. Therefore, impacts to federally listed species from construction of the natural gas pipeline would be SMALL.

State-listed species such as canebrake rattlesnake may be found in forested areas that would be cleared for the NGCC plant site and potentially on the proposed spur pipeline corridor. These state-listed species would likely disperse to adjacent habitat during construction activities. Therefore, impacts to state-listed species from construction of the NGCC plant alternative and

associated pipeline installation would be SMALL. Section E3.7.8.1.7 also discusses the state listed species that given habitat requirements and occurrence in the vicinity could occur on the SPS site. These species include four bird species that due to mobility would be able to move away from the construction site and thus any impact from clearing, construction noise and dust would be minimized. Other state listed species include three bat species. The SMR alternative would involve clearing of forested areas, so forested areas would need to be surveyed for the roosting and nursery locations, so areas can be avoided and/or mitigation measures, if needed, can be implemented.

Operations of the NGCC plant would likely not impact federally or state-listed species because, with the exception of the Atlantic sturgeon, these species would not occur within the site. For the reasons discussed in Section E3.7.8.1.7, the Atlantic sturgeon is not likely to be affected by NGCC plant operations. Impacts to aquatic species from maintenance activities such as dredging would be mitigated from adherence to seasonal restrictions that prevent activities during spawning periods for fish. Avian species such as bald eagles would also be protected from activities that would disturb birds during the nesting season. Therefore, impacts to federal and state-listed species from NGCC plant operations would be SMALL.

E7.2.3.1.8 Historic and Cultural Resources

The proposed NGCC plant would be sited within the existing SPS property. Only one cultural resource has been recorded on the property, the Lawnes Creek Church site, which is located on the western portion of the SPS property. NGCC plant construction activities would avoid this site. The proposed location of the NGCC plant would also require a pedestrian cultural resource survey prior to clearing to determine if historic or archaeological sites are present. In addition, if a USACE Section 404 permit is required for the project (including NGCC plant and pipeline), potential NHPA Section 106 consultation with the VDHR would be required if cultural resources are impacted by the proposed activities.

Operations of the NGCC plant would not result in impacts to cultural resources. The cultural resources survey conducted before construction would identify any sites and they would be avoided during NGCC plant operations.

Because cultural resources, both historic and archaeological, would be avoided or protected during the NGCC plant construction and operations, impacts would be NO ADVERSE EFFECT.

E7.2.3.1.9 Socioeconomics

The jobs created to complete the construction of the NGCC plant and natural gas connection pipeline would be temporary. It is expected some of the workers associated with the construction activity may relocate to the area during the construction of these facilities. However, most of these workers would return to their permanent places of residence at the completion of the construction.

Therefore, any boost to the local economies would be short-term, and socioeconomic impacts related to the construction of the plant would be SMALL.

The number of workers required to operate the NGCC plant would be similar to those currently employed at SPS (NRC. 2013a, Section 4.8.2.1). Workers employed at the NGCC plant would continue to live in Surry and Isle of Wight counties. They would contribute to the local economies via housing, living expenses, taxes, and other revenue contributions. Jobs associated with the operation of the NGCC plant would be permanent and would contribute long-term socioeconomic impacts.

This long-term reduction in jobs at SPS, along with the short-term NGCC plant construction job boost, may minimize the impacts to local socioeconomic conditions from the closing of SPS. Because SPS is a large employer in the county and region, it is expected that a loss of tax revenue for the counties and towns would occur from the closing of SPS and the lower level of employment at a NGCC plant. Therefore, the socioeconomic impacts resulting from the operation of an NGCC plant would be MODERATE and beneficial; however, the socioeconomic impact would be less than that of SPS as fewer workers would be employed at the NGCC plant versus at SPS.

E7.2.3.1.9.3 Transportation

Construction of the NGCC plant would increase vehicle traffic on the two-lane roads accessing the SPS property. The principal road access to SPS is SR 650. Some of the equipment for use in construction may be shipped by barge, but it is expected to be primarily transported via the existing road system. This increased traffic on the two-lane road system would translate into slower speeds and the possible staggering of material shipments to reduce potential congestion. The increase in traffic would be short-term and noticeable, and could exceed local roadway capacity during peak times given that existing units would remain operational during construction. Mitigation measures such as staggering shifts would be used as needed. Therefore, construction traffic impacts would be MODERATE.

Traffic impacts associated with the operation of the NGCC plant will be minimal. Some increase in road use may occur as SPS is decommissioned and NGCC plant operation is initiated. Overall, because the operations of the NGCC plant would require fewer workers, operations-related transportation impacts under the NGCC plant alternative would be SMALL.

E7.2.3.1.10 Human Health

Human health impacts associated with the construction of the NGCC plant alternative and natural gas pipeline connection would be primarily related to potential accidents and injuries resulting from accidents. Worker safety would be addressed by adherence to OSHA worker protection and other initiatives such as contractor safety meetings. The radiological human health impact on construction workers due to working in proximity to SPS would be SMALL due to compliance with

NRC regulations and adherence to ALARA principals. Construction activities should not have any impact on local residents because the impacts would primarily be restricted to the SPS property. Therefore, construction-related impacts on human health under the NGCC plant alternative would be SMALL.

Operations-related impacts resulting from the operation of the NGCC plant would primarily be from air pollutant emissions. The NGCC plant would emit criteria air pollutants (Table E7.2-1). Some pollutants, such as NOx, contribute to ozone formation that can potentially create health problems. These criteria pollutants are regulated and technology will be installed in the plant to limit the criteria air pollutant releases. Therefore, human health impacts from NGCC plant air pollutant emissions would be SMALL. Plant operation human health impacts would also be avoided and minimized from adherence to safety standards. Overall, the operations-related impacts on human health under the NGCC plant alternative would be SMALL.

E7.2.3.1.11 Environmental Justice

Section E3.11 presents the minority and low-income population in the region surrounding the SPS site. There are seven block groups within a six-mile radius of the SPS site that meet the criteria for a minority population. Figure E3.11-6 shows the location of the low income and minority populations in the vicinity the site who could be temporarily impacted by deliveries of materials and equipment to the site for construction of the NGCC. The closest low-income block group that meets the environmental justice guidance criteria for individual or families is Block Group 511818601002, which is located approximately 4.9 miles west-northwest of the SPS center point across the James River.

Potential impacts from construction of an NGCC plant would primarily be associated with socioeconomic effects. These impacts would consist of the short-term increase in worker expenditures at local businesses and potential rental housing shortages during the construction phase of the project. The increase in traffic on roads would likely result in no disproportionately high and adverse effects to local low-income and minority communities. Overall, environmental impacts would be minor and would not result in disproportionately high and adverse effects to low income and minority communities. Environmental impacts would be minor and likely would result in no impacts to minority and low-income populations. Overall, the construction impacts to low-income and minority populations under the NGCC plant alternative would be SMALL.

No disproportionately high and adverse impacts to minority or low-income populations are expected to occur for operations of the NGCC plant alternative because the activities associated with operating plant would be similar to those occurring at SPS with the exception of air emissions which would be subject to permit and regulatory restrictions.

E7.2.3.1.12 Waste Management

The construction of an NGCC plant would create sanitary and industrial wastes. These wastes will be properly managed onsite and disposed at an approved offsite treatment or disposal facility. Overall, waste impacts resulting from construction of an NGCC plant would be SMALL.

Operation of the NGCC plant alternative would result in different waste streams being created from spent catalytic reduction catalysts used to control nitrous oxide emissions. This waste stream is considered hazardous and would be disposed of at facility that handles hazardous materials. Other waste generated at the site would be characterized as hazardous or non-hazardous. These wastes would be properly managed and disposed of in a permitted offsite facility. Recycling and waste minimization programs would also be implemented to minimize waste streams at the plant. Therefore, waste management impacts expected during operation of the NGCC plant would be SMALL.

E7.2.3.2 New Nuclear Generation

As described in Section E7.2.1.2, the new nuclear alternative includes an ALWR option and an SMR option. The environmental impacts of each are described below.

E7.2.3.2.1 Advanced Light Water Reactor Option

The ALWR option is the proposed NAPS Unit 3. This proposed facility would generate 1,605 MWe of electricity. The NRC issued the COL for North Anna 3 on May 31, 2017. The resource and issues data and analyses presented in this section are summarized from the *Supplemental Environmental Impact Statement for the Combined License (COL) for the North Anna Power Station 3* (NRC. 2010) and the *North Anna Combined License Application Part 3i Applicant Environmental Report* (Dominion. 2016j).

E7.2.3.2.1.1 Land Use

The new nuclear unit would be constructed within the NAPS site boundary (Dominion. 2016j).

Unit 3 would occupy approximately 133 acres of the existing 1,043-acre NAPS site as described in the ESP application. The proposed Unit 3 is being sited at an existing industrial site that will require no new expansion outside the existing NAPS site. The land use impacts resulting from the NAPS Unit 3 were determined to be SMALL in NRC's FEIS for the plant's ESP (NRC. 2006). In the COLA, Dominion determined that a new Unit 3 transmission line would be installed within an existing transmission line corridor, resulting in no new land use, and that offsite modifications would be required for Unit 3 to support the transport of the reactor pressure vessel and other large components to the site. Dominion determined the land use and other impacts associated with transport of large components to the NAPS site would be SMALL (Dominion. 2016j).

Some offsite land-use impacts could occur from the road improvements needed for transportation of materials to NAPS. These impacts are anticipated to be beneficial for the roads. Therefore, land-use impacts associated with the operation of Unit 3 would be SMALL.

The new transmission line required for the operation of Unit 3 would be installed within an existing transmission line corridor that would require no widening. Therefore, the land-use impacts associated with the installation of the transmission line would be SMALL.

E7.2.3.2.1.2 Visual Resources

Because the existing NAPS site is already industrialized, the construction of Unit 3 would not change the context of the site. Some temporary modifications to existing rail and road transportation routes are planned, and these temporary changes would alter the visual character of the landscape near the site. After transportation of infrastructure to the site is complete, the modifications would be removed (Dominion. 2016j). Therefore, impacts to visual resources during the construction of Unit 3 would be SMALL.

The visual impact study indicates that the impact to the public from Unit 3 would be similar to the visual impact from the existing units, and therefore operations-related impacts on visual resources under the Unit 3 nuclear plant alternative would be SMALL (Dominion. 2016j, Table 10.4-2).

E7.2.3.2.1.3 Air Quality

Construction of the NAPS Unit 3 nuclear alternative would result in temporary impacts to air quality. These impacts would be primarily from fugitive dust generated from clearing and grubbing. In addition, emissions from equipment and vehicles would contain air pollutants such as CO, NO_x, SO_x, PM, VOCs, and GHGs. These vehicle and equipment air emissions would be intermittent and variable depending on the level of activity. Fugitive dust emissions would be mitigated via use of watering to reduce dust. Other mitigation could include carpooling to reduce the number of vehicles transporting workers to the site. Overall, air emissions from construction activities would be temporary and limited in duration. Therefore, construction-related impacts on air quality under the Unit 3 nuclear alternative would be SMALL.

Air emissions during the Unit 3 operations phase would be considered a minor source of air emissions, subject to conditions outlined in the VDEQ air permit. Particulate emissions from the cooling towers would also be subject to the VDEQ permit conditions. The NRC evaluated the impacts from cooling tower particulate emissions in the GEIS and considered these impacts to be SMALL (NRC. 2013a, Table 2.1.1). Therefore, the impacts of Unit 3 operations on air quality would be SMALL.

GHG emissions associated with nuclear power are lower than fossil-fuel based energy sources. Nuclear power lifecycle GHG emissions are within the same order of magnitude as renewable energy sources (NRC. 2013a, Section 4.12.3). The new nuclear alternative would create greatly reduced GHG emissions compared to emissions from a fossil-fuel plant. Therefore, new nuclear results in a beneficial air quality impact.

E7.2.3.2.1.4 Noise

Sources of noise during construction would include heavy equipment, compressors, hydraulic equipment, dump trucks, and other construction equipment. These noise sources would be intermittent and last for the duration of the construction activities. Construction noise is estimated to 60-80 dBA at 400 feet from the Unit 3 construction site. Because this is an existing industrial facility and noise is expected to be intermittent, construction-related noise impacts for Unit 3 were determined to be SMALL. (Dominion. 2016j)

Noise associated with the operation of Unit 3 would result from sources such as cooling towers, motors, generators, and heavy trucks. Most of the anticipated operations-related noise would be associated with the cooling towers. Noise levels from the cooling towers are expected to be less than 65 dBA at the EAB. Unit 3 noise levels would be similar to those associated with the existing NAPS operations. Therefore, operations-related noise impacts under the Unit 3 were determined to be SMALL. (Dominion. 2016j)

E7.2.3.2.1.5 Geology and Soils

Construction-related impacts to geology would be minimal, as materials such as stone and gravel used for construction of roads and buildings would be obtained from suppliers who use local sources of these materials. Clearing and grubbing associated with the construction of Unit 3 would expose soils and make them susceptible to erosion. Drainage patterns would also be susceptible to change that could result in increased runoff to streams and lakes. Because ground disturbance would be more than one acre, a VDEQ SWCGP would be required. This permit requires the installation of BMPs to reduce stormwater runoff that transports sediment and other pollutants into local waterways. Once construction activity is completed, exposed soils will be revegetated and monitored to ensure the site is reclaimed. Therefore, construction-related impacts on geology and soils would be SMALL. Likewise, NRC's FEIS for Unit 3's ESP (NRC. 2006), Table 4.6-1) indicated that erosion and sediment impacts would be SMALL with the utilization of BMPs.

Operations-related impacts on geology and soils would be minimized by adherence to management of stormwater originating from the site. BMPs would eliminate and minimize stormwater discharges from the site. Therefore, operations-related impacts would be SMALL.

E7.2.3.2.1.6 Hydrology (Surface Water and Groundwater)

E7.2.3.2.1.6.1 Surface Water

Unit 3 construction would impact two ephemeral streams, Stream B and Stream C, during construction of the cooling towers (Dominion. 2016j). The impacts to these drainages may temporarily and permanently alter these drainages, and some increased runoff may occur in these tributaries while construction of Unit 3 is being completed. These stream impacts would be minimized by installation of BMPs to prevent erosion and pollutants from entering the waterways. Unit 3 would require the construction of a new intake structure to draw water from Lake Anna. In addition, a new discharge structure will be constructed on the discharge canal. This discharge structure would be located adjacent to the discharge structure for Units 1 & 2 (NRC. 2010). Construction of these structures would result in temporary disturbances that would be mitigated through the use of a VDPES construction permit and BMPs identified in the SWPPP.

Construction activities could result in increased stormwater runoff from cleared sites, and spills and leaks from construction equipment. The SWGCP would require installation of BMPs and mitigation of the potential for stormwater runoff and erosion. The BMPs and waste management practices identified in the SWPPP would also capture and mitigate accidental spills from equipment and vehicles. Therefore, construction-related impacts on surface water use and quality under the Unit 3 nuclear alternative would be SMALL.

Operational impacts to surface water would be related to use of Lake Anna to supply circulating water, makeup water, fire-protection water, and demineralized water (NRC. 2010). Water discharges to Lake Anna would be regulated under a VPDES permit to protect water quality. Therefore, operations-related impacts on surface water use and quality under the Unit 3 nuclear alternative would be SMALL.

E7.2.3.2.1.6.2 Groundwater

Construction-related impacts to groundwater would be connected to the five new domestic wells that would be drilled for Unit 3 operations (Dominion. 2016j). These wells would be installed for potable water, and two would be in service during the construction of Unit 3. Construction impacts related to drilling and installation of these wells would be minimal as the footprint is small.

Foundation excavations may intrude on groundwater zones and require dewatering during construction. Dewatering systems used during construction would depress the water table in the vicinity. However, any drawdown in the water table would be limited by the proximity of Lake Anna and the discharge canal (NRC. 2006, Section 4.3.1).

Unit 3 would have five new groundwater wells producing potable water. These wells would not result in any environmental impacts. The NAPS site has approved waste management, spill

prevention practices, and stormwater BMPs in place to prevent and minimize any surface sources of contamination that could migrate into groundwater resources. Therefore, operations-related impacts to groundwater use and quality under the Unit 3 nuclear alternative would be SMALL.

E7.2.3.2.1.7 Ecological Resources (Terrestrial and Aquatic)

E7.2.3.2.1.7.3 Terrestrial

Terrestrial ecology impacts from the construction of Unit 3 would primarily occur from land disturbance. Some wildlife mortality is expected during construction (Dominion. 2016j). However, the mortality is not expected to affect long-term wildlife populations. Wildlife would disperse to undisturbed adjacent habitats when construction is initiated. Because NAPS is an industrialized site, it is assumed wildlife is acclimated to noise and that the additional construction noise would not disrupt wildlife in adjacent habitats.

Construction would permanently disturb approximately 0.31 acres of non-tidal wetlands and 757 linear feet of ephemeral streams. This impact to waters of the U.S. would require a USACE Section 404 permit that requires installation of BMPs to protect waters and remediation of temporarily disturbed sites. These disturbed vegetation communities would be revegetated with native and non-invasive flora species appropriate for the site conditions. Overall, construction-related impacts on terrestrial resources under the Unit 3 nuclear alternative are SMALL. (Dominion. 2016j)

Operation of the cooling towers would cause some deposition of dissolved solids on surrounding vegetation and soils. Operational noise from the cooling towers could impact terrestrial wildlife, although the site has an existing background noise level that most wildlife should be acclimated to. Overall, operations-related impacts on terrestrial resources under the Unit 3 nuclear alternative would be SMALL.

E7.2.3.2.1.7.4 Aquatic

Construction-related impacts to aquatic species would primarily be from land clearing and construction activities that could discharge sediment into Lake Anna. These sediment releases would be prevented or minimized by utilization of BMPs identified in SWPPP. Construction in the intake canal entrance would also include modification of the existing cofferdam from the installation of five box culverts. (NRC. 2010) This construction activity would result in increased sedimentation in Lake Anna. The increase in sedimentation would be temporary, lasting only through the installation of the box culverts. Overall, the construction-related impacts to aquatic life under the nuclear alternative would be SMALL. The NRC's assessment of construction-related impacts also considered the impacts to be SMALL with the application of VDPES permit requirements and BMPs. (NRC. 2006, Section 4.4.2)

Aquatic life impacts resulting from operations is primarily related to the intake and discharge structures. The addition of Unit 3 is expected to increase total impingement by 3% over the existing NAPS units. Concentrations of chemical and solids would be below VPDES permit discharge limits. Overall, the operations-related impacts on aquatic resources under the Unit 3 nuclear plant alternative would be SMALL. (Dominion. 2016j)

E7.2.3.2.1.7.5 Special Status Species

The NRC would remain the licensing agency under this alternative, and the ESA would require the NRC to initiate consultation with the USFWS and the NMFS if federally listed species or their habitats are present within the proposed project area.

One federally listed plant species, the small whorled pogonia (Isotria medeoloides) may occur within the NAPS site (NRC. 2010, Section 4.4.3). Dominion is working with the Virginia Department of Conservation and Recreation to conduct a habitat assessment for the plant within the NAPS site. No other federally listed wildlife or plant species or their habitats are known to occur on the NAPS site (Dominion. 2016j, Section 2.4.1.6, Appendix 4A.2). No federally listed fish species occur in Lake Anna or the North Anna River. Several state-listed species could potentially occur at the NAPS site. These species include the loggerhead shrike and upland sand piper. These species have not been reported at the NAPS site (NRC. 2010; Dominion. 2016j, Section 2.4.2, Appendix 4A.2). No state-listed plant species have been identified at the NAPS site (Dominion. 2016j, Section 2.4.1.6, Appendix 4A.2). Therefore, construction and operation-related impacts to special status species under the Unit 3 nuclear plant alternative would be SMALL.

E7.2.3.2.1.8 Historic and Cultural Resources

Cultural resources present within the NAPS site boundary include one historic site for which NRHP eligibility has not yet been determined (Dominion. 2016j). Construction activities would avoid this site as a standard mitigation practice. Because the site was surveyed as recently as 2006, all the historic and archaeological site locations would have been previously mapped. Therefore, construction would have no effect on cultural resources.

Impacts from the operation of Unit 3 would primarily consist of grounds and routine maintenance, construction of auxiliary buildings, and other routine operation actions. Dominion has committed to protection of historic and cultural resources during operation of Unit 3. Therefore, impacts from operations of new facilities on historic and cultural resources would be NO ADVERSE EFFECT (NRC. 2010).

E7.2.3.2.1.9 Socioeconomics

E7.2.3.2.1.9.1 Socioeconomic Issues other than Transportation

The construction and operation of the Unit 3 nuclear alternative would create construction and power plant operations employment. The construction employment would be short-term and would provide a stimulus to the local economy. Plant operations employment would be long-term and would provide additional stimulus to the local economy.

It is estimated that the peak construction workforce would be approximately 2,500 to 4,100 workers. The temporary in-migration of workers would be estimated at 20% of the workforce. This number of workers would provide an economic stimulus to the local economy as the demand for housing and goods would increase. Because this would be a short-term stimulus, the overall construction-related impacts under the Unit 3 nuclear alternative would be SMALL and beneficial for the local economy. (Dominion. 2016j)

Operation of Unit 3 would require approximately 500 workers or an increase in the population in the region of interest by 2,000, assuming each new employee represents a family of four. This increase in population is considered small and it would not result in additional stress on existing public services such as educational, medical, fire, and police services. The additional workers would purchase homes, goods and services, and pay property and sales taxes, which would increase the economic base of the region. Therefore, the operations-related impacts to socioeconomics under the Unit 3 nuclear alternative would be SMALL and beneficial. (Dominion. 2016j)

E7.2.3.2.1.9.2 Transportation

Transportation impacts resulting for construction of Unit 3 would be MODERATE due to the increase in vehicles. The employment of 4,100 construction workers combined with 1,000 NAPS site workers would add up to 2,850 vehicles on the local road system. The increase in traffic on roads would likely result in some MODERATE impacts to traffic that could affect all local commuters, including local minority and low-income populations. Increased use of the roads during construction could create some safety and maintenance issues. The work shifts during construction would be staggered, which could minimize some of the increased road use. Overall, construction-related traffic impacts under the Unit 3 nuclear alternative would be MODERATE. (Dominion. 2016j)

Traffic-related impacts would be reduced after construction of Unit 3. Transportation impacts would include some minor increase in NAPS site worker road use from the increase of 500 workers, a slight increase in equipment and materials deliveries, and a minor increase in maintenance truck traffic. Therefore, operations-related transportation impacts under the Unit 3 nuclear plant alternative would be SMALL. (Dominion. 2016j)

E7.2.3.2.1.9.3 Human Health

Impacts on human health from construction of the Unit 3 nuclear alternative would be similar to those associated with a large industrial facility construction project. Compliance with OSHA worker protection rules would prevent safety-related accidents. The radiological human health impact on construction workers due to the proximity of Units 1 and 2 would be SMALL due to compliance with NRC regulations and adherence to ALARA principals. The NRC reviewed the human health and environmental impacts from radiological emissions and waste in its license renewal GEIS and found the impacts to be SMALL (NRC. 2013a, Table 2.1-1). Therefore, the construction-related impacts on human health under the Unit 3 nuclear alternative would be SMALL.

The human health effects from the operation of Unit 3 would be similar to those of the existing NAPS Units 1 and 2. Therefore, the operations-related impacts on human health under the Unit 3 nuclear plant alternative would be SMALL.

E7.2.3.2.1.9.4 Environmental Justice

Potential impacts on local communities, including minority and low-income populations, from construction of the Unit 3 nuclear alternative would primarily be associated with socioeconomic effects. These impacts would consist of the short-term increase in worker expenditures at local businesses and potential rental housing shortages during the construction phase of the project. The increase in traffic on roads would likely result in some MODERATE impacts to traffic that could affect local commuters, including minority and low-income populations. Environmental impacts to these populations would be minor and likely would result in no impacts to minority and low-income populations. Overall, the construction impacts to low-income and minority populations under the Unit 3 nuclear alternative would be SMALL. NRC concluded that environmental justice impacts from construction of North Anna Unit 3 would be SMALL in its ESP FEIS (NRC. 2006, Section 4.7).

No disproportionately high and adverse impacts to minority or low-income populations would occur from Unit 3 plant operations because the plant operations would primarily increase economic activity in the communities adjacent to NAPS. Some of this increase in economic activity could be beneficial for low-income and minority populations adjacent to NAPS. Overall, the construction and operation of Unit 3 would not result in disproportionately high and adverse human health and environmental effects on minority and low-income population residing in the vicinity of the NAPS site. The NRC concluded that environmental justice impacts from operation of North Anna Unit 3 would be SMALL in its ESP FEIS (NRC. 2006, Section 5.7; NRC. 2010).

E7.2.3.2.1.9.5 Waste Management

The construction of the Unit 3 nuclear alternative would create sanitary and industrial wastes. These wastes would be properly managed onsite and disposed of at an approved offsite treatment or disposal facility. Overall, waste impacts resulting from construction of Unit 3 would be SMALL.

During operations, the Unit 3 nuclear alternative would generate nonhazardous, hazardous, spent nuclear fuel, and radioactive wastes. The nonhazardous and hazardous wastes would be managed in compliance with state regulations until acceptance by DOE for offsite storage. NRC considered the potential environmental impacts of at-reactor continued storage of spent fuel for 60 years beyond licensed life and determined the impacts to be SMALL (NRC 2014a, Table ES-3). Dominion has internal recycling and waste minimization programs that would reduce waste volumes. Spent nuclear fuel would be managed onsite in accordance with NRC and state regulations. The NRC reviewed the environmental impacts from nonradioactive and radioactive wastes in the GEIS and determined them to be SMALL (NRC. 2013a, Table 2.1-1). Dominion reviewed the impacts of hazardous and radioactive wastes for Unit 3 operation and determined the environmental impact to be SMALL (Dominion. 2016j, Table 10.4-2).

E7.2.3.2.2 Small Modular Reactor Option

The SMR option would consist of a cluster of SMR units with generation capacity comparable to SPS generation. The facility would be located at the SPS site adjacent to the existing units and utilize the existing transmission infrastructure and intake and discharge structures. Mechanical draft cooling towers would be constructed to provide closed-cycle cooling. Dominion and subsequently the NRC conducted an environmental impact assessment for constructing and operating two additional nuclear units at the SPS site as part of the early site permit efforts associated with the NAPS early site permit (Dominion. 2006; NRC. 2006). An earlier siting study under a cooperative agreement with the U.S. Department of Energy also considered the SPS site for various reactor options, including SMR unit clusters with generating capacities of 1,144 to 1,340 MWe (Dominion and Bechtel. 2002). Tennessee Valley Authority (TVA) also prepared an ER for an early site permit for a nuclear site for a proposed SMR cluster with a generating capacity of 800 MWe (TVA. 2016). TVA. 2016 considered various SMR technologies to develop a plant parameters envelope that encompassed the site requirements and plant parameters. These previous assessments in consideration with SMR operational parameters are used to describe the potential environmental impacts of the SMR alternative discussed below.

E7.2.3.2.2.1 Land Use

The SMR units would be located in the area adjacent to SPS Units 1 and 2 reviewed as part of the alternative sites analysis for the NAPS early site permit. The footprint would use existing developed area and the undeveloped land between the Units 1 and 2 complex and the existing ISFSI, an area of approximately 50 acres. Buildings, including the radwaste facility, currently occupy this area and may require relocation. (Dominion and Bechtel. 2002, Part 3, Section 1.1.2; NRC. 2006, Section 8.5.1) Relocation of these buildings could require additional clearing on the SPS site and could utilize a portion of the land discussed in Section E7.2.3.1.1 for the NGCC alternative. The NRC considered the land use impacts of siting a nuclear plant including a cluster of SMRs at the

SPS site to be SMALL (NRC. 2006), while the land use impacts for the NGCC alternative are estimated to be MODERATE (Section E7.2.3.1.1). Therefore, the land use impacts for this option are estimated to be SMALL to MODERATE.

E7.2.3.2.2.2 Visual Resources

The SMR units would utilize mechanical draft cooling towers, which have a lower profile to avoid visual aspects of natural draft towers. The mechanical draft cooling towers considered for the Clinch River SMR site were 65 feet above grade (TVA. 2016, Table 3.1-2), and a similar design is assumed for this option at SPS. The existing SPS containment buildings are approximately 159 feet tall (Section E3.2.3) and were designed so the elevation would be sufficiently low to blend with the surrounding forested lands due to the concern that the buildings would be visible from historic Jamestown Island (NRC. 2006). Also, this option of the new nuclear alternative assumes the use of the existing intake and discharge structures, so additional visual impact along the shoreline would be avoided.

Given the assumption of the use of lower-profile mechanical draft towers and the reactor block and cooling towers located close to the existing units, the visual impact would be consistent with the existing impact and would be SMALL.

E7.2.3.2.2.3 Air Quality

The SMR option would result in air quality impacts similar to the ALWR operation for both construction and operation, and are anticipated to result in SMALL impacts. Construction would result in temporary air quality impacts localized to the SPS site and immediate surrounding area and mitigation measures would be implemented. Much of the footprint for the SMR units described above in land use is already paved at SPS, which would result in less fugitive dust than a construction site that required clearing over its entire area. Operation of SMR units, as with ALWR units, would not result in air pollutant releases, but minimal air pollutants would result from operation of auxiliary boilers and emergency diesel generators, if applicable, as well as from commuting workers and truck deliveries. SMR units vary in the need for auxiliary boilers and emergency diesel generators, with the Clinch River SMR application listing them as part of the design parameters (TVA. 2016, Table 3.1-2) and the NuScale Design Control Document indicating that they are not (NuScale. 2016, Table 1.3-1).

As discussed for the ALWR option, GHG emissions associated with nuclear power are lower than fossil-fuel based energy sources. Nuclear power lifecycle GHG emissions are within the same order of magnitude as renewable energy sources (NRC. 2013a, Section 4.12.3). Because the new SMR nuclear alternative would create greatly reduced GHG emissions compared to emissions from a fossil-fuel plant, the air quality impacts would be SMALL.

E7.2.3.2.2.4 Noise

The SMR option is also anticipated to have noise impacts from construction and operation similar to those of the ALWR option and are anticipated to result in SMALL impacts. Much of the construction activity would be close to the existing structures, which would attenuate noise levels. Onsite workers would be subject to occupational safety procedures and programs for hearing protection. The units in operation would be similar noise sources at similar levels as the existing units, with the exception of cooling towers. Noise levels from the cooling towers at NAPS Unit 3, the ALWR option, were estimated to be less than 65 dBA at the EAB and have a SMALL environmental impact (Dominion. 2016j). Mechanical draft cooling tower noise levels at Clinch River were estimated to be less than 70 dBA at a distance of 1,000 feet (TVA. 2016, Table 3.1-2) and also have a SMALL environmental impact.

E7.2.3.2.2.5 Geology and Soils

The SMR option is also anticipated to have geological and soil impacts from construction and operation similar to those of the ALWR option, as well as the NGCC alternative, and are anticipated to result in SMALL impacts through the use of BMPs and compliance with stormwater permits.

E7.2.3.2.2.6 Hydrology (Surface Water and Groundwater)

The impacts of construction of the SMR option at SPS would be similar to those of the NGCC alternative, with the exception of dewatering. Construction of SMR units would require more dewatering than for construction of other non-nuclear alternatives. Dewatering associated with construction of the existing units' excavation and construction of the SMR option excavation is anticipated to be similar, based on the expected level of excavation. The FES for Unit 1 described the impacts of excavation "There has been no impact on the quality of potable water in this area. Gravel Neck represents an isolated geological entity; water from wells on the site comes from deep aquifers that were in no way affected by excavations performed on the site" (NRC. 1972, page 66). Implementation of BMPs and stormwater permitting would minimize run-off and sedimentation associated with construction. Use of the existing intake and discharge structures would minimize the need for any shoreline construction activities.

During operations, the cooling towers would draw makeup water from the James River. The rate would be significantly less than current operations. As presented in Section E2.2.3, SPS requires 840,000 gallons per minute (gpm) of river water per unit to supply condensing and service water needs. The Clinch River application estimates the maximum cooling tower makeup flow rate at 25,608 gpm for an 800-MWe facility (TVA. 2016, Table 3.1-2), which represents a facility about one-half the size needed as an alternative to SPS. As estimated for the NCGG alternative, the use of James River water for the SMR option will not impact flows in the river, and discharges would be less than for the existing units. Water intake and discharge would be subject to VPDES permits, and

compliance would ensure that impacts are minimized and protective of the environment. Use of groundwater is expected to be similar to current use. Overall, surface water and groundwater impacts are anticipated to be SMALL for the SMR option. Likewise, NRC assessed water use and quality impacts from construction and operation of new nuclear units at SPS to be SMALL and, therefore, are considered bounding for the SMR option (NRC. 2006, Section 8.5.2).

E7.2.3.2.2.7 Ecological Resources

E7.2.3.2.2.7.1 Terrestrial

Terrestrial ecology impacts from construction of the SMR option would be similar to those of the NGCC alternative and are anticipated to be SMALL to MODERATE. Construction activities would involve less land clearing than that of the NGCC alternative because of the proposed location in already-cleared areas, but construction activities could last longer. Terrestrial impacts during operations would be similar to that experienced at the existing units, with the addition of the use of mechanical draft cooling towers. As for the cooling towers for the NGCC alternative and the NAPS Unit 3 nuclear option, cooling towers for the SPS SMR option could deposit solids on surrounding land and result in noise. Due to the assumed lower profile of mechanical draft cooling towers, the deposition of solids is anticipated to less widespread than that of the proposed NAPS facility, and wildlife would become acclimated to the addition of cooling tower noise. Dominion anticipates that the SMR option would result in SMALL terrestrial impacts during operations. The NRC assessed the impacts of constructing and operating additional nuclear units at SPS to terrestrial ecological resources as SMALL and, therefore, are considered bounding for the SMR option. (NRC. 2006, Section 8.5.3)

E7.2.3.2.2.7.2 Aquatic

Aquatic ecology impacts from construction would be similar to those of the NGCC alternative. From the use of closed-cycle cooling the rates of impingement and entrainment would be minimized. Both the intake and discharges as well as stormwater management would be subject to VPDES permitting and compliance with the applicable permit would allow impacts to be small. The NRC also assessed the overall impact on aquatic ecological resources of construction and operation of new nuclear units and associated cooling towers at the SPS site to be SMALL. (NRC. 2006, Section 8.5.4)

E7.2.3.2.2.7.3 Special Status Species

As discussed in Section E3.7.8.1.7, with the exception of Atlantic sturgeon, federally listed or candidate species would not occur within the site. Dredging activities that could impact Atlantic sturgeon would adhere to seasonal restrictions that prevent activities during spawning periods. Section E3.7.8.1.7 explains that impingement and entrainment Atlantic sturgeon is not likely.

Section E3.7.8.1.7 also discusses the state listed species that given habitat requirements and occurrence in the vicinity could occur on the SPS site. These species include four bird species that due to mobility would be able to move away from the construction site and thus any impact from clearing, construction noise and dust would be minimized. Other state listed species include three bat species. The SMR alternative would involve clearing of forested areas, so forested areas would need to be surveyed for the roosting and nursery locations, so areas can be avoided and/or mitigation measures, if needed, can be implemented. Finally, the state-listed Canebrake rattlesnake could occur in SPS site forested areas and clearing could displace individuals. However, the SMR site has adjacent areas that would remain forested and the adjacent Hogs Island WMA habitat would remain as well. Federal and state wildlife agencies would be consulted regarding potential impacts to special status species. Given the need for clearing and the potential occurrence for some state listed species, the construction impacts from the SMR alternative may affect, but not likely to adversely affect special status species.

Impacts from operation of the SMR would be similar to that of SPS with the exception of operation of the SMR cooling towers. Mechanical draft cooling towers pose less hazard for bird collisions due to their shorter height. In addition, the cooling towers would also have noise, salt drift, icing, and fogging hazards. However, these cooling tower impacts were generically determined to be SMALL (NRC. 2013a). Therefore, the operational impacts of the SMR alternative would not affect special status species. This would involve noise from the cooling towers, pumps, and other plant equipment and water use and discharge for cooling with the potential impact to special species that is similar to the NGCC alternative.

Operations of the NGCC plant would likely not impact federally or state-listed species because, with the exception of Atlantic sturgeon, these species would not occur within the site. For the reasons discussed in Section E3.7.8.1.7, Atlantic sturgeon is not likely to be affected by NGCC plant operations. Impacts to aquatic species from maintenance activities such as dredging would be mitigated from adherence to seasonal restrictions that prevent activities during spawning periods for fish.

E7.2.3.2.2.8 Historic and Cultural Resources

SPS has only one recorded historic site, the Lawnes Creek Church site, which is located on the west of the Units 1 and 2 and, as discussed in under land use, the SMR site is east of the existing units and paved. So, given that site would avoid cultural sites and much of the site is developed and previously disturbed, construction and operation of the SMR alternative would not affect cultural resources. However, the potential exists for visual intrusion at the area's significant historic properties, districts and landscapes (NRC. 2006, Section 8.5.5.4). Given the SMR option would be adjacent to the existing units and using a SMR design would have a lower profile structure, the

visual impact would be NO ADVERSE EFFECT depending on the SMR design and the historic property's distance and geographic orientation from the site.

E7.2.3.2.2.9 Socioeconomics

E7.2.3.2.2.9.1 Socioeconomics other than Transportation

The socioeconomic impacts of construction of the SMR option would be greater than those of the NGCC alternative due to the larger workforce required and the likely longer construction period. The maximum onsite workforce size estimated for the Clinch River facility was 2,200 workers (TVA. 2016, Table 3.1-2). The additional workers would have a larger beneficial economic impact on the area during construction, but the impact on community services and infrastructure would result in a larger adverse impact during the construction years, a temporary adverse impact. It is asserted that construction of the SMR option at SPS would result in temporary SMALL to MODERATE beneficial impacts to the economy and temporary SMALL to MODERATE adverse impacts to public services and infrastructure.

Continued use of SPS for nuclear operations would allow the tax basis of the property to continue similarly to that of the existing units. The tax payments attributable to SPS are more than 60% of the overall tax revenues of Surry County (Section E3.9.5), and SPS employs approximately 941 permanent full-time workers (see Table E2.5-1). The workforce estimated for the Clinch River facility, an 800-MWe plant, is 500 permanent workers (TVA. 2016, Table 3.1-2). The larger SMR cluster that would be required for providing replacement generation if the SPS license was not renewed could require a larger workforce than that assumed for Clinch River, but to be conservative, the workforce is assumed to be less than for current operations and the impacts similar to those of the NGCC alternative. It is anticipated that the socioeconomic impacts resulting from the operation of the SMR option would be MODERATE and beneficial.

E7.2.3.2.2.9.2 Transportation

Transportation impacts would be greater during construction of an SMR than those anticipated for the NGCC due to the larger workforce and likely longer construction duration, and are estimated to be MODERATE to LARGE. As with the NGCC alternative, traffic impacts associated with the operation of the SMR option are anticipated to be minimal. Overall, because the operations of the SMR option is assumed to would require fewer workers, operations-related transportation impacts under the SMR option would be SMALL.

E7.2.3.2.2.9.3 Human Health

Like construction of the NAPS Unit 3, impacts on human health from construction of the SMR option would be similar to those associated with a large industrial facility construction project. Compliance with OSHA worker protection rules would prevent safety-related accidents. The radiological human health impact on construction workers due to the proximity of Units 1 and 2 would be SMALL due to compliance with NRC regulations and adherence to ALARA principals. The NRC reviewed the human health and environmental impacts from radiological emissions and waste associated with operation of SPS on site workers in its license renewal GEIS and found them to be SMALL (NRC. 2013a, Table 2.1-1). Therefore, the construction-related impacts on human health are anticipated to be SMALL.

The human health effects from the operation of the SMR option would be similar to those of the existing units. Given compliance with NRC and EPA limits for radiological exposure and OSHA occupational safety regulations, the operations-related impacts on human health under the SMR option would be SMALL.

E7.2.3.2.2.10 Environmental Justice

Construction and operation of the SMR option would result in impacts similar to that of the NGCC alternative and are anticipated to result in no disproportionate adverse impacts to minority and low-income populations.

E7.2.3.2.2.11 Waste Management

The waste management impacts from construction of the SMR option would be similar to those of both the NGCC alternative construction at the SPS site and the NAPS Unit 3 construction. The impacts would be SMALL because the wastes would be properly managed onsite and disposed of at permitted offsite treatment and disposal facilities.

During operations, the SMR nuclear option would generate nonhazardous, hazardous, spent nuclear fuel, and radioactive waste. The nonhazardous and hazardous waste would be managed in compliance with state regulations and disposed of in permitted facilities. Dominion has internal recycling and waste minimization programs that would reduce waste volumes (see Section E2.2.7). Radioactive waste and spent nuclear fuel would be managed onsite in accordance with NRC and state regulations. The NRC reviewed the impacts from nonradioactive and radioactive waste in the GEIS and determined the impacts to be SMALL (NRC. 2013a, Table 2.1-1). Dominion reviewed the environmental impacts of hazardous and radioactive waste for Unit 3 operation and determined them to be SMALL (Dominion. 2016j, Table 10.4-2).

The impacts of operation of a SMR facility are likewise anticipated to be SMALL.

E7.2.3.3 Combination of Alternatives

The combination of alternatives involves the construction and operation of a NGCC plant and solar PV facility. This combination of alternatives is presented by Dominion in the IRP as an approach to provide electrical generation in their 15-year plan. This combination of alternatives would provide the following generation:

- 1,743-MWe NGCC plant operating at an 87% capacity factor (EIA. 2016).
- Solar PV at one 20-MW sites.
- Demand-side management.

As presented in Section E7.2.1.1, the NGCC plant would be sited on the SPS property. Approximately 66 acres of land would be required to construct the facility.

The solar PV facility would be sited on approximately 280 acres of land. A site selection process would be used to select sites that provide sufficient transmission infrastructure and avoids sensitive resources including cultural resources, wetlands, and threatened and endangered species habitat.

Demand side management would consist of existing Dominion energy efficiency programs that would provide reduction in the use of electrical generation.

Environmental impacts associated with the combination alternatives are described below.

E7.2.3.3.1 Land Use

The impact on land use due to construction and operation of the NGCC plant and associated pipeline connection would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.1 and would be MODERATE.

Utility-scale solar facilities use relatively large areas of land to generate electricity. Approximately one site of 280 acres of land would be required to install 20 MW of solar PV. The solar technology selected for this alternative would be a fixed-tilt system that typically average 13% less land than one axis tracking system on a capacity basis, but uses 15% more land on a generation basis (NREL. 2013). Land impacts can be minimized by siting the facilities on previously disturbed industrial and commercial land. Overall, because of the large land requirements, solar impacts on land use would be MODERATE.

Demand side management would not have a direct effect on land-use. However, increased turnover of older appliances for more energy efficient units may result in a minor increase in landfill use and recycling. However, this minimal increase in disposal of appliances is normal and would result in SMALL land-use impact.

E7.2.3.3.2 Visual Resources

Visual impacts from the NGCC plant component of the combination alternative would be essentially the same as those described for the discrete NGCC alternative in Section E7.2.3.1.2 and would be SMALL.

The solar facility would require a large land area sited on previously disturbed industrial or commercial land. The addition of the solar PV would be visible, but the location would already be visually altered by the presence of industrial or commercial facilities. The aesthetic impacts of the construction and operation of the solar component of the combination alternative would be SMALL.

E7.2.3.3.3 Air Quality

The impact on air quality due to construction and operation of the NGCC plant would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.3 and would be SMALL for construction related impacts and MODERATE for operational impacts. Construction activities associated with the solar PV installation would generate fugitive dust. Mitigation would be implemented via wetting of cleared areas and dirt roads to minimize the fugitive dust. Construction equipment and vehicles would also emit exhaust emissions. These emissions would be temporary and mitigation such as curtailing idling of vehicles would be implemented to minimize short-term air impacts. Overall, construction emissions associated with the solar component of the combination alternative would be SMALL.

Operational impacts associated with the NGCC plant combination alternative would be slightly less than the discrete NGCC plant alternative shown in Table E7.2-1. The solar alternative would not release any air emissions during operation. Overall, the air quality impacts from the operation of the combination alternative would range from SMALL to MODERATE.

E7.2.3.3.4 Noise

The construction and operation of the NGCC plant component of the combination alternative would have noise impacts similar to those described in the discrete NGCC plant alternative presented in Section E7.2.3.1.4 and would be SMALL. Construction of the solar PV facility would likewise have SMALL noise impacts.

No noise impacts would occur from operation of the solar PV facility.

Overall, construction and operations-related noise impacts associated with combination alternative would be SMALL.

E7.2.3.3.5 Geology and Soils

The impact on geology and soils due to constructing and operating the NGCC component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.5 and would be SMALL.

Construction impacts to geology and soils resulting from the construction of the solar PV facilities would primarily be impacts to soils from clearing and grubbing. These temporary soil impacts would be minimized by implementation of BMPs identified in the SWPPP. Geological impacts would be minor, as any gravel or stone used in the construction of roads and infrastructure would be sourced from local businesses that sell materials sourced from local quarries. During operations, the NGCC plant and the solar PV facility would be required to comply with VDEQ regulations that regulate stormwater runoff. If stormwater is an issue at the facilities, BMPs would be installed to minimize the impact of erosion and runoff from these sites. Overall, construction and operational impacts on geology and soils from the solar component of the combination alternative would be SMALL.

E7.2.3.3.6 Hydrology (Surface Water and Groundwater)

The impact on surface water use and quality due to constructing and operating the NGCC plant component would be similar to that associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.6 and would be SMALL.

Dominion assumes water used for construction of the solar facilities will be used for dust suppression, equipment washing, and sanitary systems, while potable water will be trucked in by the construction contractor. Water quality impacts would result from erosion and runoff associated with the construction of the solar facility. These temporary soil impacts would be minimized by implementation of BMPs identified in the SWPPP.

The surface water use and water quality impacts associated with the construction and operation of the solar PV facility would be SMALL. Therefore, the impact on surface water use and quality due to constructing and operating the solar PV facility would be SMALL.

E7.2.3.3.6.1 Groundwater

The impact on groundwater use and quality due to constructing the NGCC plant component of the combination alternative would be similar to that associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.6 and would be SMALL.

No groundwater use or quality impacts are associated with the construction or operation of the solar PV component of the combination alternative. The impacts to groundwater from the combination alternative would be SMALL.

E7.2.3.3.7 Ecological Resources (Terrestrial and Aquatic)

E7.2.3.3.7.1 Terrestrial

The impact on terrestrial resources due to constructing the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.7 and would be SMALL to MODERATE.

Terrestrial ecological impacts associated with the construction of the solar PV component of the combination alternative would be from clearing and grubbing of vegetation.

Terrestrial ecology impacts resulting from the construction of the solar PV facility would result from the 560 acres of land development required for the facilities. This development could occur at two separate sites. Siting at previously disturbed locations would minimize the disturbance of vegetation and wildlife habitat. Therefore, terrestrial ecology impacts associated with the solar PV component of the combination alternative would be SMALL.

No operational impacts to terrestrial ecological resources would occur from the solar PV component of the combination alternative. Therefore, terrestrial ecology impacts resulting from the combination alternative would be SMALL.

E7.2.3.3.7.2 Aquatic

The impact on aquatic resources due to constructing the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.7 and would be SMALL.

SMALL impacts to aquatic resources would result from the construction of the solar PV component of the combination alternative due to the implementation of BMPs to control erosion and run-off.

SMALL impacts to aquatic resources would result from the operation of the solar PV component of the combination alternative.

E7.2.3.3.7.3 Special Status Species

The impact on special status species due to constructing the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.7 and would be SMALL.

The site selection process used to select sites for the solar facilities would have criteria to avoid locations whose development would impact special status species. No impacts to special status species are anticipated from constructing and operating the solar PV component of the combination alternative. Therefore, impacts to special status species under the combination alternative would be SMALL.

E7.2.3.3.8 Historic and Cultural Resources

The impact on historic and cultural resources due to constructing the NGCC plant component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.8 and would be SMALL.

The site selection process that would be used to select sites for the solar facilities would have criteria to avoid locations whose development would impact cultural resources. With application of the site selection process, impacts to historic and cultural resources from constructing and operating the solar PV facilities would be avoided.

Because cultural resources, both historic and archaeological, would be avoided or protected during the operation of the facilities under the combination alternative, impacts would be NO ADVERSE EFFECT.

E7.2.3.3.9 Socioeconomics

E7.2.3.3.9.1 Socioeconomic Issues other than Transportation

The construction and operation of the NGCC component of combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.9 and would be SMALL for construction and MODERATE for operations.

The construction and operation of the solar PV component of the combination alternative would create fewer construction and operations jobs than the NGCC plant. The jobs created to complete the construction of the NGCC plant and solar PV facility components of the combination alternative would be temporary jobs. It is expected some of the workers associated with the construction activity may relocate to the area temporarily during the construction of these facilities. However, most of these workers would return to their permanent places of residence at the completion of the construction. Therefore, any boost to the local economies would be short-term, and socioeconomic impacts related to the construction of combination alternative would be SMALL.

The number of worker required to maintain the solar PV facility would be small and would not result in a quantifiable impact on the local economy. Therefore, the operations-related socioeconomic impacts under the solar PV component of combination alternative would be SMALL.

Demand side management programs such as energy efficiency initiatives could result in a need for more workers to install windows, appliances, insulation, and other building components to reduce energy use. The workers involved in these programs would stimulate the local economy through purchases of good s and services. Any socioeconomic stimulus from energy efficiency programs would be minimal and the result would be a SMALL socioeconomic impact.

E7.2.3.3.9.2 Transportation

Transportation impacts during the construction and operation of the NGCC plant be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.9 and would be MODERATE for construction and SMALL for operations.

Transportation impacts during the construction of the solar PV facility components of the combination alternative would be less than the impacts for any of the other alternatives discussed. The construction workforce and equipment transported to the sites would be less than the amounts required for the other alternatives.

Traffic impacts associated with the operation of the solar PV facility would not be quantifiable. Once the facility is in operation, very few to no employees would be required for the facility operations. Therefore, transportation impacts under the solar PV facility component of the combination alternative would be SMALL.

E7.2.3.3.10 Human Health

Impacts on human health from construction of the NGCC component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.10 and would be SMALL.

During construction of the solar PV facility, worker safety would be addressed by following the OSHA worker protection standards. Therefore, construction-related impacts on human health under the solar PV component of the combination alternative would be SMALL.

Operations-related impacts resulting from the operation of the NGCC plant would primarily be from air pollutant emissions. The NGCC plant would emit criteria air pollutants (Table E7.2-1). Some pollutants, such as NOx, contribute to ozone formation that can potentially create health problems. These criteria pollutants are regulated, and technology will be installed in the plant to limit the criteria air pollutant releases. Therefore, human health impacts from NGCC plant air pollutant emissions would be MODERATE.

No operations-related impacts to human health are expected under the solar PV component of the combination alternative.

Overall, human health risks during construction and operations to occupational workers and members of the public from the combination alternative would be MODERATE.

E7.2.3.3.11 Environmental Justice

No disproportionate high and adverse impacts on minority and low-income populations is expected from the construction and operations of the combination alternative generation sources. Some minor environmental impacts would result from the construction of the NGCC plant and solar PV

facility from fugitive dust, but this impact would be temporary and short-term. The operation of the NGCC plant would result in air emissions impacting air quality in the region. Air emissions from the NGCC plant would be minimized by installation of technology that reduces criteria air pollutants. Therefore, the emissions associated with the NGCC plant would not have disproportionate high and adverse impacts on minority and low-income populations. Because of the minor environmental impacts associated with the construction and operation of the NGCC plant and solar PV, both of these facilities would not have a disproportionately high and adverse effect on low-income and minority populations.

Socioeconomic impacts on minority and low-income populations under the combination alternative would not result in disproportionately high and adverse impacts. The potential short-term increase in rental housing shortages and the minor increases in costs should be short-term and adversely affect minority and low-income populations.

Demand side management programs such as energy efficiency programs that are targeted for low-income populations could have a minor positive effect on the households that participate in the programs. These programs could also result in employment opportunities for low-income and minority populations. Overall, demand side management programs, especially those targeted for low-income communities, would not have a disproportionately high and adverse effect on low-income and minority populations.

Overall, the construction and operations of the combination alternative would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

E7.2.3.3.12 Waste Management

Impacts on waste management from construction and operation of the NGCC component of the combination alternative would be similar to those associated with the discrete NGCC plant alternative presented in Section E7.2.3.1.12 and would be SMALL.

The construction of the solar PV facility component of the combination alternative would create sanitary and industrial wastes, although it will be in smaller quantity as compared to the NGCC plant. These wastes would be recycled, disposed of onsite, or shipped to an offsite waste disposal facility. The operation of the solar PV facility is expected to generate very minimal waste. All waste generated at the facility would be recycled or disposed of at an offsite waste disposal facility.

Demand side management could have some effect on local waste management programs because of the disposal of older appliances and housing materials. These materials would either be disposed of in land-fills or recycling centers. However, the disposal of these items is expected to be minimal and similar to what would occur with the turnover of appliances that require replacement. Therefore, demand side management impacts to waste management would be SMALL.

Overall, the waste management impacts from the construction and operation of the combination facility would be SMALL.

Table E7.2-1 Air Emissions from NGCC Plant Alternatives

Emission	Discrete Alternative (annual amount	Combination Alternative (annual amount)
Gas consumption	113 billion ft^3	112 billion ft^3
Sulfur dioxide	199 tons	197 tons
Nitrogen oxides[a]	760 tons	755 tons
Carbon monoxide	1,750 tons	1,740 tons
Particulate matter	386 tons	383 tons
Nitrous oxide	175 tons	174 tons
Volatile organic compounds	123 tons	122 tons
Carbon dioxide	6.43 million tons	6.39 million tons

a. Assumes 90% reduction in emissions due to operation of air pollution control equipment (selective catalytic reduction).

Formulas and Sources

Annual gas consumption (ft^3)	Plant size in MW x heat rate, 7,655 Btu/kWh x 1,000 x (1/fuel heating average value = 1,035 Btu/ft^3) x hours in a year						
Fuel heating average value = 1,035 Btu/ft^3 (EPA. 2017)							
Heat rate = 7,655 Btu/kWh (EPA. 2017)							
Annual MMBtu	= (annual gas consumption x fuel heating average value)/1,000,000						
	CO_2	NO_X	CO	PM	SO_2	VOC	N_2O
Emission factor for processed natural gas (lbs/MMBtu)	110	0.13	0.03	0.0066	0.0034	.0.0021	0.003
Annual emissions (tons)	= (emission factor) x (annual MMBtu)/2000						

(EPA. 2000)

CO_2 = carbon dioxide

E7.3 ALTERNATIVES FOR REDUCING ADVERSE IMPACTS

E7.3.1 ALTERNATIVES CONSIDERED

As noted in 10 CFR 51.53(c)(3)(iii), "The report must contain a consideration of alternatives for reducing adverse impacts, as required by 51.45(c), for all Category 2 license renewal issues in Appendix B to Subpart A of this part." A review of the environmental impacts associated with the Category 2 issues in Chapter 4 identified no significant adverse effects that would require consideration of additional alternatives. Therefore, Dominion concludes that the impacts associated with renewal of the SPS OLs would not require consideration of alternatives for reducing adverse impacts as specified in NRC Regulatory Guide 4.2, Revision 1 (NRC. 2013b, Section 7.2). This determination assumes the existing mitigation measures presented in Section E6.2 adequately minimize and avoid environmental impacts associated with operating SPS.

E7.3.2 ENVIRONMENTAL IMPACTS OF ALTERNATIVES FOR REDUCING ADVERSE IMPACTS

No additional alternatives were considered by Dominion to reduce impacts because as determined in Chapter 4, the continued operation of SPS does not result in significant adverse effects to the environment.

Intentionally Blank

E8.0 COMPARISON OF THE ENVIRONMENTAL IMPACT OF SUBSEQUENT LICENSE RENEWAL WITH THE ALTERNATIVES

To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form . . . . [10 CFR 51.45(b)(3)]

The proposed action is renewal of the SPS Units 1 and 2 OLs, which would preserve the option to continue to operate SPS to provide reliable baseload power and meet Dominion's future system generating needs throughout the proposed 20-year SLR operating term. Chapter 4 analyzes the environmental impacts of the proposed action. The proposed action is compared to the no-action alternative, which includes both the termination of operations and decommissioning of SPS and replacement of its baseload generating capacity. The termination of operations and decommissioning impacts are presented in the GEIS (NRC. 2013a, Section 14.2.2, and decommissioning impacts are analyzed in the GEIS on decommissioning, NUREG-0586, Supplement 1 (NRC. 2002b). The energy alternatives component of the no-action alternative is described and its impacts analyzed in Chapter 7.

Table E8.0-1 summarizes the environmental impacts of the proposed action and the alternatives deemed reasonable for comparison purposes. Tables E8.0-2 and E8.0-3 provide a more detailed comparison. The environmental impacts compared in Tables E8.0-1, E8.0-2, and E8.0-3 are Category 1 and 2 issues that apply to the proposed action or issues that the GEIS identified as major considerations in an alternatives analysis.

As shown in Tables E8.0-1, E8.0-2, and E8.0-3, there are no reasonable alternatives superior to that of the continued operation of SPS, providing approximately 1,676 MWe of reliable baseload power generation. The continued operation of SPS would create significantly less environmental impact than the construction and operation of new alternative generating capacity. In addition, the continued operation of SPS will have a significant positive economic impact on Surry County through tax revenues paid by Dominion for SPS. Continued employment of plant workers will continue to provide economic benefits to the communities surrounding the station.

Table E8.0-1 Environmental Impacts Comparison Summary

Impact Area [a]	Proposed Action	No-Action Alternative				
		Termination of Operations and Decommissioning	NGCC Plant Alternative	New Nuclear Plant Alternative		Combination of Alternatives
				ALWR Option	SMR Option	
Land Use	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE	MODERATE
Visual Resources	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	SMALL	SMALL (construction) MODERATE (operations)	SMALL	SMALL	SMALL (construction) MODERATE (operations)
Noise	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Geology and Soils	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Surface Water	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Groundwater	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Terrestrial	SMALL	SMALL	MODERATE	SMALL	SMALL	MODERATE
Aquatic	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Special Status Species	NO EFFECT	(b)	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT
Historic and Cultural	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT

Table E8.0-1 Environmental Impacts Comparison Summary

Impact Area [a]	Proposed Action	No-Action Alternative				
		Termination of Operations and Decommissioning	NGCC Plant Alternative	New Nuclear Plant Alternative		Combination of Alternatives
				ALWR Option	SMR Option	
Socioeconomics	SMALL	Termination: MODERATE to LARGE; Decommissioning: SMALL	SMALL (construction) MODERATE (beneficial; operations)	SMALL	SMALL to MODERATE (construction) MODERATE (beneficial; operations)	SMALL (construction) MODERATE (beneficial; operations)
Transportation	SMALL	SMALL	SMALL to MODERATE	SMALL (operations) MODERATE (construction traffic)	SMALL (operations) MODERATE to LARGE (construction traffic)	SMALL to MODERATE
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental Justice	(c)	(b)	(c)	(c)	(c)	(c)
Waste Management	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL

a. As defined in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3:

SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

b. NUREG-0586 Supplement 1 (NRC. 2002b), the decommissioning GEIS, identifies this resource area as requiring a site-specific analysis based on site conditions at the time of decommissioning, as well as the proposed decommissioning method and activities. Decommissioning SPS would at a minimum occur after the expiration of the current license term. The magnitude of impacts could vary widely based on site-specific conditions at the time and analysis of special status species and/or their habitat(s), a consideration of their presence or their habitats' presence, and environmental justice analysis, the potential for disproportionately high and adverse impacts from the impacts of decommissioning being experienced by minority or low-income populations as determined by the most recent USCB decennial census data when the alternative is implemented. Thus, Dominion cannot forecast a level of impact for this resource area.

c. This alternative would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

Table E8.0-2 Environmental Impacts Comparison Detail (by Alternative)

	NGCC Alternative	New Nuclear Alternative		Combination Alternative
		ALWR Option	SMR Option	
Summary of Alternative	Multiple combustion turbines assembled in appropriate power train configurations for a total of 1,926 net MWe. (Section E7.2.1.1)	One unit nuclear plant for a total of 1,605 net MWe. (Section E7.2.3.2.1)	Cluster of SMR units with generation capacity comparable to SPS generation. (Section E7.2.3.2.2)	One NGCC plant of 1,743 net MWe; two 20 MWe solar PV at 26% capacity for a total of 10 net MWe. (Section E7.2.3.3) Total of 1,926 net MWe
Location	At existing Dominion SPS and GNCTS property.	NAPS Unit 3, Louisa County, Virginia	At existing Dominion SPS site.	At existing Dominion SPS and GNCTS property (NGCC). Solar PV unit locations determined via site selection process.
Cooling System	Closed-cycle cooling with mechanical draft cooling towers; some infrastructure upgrades may be required.	Closed-cycle cooling with mechanical draft cooling towers; some infrastructure upgrades may be required.	Closed-cycle cooling with mechanical draft cooling towers	NGCC: Closed-cycle cooling with mechanical draft cooling towers; some infrastructure upgrades may be required. Solar PV: No cooling system required
Land Requirements	83 acres on existing SPS and GNCTS property, no additional gas fields required. (Section E7.2.3.1.1)	133 acres for the plant.	50 acres for the plant.	83 acres for the NGCC plant on existing SPS and GNCTS property; 280 acres for each solar PV plant.
Workforce	Short-term increase during peak construction; smaller workforce during operations.	2,500 to 4,100 during peak construction; 500 during operations. (Section E7.2.3.2.1)	2,200 during construction; 500 during operations. (Section E7.2.3.2.2)	Short-term increase during peak construction; smaller workforce during operations.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Land Use		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR 51, Subpart A, Appendix B, Table B-1 for the following: Onsite land use Offsite land use
Termination of operations and decommissioning		**SMALL: T**emporary onsite land use changes during decommissioning are anticipated to be comparable to changes that occur during construction and operations and would not require additional land. Temporary changes in onsite land use would not change the fundamental use of the reactor site. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**MODERATE: P**lant to be constructed on forested land not previously disturbed; new gas pipeline may be co-located within existing ROW; existing gas supply assumed adequate to support NGCC plant operations.
New nuclear plant alternative	**ALWR Option**	**SMALL: P**lant to be constructed on previously disturbed land; no encroachment into wetlands during operations.
	SMR Option	**SMALL to MODERATE: P**lant to be constructed on previously disturbed land; relocation of buildings may require use of forested land not previously disturbed.
Combination of alternatives		**MODERATE: N**GCC plant to be constructed on forested land not previously disturbed; new gas pipeline may be co-located within existing ROW; existing gas supply assumed adequate to support NGCC plant operations; solar PV plants require large areas of land, impact can be lessened during site selection by building on previously disturbed land.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Visual Resources		
Proposed action		**SMALL: A**dopting by reference the Category 1 issue finding for aesthetic impacts in 10 CFR 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL: T**erminating nuclear power plant operations would not change the visual appearance of the nuclear power plant until demolition of structures. Decommissioning activities would be localized and reduced with implementation of BMPs. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL:** Construction and operations activities would appear similar to other ongoing onsite activities because the Dominion property is already aesthetically altered by the presence of existing power plants.
New nuclear plant alternative	**ALWR Option**	**SMALL: C**onstruction and operations activities would appear similar to other ongoing onsite activities because the NAPS property is already aesthetically altered by the presence of existing power plants.
	SMR Option	**SMALL: C**onstruction and operations activities would appear similar to other ongoing onsite activities because the Dominion property is already aesthetically altered by the presence of existing power plants.
Combination of alternatives		**SMALL: N**GCC plant construction and operations activities would appear similar to other ongoing onsite activities because the Dominion property is already aesthetically altered by the presence of existing power plants; solar PV plants impact can be lessened during site selection by building on previously disturbed commercial or industrial land.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Air Quality		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR 51, Subpart A, Appendix B, Table B-1 for the following: Air quality impacts (all plants) Air quality effects of transmission lines
Termination of operations and decommissioning		**SMALL:** After termination of operations, air emissions from the nuclear power plant would continue, but at greatly reduced levels. The most likely impact of decommissioning on air quality is degradation by fugitive dust. Use of BMPs, such as seeding and wetting, can be used to minimize fugitive dust. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL** (construction); **MODERATE** (operations): Construction impacts would be temporary; emission estimates during the operations period are as follows: Sulfur dioxide = 220 tons per year Nitrogen oxides = 840 tons per year Carbon monoxide = 1,940 tons per year Particulate matter = 426 tons per year Nitrous oxide = 194 tons per year Volatile organic compounds = 136 tons per year Carbon dioxide = 7.11 million tons per year
New nuclear plant alternative	**ALWR Option**	**SMALL:** Construction impacts would be temporary; operations impacts would be minor, and emissions being maintained within federal and state regulatory limits.
	SMR Option	**SMALL:** Construction impacts would be temporary; operations impacts would be minor, and emissions being maintained within federal and state regulatory limits.
Combination of alternatives		**SMALL** (construction); **MODERATE** (operations): Construction impacts would be temporary; emission estimates during the operations period are as follows: *NGCC Plant* Sulfur dioxide = 218 tons per year Nitrogen oxides = 834 tons per year Carbon monoxide = 930 tons per year Particulate matter = 424 tons per year Nitrous oxide = 193 tons per year Volatile organic compounds = 135 tons per year Carbon dioxide = 7.06 million tons per year *Solar PV Plant* The solar alternative would not release any air emissions during operation.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Noise		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for noise impacts in 10 CFR 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL:** During decommissioning, noise would generally be far enough away from sensitive receptors outside the plant boundaries that the noise would be attenuated to nearly ambient levels and would be scarcely noticeable offsite. Noise abatement procedures could also be used during decommissioning in order to reduce noise. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations are not anticipated to be greater than those currently associated with SPS.
New nuclear plant alternative	**ALWR Option**	**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would be similar to those currently associated with NAPS.
	SMR Option	**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would be similar to those currently associated with SPS.
Combination of alternatives		**SMALL:** NGCC plant noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations are not anticipated to be greater than those currently associated with SPS; noise impacts from construction activities for the solar facility would be intermittent and last only through the duration of construction; no noise impacts would occur from operation of the solar PV facility.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Geology and Soils		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for geology and soils in 10 CFR 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL:** Termination of nuclear plant operations is not expected to impact geology and soils. Erosion problems could be mitigated by using BMPs during decommissioning. Site geologic resources would not be affected by decommissioning. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
New nuclear plant alternative	**ALWR Option**	**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
	SMR Option	**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
Combination of alternatives		**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Surface Water		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR 51, Subpart A, Appendix B, Table B-1 for the following: Surface water use and quality (non-cooling system impacts) Altered current patterns at intake and discharge structures Altered salinity gradients Scouring caused by discharged cooling water Discharge of metals in cooling system effluent Discharge of biocides, sanitary waste, and minor chemical spills Surface water use conflicts (plants with once-through cooling systems) Effects of dredging on surface water quality Temperature effects on sediment transport capacity
Termination of operations and decommissioning		**SMALL:** The NRC concluded that the impacts on water use and water quality from decommissioning would be SMALL for all plants. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL:** Construction impacts would be minimized through implementation of BMPs; during operations, the use of the James River water will not impact flows in the river; cooling water discharges would be regulated under a VPDES permit.
New nuclear plant alternative	**ALWR Option**	**SMALL:** Construction impacts would be minimized through implementation of BMPs; during operations, impacts to surface water would be related to use of Lake Anna to supply circulating water, makeup water, fire-protection water, and demineralized water and water discharges to Lake Anna would be regulated under a VPDES permit to protect water quality.
	SMR Option	**SMALL:** Construction impacts would be minimized through implementation of BMPs and similar to those in the NGCC alternative; during operations, impacts to surface water would be related to use of the James River to supply circulating water, makeup water, fire-protection water, and demineralized water and water discharges would be regulated under a VPDES permit to protect water quality.
Combination of alternatives		**SMALL:** NGCC plant construction impacts would be minimized through implementation of BMPs; during operations, the use of the James River water will not impact flows in the river; cooling water discharges would be regulated under a VPDES permit; no impacts are associated with the solar PV component.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Groundwater		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for groundwater contamination and use (non-cooling system impacts) and groundwater quality degradation resulting from water withdrawals in 10 CFR 51, Subpart A, Appendix B, Table B-1. **SMALL[(a)]:** (groundwater use conflicts [plants that withdraw more than 100 gpm]): The combined groundwater withdrawals from both SPS and GNCTS (294.4 gpm) are 80% of the permitted groundwater withdrawal limit (367.8 gpm). It is not anticipated that groundwater withdrawal increases above permitted quantities will be required during the license period; therefore, Dominion concludes that impacts from groundwater withdrawals are SMALL and do not warrant additional mitigation measures. **SMALL[(a)]:** (radionuclides released to groundwater): Tritium has been measured, with one short-lived Co-58 detection. No other plant-related gamma isotopes or hard-to-detect radionuclides have been detected since initiation of the groundwater monitoring program in 2006. Since water from station uses continues to be processed and monitored in compliance with licensing and permitting, Dominion concludes that impacts from radionuclides to groundwater are SMALL and do not warrant additional mitigation measures beyond Dominion's existing groundwater monitoring program.
Termination of operations and decommissioning		**SMALL:** Decommissioning activities include some that may affect groundwater quality through the infiltration of water used for various purposes (e.g., cooling of cutting equipment, decontamination spray, and dust suppression). BMPs are expected to be employed as appropriate to collect and manage these waters. Groundwater chemistry may change as rainwater infiltrates through rubble. The increased pH could promote the subsurface transport of radionuclides and metals. However, this effect is expected to occur only over a short distance as a function of the buffering capacity of soil. Offsite transport of groundwater contaminants is not expected. (NRC. 2013a)
NGCC plant alternative		**SMALL:** During construction and operations, potable water would be supplied by a local water supply; dewatering activities, if necessary, would be regulated by a VPDES permit; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation.
New nuclear plant alternative	**ALWR Option**	**SMALL:** During construction and operations, potable water would be supplied by five new groundwater supply wells; any drawdown in the water table from dewatering activities would be limited by the proximity of Lake Anna and the discharge canal; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation.
	SMR Option	**SMALL:** During construction and operations, potable water would be supplied by a local water supply; dewatering activities would be larger than the NGCC alternative and regulated by a VPDES permit; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation. Use of groundwater would be similar to current use by SPS.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Groundwater	
Combination of alternatives	**SMALL:** During NGCC plant construction and operations, potable water would be supplied by a local water supply; dewatering activities, if necessary, would be regulated by a VPDES permit; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation; no impacts are associated with the solar PV component.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Terrestrial		
Proposed action		**SMALL: A**dopting by reference the Category 1 issue findings in 10 CFR 51, Subpart A, Appendix B, Table B-1 for the following: Exposure of terrestrial organisms to radionuclides Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds) Bird collisions with plant structures and transmission lines Transmission line right-of-way management impacts on terrestrial resources Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) **SMALL**[(a)] (effects on terrestrial resources—non-cooling system impacts): No license renewal-related refurbishment or other license renewal-related construction activities have been identified; adequate management programs and regulatory controls in place to protect onsite important terrestrial ecosystems.
Termination of operations and decommissioning		**SMALL:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect terrestrial biota, but at a reduced level of impact. Areas disturbed or used to support decommissioning are within the operational areas of the site and are also within the protected area. Decommissioning activities conducted within the operational areas are not expected to have a detectable impact on important terrestrial resources. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**MODERATE: C**onstruction results in loss of 83 acres of forested land and construction of new natural gas pipeline; NGCC plant has higher air emissions than a nuclear plant; operation of the cooling towers would cause some deposition of dissolved solids on surrounding vegetation; shadowing and fogging could also damage vegetation in close proximity to the plant; noise from the cooling tower could also impact wild life species; the cooling towers could also result in avian collisions.
New nuclear plant alternative	**ALWR Option**	**SMALL: I**mpacts would be limited to previously disturbed areas during construction with appropriate BMPs implemented; construction would disturb 0.31 acres of wetlands and 757 linear feet of ephemeral streams; cooling tower impacts would be similar to other nuclear plants with cooling towers.
	SMR Option	**SMALL to MODEERATE:** Impacts from construction would be similar to those of the NGCC alternative; however, construction activities would involve less land clearing than that of the NGCC alternative, but construction activities could last longer. Cooling tower impacts during operations would be similar to other nuclear plants with cooling towers.
Combination of alternatives		**MODERATE:** NGCC component same as for NGCC plant alternative above; solar PV plants impact can be lessened during site selection by building on previously disturbed commercial or industrial land.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Aquatic	
Proposed action	**SMALL: A**dopting by reference the Category 1 issue findings in 10 CFR 51, Subpart A, Appendix B, Table B-1 for the following: Entrainment of phytoplankton and zooplankton (all plants) Infrequently reported thermal impacts (all plants) Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication Effects of nonradiological contaminants on aquatic organisms Exposure of aquatic organisms to radionuclides Effects of dredging on aquatic organisms Effects on aquatic resources (non-cooling system impacts) Impacts of transmission line right-of-way management on aquatic resources Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses **SMALL[(a)]:** Based on past and current impingement studies, no impacts have been identified. The low-level intake structure has been previously approved as the best technology available by the VDEQ (2008 and 2012). Studies will be utilized by VDEQ to determine if the current operational methods to prevent entrainment and impingement at SPS are sufficient to meet newer best technology available requirements. **SMALL[(a)]** (impingement and entrainment of aquatic organisms-plants with once-through cooling systems or cooling ponds): While there is a small thermal plume associated with SPS discharge, it represents a *de minimis* portion of the cross-sectional and vertical area of the James River. The location of the plume does not block the movement of fish, upstream or downstream of the SPS plant. **SMALL[(a)]** (thermal impacts on aquatic organisms-plants with once-through cooling systems or cooling ponds): Issue is applicable because SPS utilizes a once-through cooling system.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Aquatic		
Termination of operations and decommissioning		**SMALL: T**he termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. Some aquatic organisms may have become established in the mixing zone because of the warmer environment, and these organisms likely would be adversely affected as the water temperature cooled and the original conditions were restored within the body of water. The NRC concluded that for facilities at which the decommissioning activities would be limited to existing operational areas, the potential impacts on aquatic resources would be SMALL. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL: I**mplementation of BMPs would minimize impacts on aquatic ecosystems during construction; during operations, less cooling water would be withdrawn; discharges would be governed under a VPDES permit.
New nuclear plant alternative	**ALWR Option**	**SMALL:** Implementation of BMPs would minimize impacts on aquatic ecosystems during construction. Aquatic life impacts resulting from operations is primarily related to the intake and discharge structures. The addition of Unit 3 is expected to increase total impingement by 3% over the existing NAPS units. Concentrations of chemical and solids would be below VPDES permit discharge limits. In addition, Unit 3 would have no perceptible impact on temperature of the discharge water. Overall, the operations-related impacts on aquatic resources under the Unit 3 nuclear plant alternative would be SMALL.
	SMR Option	**SMALL: I**mplementation of BMPs would minimize impacts on aquatic ecosystems during construction; during operations, less cooling water would be withdrawn; discharges would be governed under a VPDES permit.
Combination of alternatives		**SMALL:** Implementation of BMPs would minimize impacts on aquatic ecosystems during NGCC plant construction; during operations, less cooling water would be withdrawn; discharges would be governed under an VPDES permit; no impacts would result from the solar PV component.

a. Category 2 issue requiring site-specific evaluation.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Land Use		
Proposed action		**NO EFFECT:** No license renewal-related refurbishment or other license renewal-related construction activities have been identified. The continued operation of the site would have no adverse effects to any federally or state-listed species. The proposed SLR would have no effect on threatened, endangered, and protected species in the vicinity of SPS.
Termination of operations and decommissioning		**Site Specific:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. Some aquatic organisms may have become established in the mixing zone because of the warmer environment, and these organisms likely would be adversely affected as the water temperature cooled and the original conditions were restored within the body of water. The magnitude of impacts could vary widely based on site-specific conditions at the time of decommissioning and the presence or absence of special status species and habitats when the alternative is implemented. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**NO EFFECT:** No federally listed terrestrial species have been identified as occurring on the SPS site; state-listed species may be found in forested areas that would be cleared for the NGCC plant site and potentially on the proposed spur pipeline corridor; however, these state-listed species would likely disperse to adjacent habitat during construction activities; impacts to aquatic and avian species from maintenance activities such as dredging would be mitigated by adherence to seasonal restrictions that prevent activities during spawning periods for fish and eagle nesting.
New nuclear plant alternative	**ALWR Option**	**NO EFFECT:** No federally listed wildlife or plant species or their habitat(s) are known to occur on the NAPS site or Lake Anna. No state-listed plant species have been identified at the NAPS site; however, state-listed species could potentially occur at the NAPS site but have not been reported at the NAPS site.
	SMR Option	**NO EFFECT:** No federally listed terrestrial species have been identified as occurring on the SPS site; state-listed species may be found in forested areas that would be cleared for the SMR plant site; however, these state-listed species would likely disperse to adjacent habitat during construction activities; impacts to aquatic and avian species from maintenance activities such as dredging would be mitigated by adherence to seasonal restrictions that prevent activities during spawning periods for fish and eagle nesting.
Combination of alternatives		**NO EFFECT:** NGCC component same as for NGCC plant alternative above; the site selection process that would be used to select sites for the solar facilities would have criteria to avoid locations whose development would impact special status species.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Historic and Cultural Resources		
Proposed action		**NO ADVERSE EFFECT: N**o license renewal-related refurbishment or construction activities identified; administrative controls ensure protection of cultural resources in the event of excavation activities.
Termination of operations and decommissioning		**NO ADVERSE EFFECT: T**he termination of nuclear plant operations would not affect historic or cultural resources. The NRC conducted an analysis of the potential effects of decommissioning on historic and archaeological (cultural) resources and found that the potential onsite impacts at sites where the disturbance of lands would not go beyond the operational areas would be SMALL. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**NO ADVERSE EFFECT:** The proposed location of the NGCC plant would also require a pedestrian cultural resource survey prior to clearing to determine if historic or archaeological sites are present. In addition, if a USACE Section 404 permit is required for the project (including NGCC plant and pipeline), potential NHPA Section 106 consultation with the VDHR would be required if cultural resources are impacted by the proposed activities. Because cultural resources, both historic and archaeological, would be avoided or protected during the NGCC plant construction and operations, impacts would be SMALL.
New nuclear plant alternative	**ALWR Option**	**NO ADVERSE EFFECT: C**onstruction activities would avoid the mapped historic site and operations would have no effect on historic resources.
	SMR Option	**NO ADVERSE EFFECT: T**he proposed location of the SMR plant would also require a pedestrian cultural resource survey prior to clearing to determine if historic or archaeological sites are present. In addition, if a USACE Section 404 permit is required for the project, potential NHPA Section 106 consultation with the VDHR would be required if cultural resources are impacted by the proposed activities. Because cultural resources, both historic and archaeological, would be avoided or protected during the SMR plant construction and operations, impacts would be SMALL.
Combination of alternatives		**NO ADVERSE EFFECT:** *NGCC Plant* NGCC component same as for NGCC plant alternative above. *Solar PV Plant* Historic and archeological resources would be assessed and impacts avoided during the site selection process.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Socioeconomics	
Proposed action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR 51, Subpart A, Appendix B, Table B-1 for the following: Employment and income, recreation and tourism Tax revenues Community services and education Population and housing Transportation
Termination of operations and decommissioning	When a nuclear power plant is closed and decommissioned, most of the important socioeconomic impacts will be associated with the plant closure rather than with the decommissioning process (NRC. 2002b, Section 4.3.12). **MODERATE to LARGE:** Terminating nuclear plant operations would have a noticeable impact on socioeconomic conditions in the region around the nuclear power plant. There would be immediate socioeconomic impacts from the loss of jobs. The impacts from the loss or reduction of tax revenue due to the termination of plant operations on community and public education services could range from SMALL to LARGE. (NRC. 2013a, Section 4.12.2.1) The tax payments attributable to SPS are more than 60% of the overall tax revenues of Surry County (Section E3.9.5). The plant staff residing in Surry County, approximately 108 (Section E2.5), is a small percentage of Surry County's employed population of 3,272 (Section E3.9.1). Therefore, the loss of jobs would affect a small percentage of the population, but the revenue loss would have a noticeable and potentially destabilizing impact on Surry County. **SMALL**: Decommissioning itself has no impact on the tax base and no detectable impact on the demand for public services. The impacts of decommissioning on socioeconomics are neither detectable nor destabilizing; therefore, the impacts on socioeconomics are SMALL. (NRC. 2002b, Section 4.3.12.3 and 4.3.12.4)
NGCC plant alternative	**SMALL** (beneficial) for construction; **SMALL** for construction traffic; **MODERATE** for operations; **SMALL** for operations traffic: The jobs created to complete the construction of the NGCC plant and natural gas connection pipeline would be temporary. This alternative would result in the loss of jobs at SPS, which would translate to a reduction in local economic activity. The increase in traffic would be short-term and noticeable, and could exceed local roadway capacity during peak times given that existing units would remain operational during the construction time period. Traffic impacts associated with the operation of the NGCC plant will be minimal.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Socioeconomics		
New nuclear plant alternative	**ALWR Option**	**SMALL** (beneficial): The construction employment would be short-term and would provide a stimulus to the local economy. Plant operations employment would be long-term and would provide additional stimulus to the local economy. **MODERATE** (construction traffic): This increase in traffic would increase traffic on the roads and congestion would be noticed by commuters. Increased use of the roads during construction could create some safety and maintenance issues. **SMALL** (operations traffic): Transportation impacts would include some minor increase in NAPS site worker road use from the increase of 500 workers, equipment and materials deliveries slightly increased, and a minor increase in maintenance truck traffic.
	SMR Option	**SMALL to MODERATE** for construction; **MODERATE to LARGE** for construction traffic; **MODERATE** (beneficial) for operations; **SMALL** for operations traffic: The jobs created to complete the construction of the SMR plant would be temporary. This alternative would result in the loss of jobs at SPS, which would translate to a reduction in local economic activity. The increase in traffic would be short-term and noticeable, and could exceed local roadway capacity during peak times given that existing units would remain operational during the construction time period. Traffic impacts associated with the operation of the SMR plant will be minimal.
Combination of alternatives		**SMALL** (beneficial) for construction; **SMALL** for construction traffic; **MODERATE** for operations; **SMALL** for operations traffic: NGCC component same as for NGCC plant alternative above; **SMALL** (beneficial) for construction; **SMALL** for construction traffic; **SMALL** for operations; **SMALL** for operations traffic: The jobs created to complete the construction of the solar PV plant would less than those needed for the NGCC plant and temporary. Traffic impacts associated with the construction of the solar PV plants would less than any other alternative. Very few employees are required for maintenance and operation of the solar PV plants.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Human Health		
Proposed action		**SMALL**: Adopting by reference the Category 1 issue findings in 10 CFR 51, Subpart A, Appendix B, Table B-1 for the following: Radiation exposures to the public Radiation exposures to plant workers Human health impact from chemicals Microbiological hazards to plant workers Physical occupational hazards **SMALL**(a) (microbiological hazards to the public [plants with cooling ponds or canals or cooling towers that discharge to a river]): Impacts thermophilic microorganisms are minimized due the size of the James River, the saline and tidal influence of the estuary, the documented reduction in water temperatures surrounding the effluent discharge point, and regulatory restrictions placed on public access to the waters adjacent to the discharge structures. **SMALL**(a) (electric shock hazards): Transmission lines located entirely within Dominion property and Dominion has occupational safety and health measures in place to maintain ground clearances and minimize shock hazards from overhead lines.
Termination of operations and decommissioning		**SMALL: T**he human health impacts from physical, chemical, and microbiological hazards during the termination of plant operations and decommissioning would be SMALL for all plants. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL: C**ompliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction and operations; air emissions would be subject to regulatory standards that are protective of human health.
New nuclear plant alternative	**ALWR Option**	**SMALL: C**ompliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction; human health impacts during operation would be similar to NAPS. The radiological human health impact would be SMALL due to compliance with NRC regulations and adherence to ALARA principals.
	SMR Option	**SMALL: C**ompliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction; human health impacts during operation would be similar to SPS. The radiological human health impact would be SMALL due to compliance with NRC regulations and adherence to ALARA principals.
Combination of alternatives		**SMALL: C**ompliance with OSHA worker protection rules would control impacts on workers at acceptable levels during NGCC plant construction and operations; air emissions would be subject to regulatory standards that are protective of human health; impacts from solar PV component would be similar with no expected operational impacts.

a. Category 2 issue requiring site-specific evaluation

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Environmental Justice		
Proposed action		There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the proposed action.
Termination of operations and decommissioning		Termination of power plant operations and the resulting loss of jobs, income, and tax revenue could have a disproportionate effect on minority and low-income populations (NRC. 2013a, Section 4.12.2). **Site Specific:** The determination of whether the minority or low-income populations are disproportionately highly and adversely impacted by facility decommissioning activities needs to be made on a site-by-site basis because their presence and their socioeconomic circumstances will be site specific (NRC. 2002b, Section 4.3.13.3).
NGCC plant alternative		The closest low-income block group is located across the James River. Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of an NGCC plant alternative.
New nuclear plant alternative	**ALWR Option**	Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of a new nuclear plant alternative.
	SMR Option	The closest low-income block group is located across the James River. Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of a new nuclear plant alternative.
Combination of alternatives		The closest low-income block group for the NGCC plant is located across the James River. Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of the combination of energy alternatives.

Table E8.0-3 Environmental Impacts Comparison Detail (by Issue)

Waste Management		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR 51, Subpart A, Appendix B, Table B-1 for the following: Low-level waste storage and disposal Onsite storage of spent nuclear fuel Offsite radiological impacts of spent nuclear fuel and high-level waste disposal Mixed waste storage and disposal Nonradioactive waste storage and disposal
Termination of operations and decommissioning		**SMALL:** After termination of nuclear plant operations, there would be a period before the beginning of decommissioning when the reactor would be placed in a cold shutdown condition and maintained. The quantities of waste generated would be smaller than the quantities generated during either operations or decommissioning. The impacts associated with the management of LLRW, hazardous waste, mixed waste, and nonradioactive and nonhazardous waste during operations and decommissioning would be SMALL. (NRC. 2013a, Section 4.12.2.1)
NGCC plant alternative		**SMALL:** Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; spent selective catalytic reduction catalysts would make up the majority of the waste during operations; operations-related waste would be managed and recycled or disposed of at permitted offsite facilities.
New nuclear plant alternative	**ALWR Option**	**SMALL:** Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; during operations, nonhazardous, hazardous, and radioactive wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities.
	SMR Option	**SMALL:** Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; during operations, nonhazardous, hazardous, and radioactive wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities.
Combination of alternatives		**SMALL:** NGCC component same as for NGCC plant alternative above. Construction of the solar PV facility component of the combination alternative would create sanitary and industrial wastes, although it will be in smaller quantity as compared to the NGCC plant. All waste generated at the solar PV plants would be recycled or disposed of at an offsite waste disposal facility.

Intentionally Blank

E9.0 STATUS OF COMPLIANCE

The ER shall list all federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The ER shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land use regulations, and thermal and other water pollution limitation or requirements which have been imposed by the federal, state, regional, and local agencies having responsibility for environmental protection. [10 CFR 51.45(d)]

E9.1 SPS AUTHORIZATIONS

Table E9.1-1 provides a summary of authorizations held by SPS for current plant operations. Authorizations in this context include any permits, licenses, approvals, or other entitlements that would continue to be in place, as appropriate, throughout the period of extended operation given their respective renewal schedules. Table E9.1-2 lists additional environmental authorizations and consultations related to the renewal of the SPS Units 1 and 2 OLs.

Table E9.1-1 Environmental Authorizations for Current SPS Operations

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
CILLRWC	Omnibus Low-Level Radioactive Waste Interstate Compact Consent Act (1980; amended in 1985)	Authorization to export waste	None	Updated annually	Export of LLRW outside the region.
NRC	Atomic Energy Act [10 CFR 49]	SPS license to operate Unit 1	DPR-32	05/25/2032	Operation of SPS Unit 1.
NRC	Atomic Energy Act [10 CFR 50]	SPS license to operate Unit 2	DPR-37	01/29/2033	Operation of SPS Unit 2.
NRC	[10 CFR 51] [10 CFR 72]	ISFSI	SNM-2501	07/31/2046	Operation of a dry storage ISFSI.
USACE	Federal Clean Water Act, Section 404 [33 USC 1344]	Authorization to use regional permit	2013-RP-02 NAO-2008-1451/ VMRC#16-0710	08/14/2018 Reissuance application is in progress.	Periodic maintenance dredging of the intake channel in the James River.
USACE	Federal Clean Water Act, Section 404 [33 USC 1344]	Authorization to use nationwide permit	2012-NWP #3 NAO-2018-00103 / VMRC# 18-0069	Reissued 04/17/2018 to 03/18/2022	Maintenance of low-level intake structure debris removal.
USFWS	MBTA [50 CFR 13] [50 CFR 21.41]	Depredation permit	MB705136-0	03/31/2018	Currently, Dominion maintains a depredation permit authorizing it to take a maximum of 70 black vultures, 20 turkey vultures, and 40 Canada geese at all Dominion power generation locations (USFWS. 2017b). Because Dominion submitted its application for renewal before the expiration date, depredation permit activities are authorized until a new permit is issued.

Table E9.1-1 Environmental Authorizations for Current SPS Operations

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
VDEQ	CAA, 9VAC5-80-50 through 9VAC5-80-300 and 9VAC5-140-10 through 9VAC5-140-900	Title V permit	Registration number: PRO50336	12/31/2022	NSR and acid rain permit incorporated in to Title V permit. Title V permit is the federal operating permit.
VDEQ	CWA, Section 402; 9VAC25-790	Permit	VA0004090	02/28/2021	Once-through cooling, process water, sewage treatment plant, and stormwater discharges.
VDEQ	9VAC25-260	Permit	GW0003901	11/1/2023	Groundwater withdrawal for use as potable, process, and cooling water.
VDEQ	CWA, Section 402; 9VAC25-880	Authorization to use construction stormwater general permit	VAR106343	06/30/2019	Land disturbance activity, spoils yard.
VDEQ	18VAC160-20	Authorization to operate a wastewater treatment plant	23074	None	Wastewater treatment plant operating permit.
VDEQ	Section 307(c)(3)(A) of the Coastal Zone Management Act [16 USC 1456[c][3][A]]	Consistency determination with the Virginia Coastal Management Program	N/A	Letter from VDEQ to Dominion	Certification that SPS complies with the Virginia Coastal Management Program.
VDH	Section 3.14, Waterworks Regulations of the Virginia Department of Health	Waterworks operation permits	31810800, 3181802	N/A	Authorization of operate a non-transient non-community waterworks.
VMRC	COV Title 28.2, Chapters 12 and 13	Permit	VMRC16-0710	07/26/2021	Periodic maintenance dredging of the intake channel in the James River.
USDOT	[40 CFR 107 Subpart G]	Registration	531000020241	None	Hazardous materials shipments.

Table E9.1-2 Environmental Authorizations and Consultations for SPS License Renewal

Agency	Authority	Requirement	Remarks
NRC	Atomic Energy Act [42 USC 2011 *et seq*.]	License renewal	Applicant for federal license must submit an ER in support of license renewal application.
USFWS	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS, and NMFS if applicable, regarding federally protected species.
NMFS	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS, and NMFS if applicable, regarding federally protected species.
Virginia Marine Resource Commission	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS, and NMFS if applicable, regarding federally protected species. During the review for the first license term, the USFWS requested that this agency be contacted by Dominion to provide input to support a timely and thorough review of potential impacts to threatened and endangered species and important habitats.
Virginia Department of Agriculture and Consumer Services	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS, and NMFS if applicable, regarding federally protected species. During the review for the first license term, the USFWS requested that this agency be contacted by Dominion to provide input to support a timely and thorough review of potential impacts to threatened and endangered species and important habitats.
VDGIF	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS, and NMFS if applicable, regarding federally protected species. During the review for the first license term, the USFWS requested that this agency be contacted by Dominion to provide input to support a timely and thorough review of potential impacts to threatened and endangered species and important habitats.

Table E9.1-2 Environmental Authorizations and Consultations for SPS License Renewal

Agency	Authority	Requirement	Remarks
Virginia Department of Conservation and Recreation Division of Natural Heritage	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS, and NMFS if applicable, regarding federally protected species. During the review for the first license term, the USFWS requested that this agency be contacted by Dominion to provide input to support a timely and thorough review of potential impacts to threatened and endangered species and important habitats.
VDEQ	Clean Water Act Section 401 [33 USC 1341)	Certification or waiver	Requires applicant to provide State's certification or waiver to the federal agency issuing the license that the license is protective of the State's water quality standards.
VDEQ	Federal Coastal Zone Management Act [16 USC 1451]	Certification	Requires applicant to provide certification to the federal agency issuing the license that license renewal would be consistent with the federally approved state coastal zone management program. Based on its review of the proposed activity, the state must concur with or object to the applicant's certification.
VDEQ	Federal Coastal Zone Management Act [16 USC 1451]	Certification - response	Conditional certification was received 2/2/2018.
VDHR	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
VDHR	National Historic Preservation Act Section 106	Consultation-response	VDHR responded that SLRA "... is unlikely to adversely affect historic properties ..."
Catawba Cultural Preservation Project	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Catawba Indian Nation	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
The Delaware Nation	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.

Table E9.1-2 Environmental Authorizations and Consultations for SPS License Renewal

Agency	Authority	Requirement	Remarks
The Delaware Nation	National Historic Preservation Act Section 106	Consultation - response	The Delaware Nation responded that they concur with the consultation letter which recommended that the SLR would have no adverse effect on historic properties.
Pamunkey Tribal Government	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Cheroenhaka (Nottoway) Indian Tribe	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Cheroenhaka (Nottoway) Indian Tribe	National Historic Preservation Act Section 106	Consultation - response	The Cheroenhaka (Nottoway) Indian Tribe responded with appreciation that continuing processes and consultation would be followed as necessary.
Chickahominy Tribe	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Chickahominy Indians Eastern Division	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Mattaponi Tribe	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Nansemond Indian Tribal Association	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Nottoway Tribe	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Patawomeck Tribe	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Rappahannock Tribe	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.
Upper Mattaponi Tribe	National Historic Preservation Act Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO and/or tribal historic preservation officer.

E9.2 STATUS OF COMPLIANCE

SPS has established control measures in place to ensure compliance with the authorizations listed in Table E9.1-1, including monitoring, reporting, and operating within specified limits. SPS environmental compliance coordinators are primarily responsible for monitoring and ensuring that the site complies with its environmental permits and applicable regulations. Monitoring and sampling results associated with environmental programs are submitted to appropriate agencies, as specified in the permits and/or governing regulations.

E9.3 NOTICES OF VIOLATIONS

Based on review of records over the six-year period 2012-2017 of various environmental programs and permits that SPS is subject to and complies with, there have been no federal (i.e., agencies other than the NRC), state, or local regulatory notices of violations issued to the facility.

E9.4 REMEDIATION ACTIVITIES

As presented in Section E3.6.4.2.1, in 2012 there were three onsite liquid radioactive releases estimated to be greater than 100 gallons each. The tritium concentration in these releases ranged from approximately 1,250 to 1,450 picocuries per liter. As of December 15, 2016, tritium has been measured in the groundwater at a range of 1,330-8,340 picocuries per liter. One 2017 tritium sample from a later installed well (Piez-44) reported a concentration of 59,300 picocuries per liter. One 2018 follow-up sample for tritium reported a concentration of approximately 79,000 picocuries per liter. In addition, tritium measured as part of the ongoing GPP (see Section E3.6.4.2) is tracked and trended for reporting and corrective or improvement actions, such as remedial pumping and additional monitoring, e.g., via new wells or detection capabilities. A subject matter expert team has benchmarked the industry, and working toward zero-leakage goals has become an integrated component of the GPP. The SPS radiological GPP has detected tritium, but no plant-related gamma isotopes or hard-to-detect radionuclides since the program was initiated in 2006 (SPS. 2017b).There are no other current or ongoing remediation activities or investigations occurring at SPS.

E9.5 FEDERAL, STATE, AND LOCAL REGULATORY STANDARDS: DISCUSSION OF COMPLIANCE

E9.5.1 ATOMIC ENERGY ACT

E9.5.1.1 Radioactive Waste

Radioactive waste stream handling procedures are presented in Section E2.2.6. As a generator of both LLRW and spent fuel, SPS is subject to and complies with provisions and requirements of the Low-Level Radioactive Waste Policy Amendment Act of 1985 and the Nuclear Waste Policy Act of 1982, as subsequently amended.

E9.5.2 CLEAN AIR ACT

E9.5.2.1 Air Permit

SPS has a permit to operate oil-fired boilers, backup diesel generators, and backup electric generators (VDEQ. 2018).

Operation of these air emission sources is maintained within the emission, opacity, fuel sulfur content, and fuel usage (as applicable) limits established in the station air permit issued by the VDEQ. As required by the air permit, reports are submitted annually and semi-annually to the VDEQ. SPS is in compliance with this permit.

E9.5.2.2 Chemical Accident Prevention Provisions [40 CFR 68]

SPS is not subject to the risk management plan requirements described in 40 CFR 68 because the amount of regulated chemicals present onsite do not exceed the threshold quantities specified in 40 CFR 68.130 (VDEQ. 2018).

E9.5.2.3 Stratospheric Ozone [40 CFR 82]

Under Title VI of the CAA, the EPA is responsible for several programs that protect the stratospheric ozone layer. Regulations promulgated by the EPA to protect the ozone layer are contained in 40 CFR 82. Refrigeration appliances and motor vehicle air conditioners are regulated under Sections 608 and 609 of the CAA, respectively. A number of service practices, refrigerant reclamation, technician certification, and other requirements are covered by these programs. SPS is in compliance with Section 608 of the CAA as amended in 1990 and the implementing regulations codified in these regulations. The program to manage stationary refrigeration appliances at SPS is described in a Dominion fleet procedure (Dominion. 2014b).

Because motor vehicle air conditioners are not serviced onsite, Section 609 of the CAA is not applicable.

E9.5.3 CLEAN WATER ACT

E9.5.3.1 Water Quality (401) Certification

Federal CWA Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters provide the licensing agency with either a waiver from the state or a certification from the state that the discharge will comply with applicable CWA requirements [33 USC 1341]. During the previous license renewal, NRC accepted the VPDES permit as the 401 certification (NRC. 2002a). Dominion has been notified by VDEQ that it will require a separate 401 certification for this renewal. Dominion is coordinating with VDEQ on that process.

E9.5.3.2 VPDES Permit

VPDES Permit No. VA0004090 (Attachment B), issued by the VDEQ, authorizes the discharge of once-through cooling water, process water, treated sanitary wastewater, and stormwater to state waters. This permit expires on February 28, 2021. The application to renew the SPS VPDES permit is expected to be submitted to the VDEQ in 2020. The application for renewal will include the results of the impingement and entrainment studies discussed in Section E3.7.7.1.1, in addition to the 316(b) §122.21(r)(2)-(13) submittal requirements in accordance with the rule's technical and schedule requirements.

VPDES Permit Regulation 9VAC25-31-165.C requires existing facilities with cooling water intake structures to meet the requirements under §316(b) of the CWA which mandates that for permits issued before July 14,2018, for which an alternate schedule has been established for the submission of information required by 40 CFR 122.21(r), must include interim BTA requirements in the permit based on best professional judgment on a site-specific basis. A special condition was added in the VPDES permit. It outlines interim BTA practices to minimize impingement and entrainment (I&E) mortality and adverse impacts to aquatic organisms.

As presented in Section E3.6.1.2.1, there are 28 outfalls (six external and 22 internal) identified in the VPDES permit. Monitoring results associated with these outfalls are submitted in discharge monitoring reports to the VDEQ at the frequency specified in the permit. SPS has maintained compliance with the VPDES permit over the years from 2012-2017. A warning letter regarding elevated BOD was received in October 2016. Corrective actions were implemented and follow-up sampling indicated the initial elevated BOD condition was temporary. (VDEQ. 2016b) An NOV was also not issued for one Enterococci bacteria sampling result exceeding previous reporting results in January 2017.

There are no plant operations or modifications planned for the proposed SLR operating term that would alter the thermal discharge. Construction activities resulting in land disturbance of greater than one acre must apply for permit coverage under the DEQ Construction General Permit Number VAR10, which grants authorization to discharge under the Virginia Stormwater Management Program (VSMP) and the Virginia Stormwater Management Act. SPS will comply with this general permit should any construction activities be required at the site.

E9.5.3.3 Industrial Stormwater Discharge

As presented in Section E3.6.1.2.2, stormwater discharges associated with SPS industrial activities are regulated and controlled through VPDES Permit No. VA0004090 issued by the VDEQ. SPS samples stormwater runoff at VPDES Outfalls 050, 051, 052, and 053 on a quarterly basis and analyzes for pollutants as specified in the permit. SPS is also required to develop, maintain, and implement an SWPPP for the facility that identifies potential sources of pollution that would reasonably be expected to affect the quality of stormwater and identify the BMPs that will be used to prevent or reduce the pollutants in stormwater discharges (Attachment B). SPS is in compliance with the terms and conditions of the VPDES permit as it relates to the stormwater program.

E9.5.3.4 Sanitary Wastewaters

As previously presented in Section E3.6.1.2.3, SPS is equipped with its own sewage treatment plant. Additionally, wastewater from the low-level restroom trailers at SPS is pumped and transported offsite for treatment. Wastewater from GNCTS is pumped and transported offsite for treatment. With the exception of the low-level intake restrooms, sanitary wastewater from SPS locations is collected and treated in the sewage treatment plant, where it is treated and then discharged to Internal Outfall 101, which then discharges to Outfall 001. Discharge of treated sanitary wastewater from SPS is regulated by SPS's VPDES Permit No. VA0004090 (Attachment B). Authorization for SPS to operate the sewage treatment plant was granted by the VDEQ under Certificate to Operate No. 23074 (VDEQ. 2007).

Because sanitary wastewaters at SPS are collected in sewage lift stations at the plant and treated in a sewage treatment unit prior to discharge to the James River, SPS is required to employ or contract at least one Class II licensed wastewater works operator for the sewage treatment facility. The license must be issued in accordance with Title 54.1 of the Code of Virginia and the regulations of the Board for Waterworks and Wastewater Works Operators and Onsite Sewage Professionals (Attachment B). SPS maintains onsite certified wastewater operators; therefore, the site is in compliance with this program.

E9.5.3.5 Spill Prevention, Control, and Countermeasures

The EPA's Oil Pollution Prevention Rule became effective January 10, 1974, and was published under the authority of Section 311(j)(1)(C) of the Federal Water Pollution Control Act. The regulation has been published in 40 CFR 112, and facilities subject to the rule must prepare and implement an SPCC plan to prevent any discharge of oil into or upon navigable waters of the United States or adjoining shorelines. SPS is subject to this rule and has a written SPCC plan that identifies and describes the procedures, materials, equipment, and facilities that are utilized at the station to minimize the frequency and severity of oil spills in order to meet the requirements of this rule (Dominion. 2014c).

E9.5.3.6 Reportable Spills [40 CFR 110]

SPS is subject to the reporting provisions of 40 CFR 110 as it relates to the discharge of oil in such quantities as may be harmful pursuant to Section 311(b)(4) of the Federal Water Pollution Control Act. Any discharges of oil in such quantities that may be harmful to the public health or welfare or the environment must be reported to the U.S. Coast Guard (USCG) National Response Center. Based on review of site records from 2012-2017, one inadvertent release of approximately eight gallons of glycol-based hydraulic fluid occurred during cleaning of the Unit 2 D service water intake bay. The release was reported to VDEQ and no NOV resulted.

E9.5.3.7 Reportable Spills [§62.1-44.34:19]

SPS is also subject to the reporting provisions of the State Water Control Law §62.1-44.34:19 (Article 11). This reporting provision requires that any release of oil in a quantity of 25 gallons or greater to the environment be reported to the VDEQ, the coordinator of emergency services of the locality that could reasonably be expected to be impacted, and appropriate federal authorities. Based on review of records from 2012-2017, one inadvertent release of approximately eight gallons of glycol-based hydraulic fluid occurred during cleaning of the Unit 2 D service water intake bay. The release was reported to VDEQ and no NOV resulted. No sheen was observed nor impact to state waters resulted.

E9.5.3.8 Facility Response Plan

SPS is not subject to the facility response plan risk requirements described in 40 CFR 112.20 because the facility does not transfer oil over water to or from vessels and does not store oil in quantities greater than one million gallons.

E9.5.3.9 Section 404 Permit

As presented in Section E3.6.1.2.4, SPS performs maintenance dredging operations of the intake channel every 3-4 years. These activities are authorized under a USACE Norfolk District Regional Permit 02 (Permit No. NAO-2008-1451/VMRC#16-V0710). The State Water Control Board provided conditional Section 401 water quality certification for this regional permit should new dredging be determined necessary.

The condition applies to new dredging projects in water body segments on the current effective Section 303(d) total maximum daily load (TMDL) priority list or water body segments with an approved TMDL.

Maintenance dredging for previously authorized projects is exempt from this requirement provided that (USACE. 2013):

a. A permit from the Norfolk District Corps for the initial dredging must have been received for the area proposed for maintenance dredging.
b. Maintenance dredging is limited to the removal of material accumulated after the initial authorized dredging.
c. Areas to be dredged and dredged depths shall not exceed those specified by the original authorization.

Therefore, the activities qualifying for the regional permit meet the requirements of VDEQ water protection permit regulation, provided that the permittee abides by the conditions of the regional permit (USACE. 2016). No other current operations at SPS require a Section 404 permit. The station would comply with regulatory requirements imposed by the USACE as it relates to performing future activities in federal jurisdictional wetland areas when appropriate.

E9.5.4 SAFE DRINKING WATER ACT

As presented in Section E2.2.3.3, potable water for SPS is supplied by a 4,000-gallon hydropneumatic tank. Water is supplied to these tanks via the onsite well water supply system. Hypochlorinator equipment provides a means of chlorinating the domestic water supply. As the operator of a non-transient non-community waterworks, SPS is subject to the Safe Drinking Water Act. State governments, such as Virginia's, are approved to implement these rules and drinking water standards for the EPA through waterworks regulations. Virginia has established secondary standards (nuisance-related) for drinking water in the waterworks regulations.

Title 12 of VAC Agency 5, Chapter 590 (12VAC5-590) regulates the operation of public waterworks in Virginia. SPS maintains a waterworks operation permit, issued by the Virginia Department of Health Office of Drinking Water. This permit authorizes the operation of public waterworks in accordance of Part 2 of the waterworks regulations. SPS is classified as a non-transient non-community waterworks. SPS is restricted to a design capacity of 28,000 gpd. SPS maintains compliance with this permit.

E9.5.5 ENDANGERED SPECIES ACT

Potential impacts on federally and state-listed species were considered in Dominion's review and analysis in Section E4.6, and it was concluded that none would likely be adversely affected as a result of SLR.

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of species that are listed, or proposed for listing, as endangered or threatened. Depending on the action involved, the ESA requires consultation with the USFWS, and with the NMFS if marine or anadromous species could be affected. Although Dominion invited comment from the USFWS and NMFS (Attachment C) during the development of this ER, a more structured consultation process with these agencies may be initiated by the NRC per Section 7 of the ESA.

E9.5.6 MIGRATORY BIRD TREATY ACT

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell birds listed, and grants protection to any bird parts, including feathers, eggs, and nests. Dominion has historically maintained a USFWS depredation permit (Table E9.1-1) for the selective take of up to 70 black vultures, 20 turkey vultures, and 40 Canada geese (USGS. 2017b).

E9.5.7 BALD AND GOLDEN EAGLE PROTECTION ACT

The BGEPA prohibits the take, transport, sale, barter, trade, import and export, and possession of eagles, making it illegal for anyone to collect eagles and eagle parts, nests, or eggs without a USFWS permit. Bald eagles are known to nest on the SPS site; therefore, consultation with the USFWS is conducted prior to new activities and maintenance activities to ensure compliance with the BGEPA. There are currently no BGEPA permitting requirements associated with SPS operations.

E9.5.8 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

As presented in Section E3.7.8.5, according to the 2009 EFH final amendment, potential EFH exists within the proposed project area for the following species:

- All life stages of the sandbar shark
- All life stages of the Atlantic butterfish
- All life stages of the summer flounder
- All life stages of the black sea bass
- All life stages of the bluefish

Dominion has chosen to invite comment by the NMFS. Dominion initiated correspondence with the NMFS by letter, and is awaiting the agency's response. Attachment C includes a copy of Dominion correspondence with the NMFS, regarding the potential effects that SPS SLR might have on EFH and habitat areas of particular concern.

E9.5.9 MARINE MAMMAL PROTECTION ACT

The Marine Mammal Protection Act prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. There are currently no Marine Mammal Protection Act permitting requirements associated with SPS operations.

E9.5.10 COASTAL ZONE MANAGEMENT ACT

The federal Coastal Zone Management Act (CZMA) [16 USC 1451 et seq.] imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. The CZMA requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program [16 USC 1456(c)(3)(A)]. NOAA has promulgated implementing regulations indicating that the requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The regulation requires that the license applicant provide its certification to the federal licensing agency and a copy to the applicable state agency [15 CFR 930.57(a)].

The NRC's Office of Nuclear Reactor Regulation has issued guidance to its staff regarding compliance with the CZMA. This guidance acknowledges that Virginia has an approved coastal zone management program (NRC. 2013d). SPS, located in Surry County, is within the Virginia coastal zone (Tidewater Virginia).

SLR is a new federal action which triggers the requirement for a new certification. To meet the requirements of the federal consistency review, Dominion has developed a CZMA consistency certification for this project, which is located within Virginia's designated coastal zone. The certification demonstrates the project is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Zone Management Program (VCP) and will be conducted in a manner consistent with the program. VDEQ responded with a conditional concurrence on February 2, 2018. Attachment E includes a copy of Dominion's and VDEQ's correspondence regarding a certification of compliance with Virginia's coastal zone policies. Therefore, SPS has fulfilled the regulatory requirement to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved VCP for the Virginia coastal zone (VDEQ. 2017c).

E9.5.11 NATIONAL HISTORIC PRESERVATION ACT

Potential impacts on historic properties are presented in Section E4.7. As previously presented in Section E3.8.6, cultural resources on the SPS site are protected by Dominion's historic resources consultation guidance (Dominion. 2009b) and Dominion's CRDP, which is specifically applicable to SPS and NAPS. The guidance document and the CRDP ensure that cultural resources are protected from unauthorized removal and that, in the event ground disturbance is required in these areas, coordination with the VDHR (serving as Virginia's SHPO) is conducted. The guidance protects known cultural resources (e.g., the Lawnes Creek Church site), as well as unknown cultural resources, by establishing a process for all activities that require a federal permit or use federal funding, or have the potential to impact historic resources.

Section 106 of the NHPA [54 USC 306108] requires federal agencies having the authority to license any undertaking, prior to issuing the license, to consider the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for establishing an agreement with any SHPO to substitute state review for council review [35 CFR 800.7]. Although not required of an applicant by federal law or NRC regulation, Dominion has chosen to invite comments by the SHPO, and has received the agency's response. Attachment D includes a copy of Dominion correspondence with the SHPO, regarding potential effects that SPS SLR might have on historic or cultural resources.

E9.5.12 RESOURCE CONSERVATION AND RECOVERY ACT

E9.5.12.1 Nonradioactive Waste

As a generator of hazardous and nonhazardous wastes, SPS is subject to and complies with Resource Conservation and Recovery Act (RCRA) and specific VDEQ regulations contained in 9 VAC 20 - 81 (Solid Waste Management Regulations). SPS is classified as a small quantity generator of hazardous waste; therefore, hazardous waste routinely makes up only a small percentage of the total waste generated. As a generator of hazardous waste, SPS also maintains a hazardous waste generator identification number (Table E9.1-1). Dominion maintains an electronic waste management database known as the Waste Disposal Management System (WDMS). Dominion tracks all waste disposal, including hazardous waste, within this database. Dominion is able to check trends in disposal and recycling efforts by using the information in the database and can make informed decisions about more appropriate future disposal and recycling opportunities. (Dominion. 2015a)

For most hazardous waste records, the regulations require that records be retained for at least three years from the date the hazardous waste, for which the record pertains, is last shipped offsite. It is a Dominion BMP to maintain most records for a minimum of five years in accordance with the Dominion record retention schedule. (Dominion. 2015a)

E9.5.12.2 Reportable Spills [40 CFR 262]

SPS is subject to the reporting provisions of 40 CFR 262.34(d)(5)(iv)(C) as it relates to a fire, explosion, or other release of hazardous waste, which could threaten human health outside the facility boundary or when the facility has knowledge that a spill has reached surface water. Any such events must be reported to the national response center. As presented in Section E3.6.4.2.1, in 2012, there were three onsite liquid radioactive releases estimated to be greater than 100 gallons each. The tritium concentration in these releases ranged from approximately 1,250 to 1,450 picocuries per liter. These spills were voluntarily reported to county and state officials, and to the NRC. As of December 15, 2016, tritium has been measured in the groundwater at a range of 1,330-8,340 picocuries per liter, with short-lived Co-58 detected once. One 2017 tritium sample from a later installed well (Piez-44) reported a concentration of 59,300 picocuries per liter. One follow-up sample for tritium reported a concentration of approximately 79,000 picocuries per liter. In addition, tritium measured as part of the ongoing GPP (see Section E3.6.4.2) is tracked and trended for reporting and corrective or improvement actions, such as remedial pumping and additional monitoring, e.g., via new wells or detection capabilities. The SPS radiological GPP has detected tritium, but not any plant-related gamma isotopes or hard-to-detect radionuclides, since the groundwater monitoring program was initiated in 2006 (SPS. 2017b).

Based on review of site records from 2012-2017, one inadvertent release of approximately eight gallons of glycol-based hydraulic fluid occurred during cleaning of the Unit 2 D service water intake bay. The release was reported to VDEQ and no NOV resulted.

E9.5.12.3 Mixed Waste

Radioactive materials are regulated by the NRC under the Atomic Energy Act of 1954, and hazardous waste is regulated by the EPA under the RCRA of 1976. Management of radioactive waste is presented in Section E2.2.6. Dominion has developed guidance documents for managing its hazardous waste streams, including mixed waste. In addition, Dominion inspects its waste management areas for compliance with applicable regulations and permits on a weekly basis using a facility waste inspection checklist. Dominion's management of its waste streams is in compliance with applicable regulatory standards and has not resulted in any notices of violation for the 2012-2017 time frame. Dominion would continue to store and dispose of hazardous and nonhazardous waste in accordance with EPA and state regulations, and dispose of the waste in appropriately permitted treatment and disposal facilities during the proposed SLR operating term. As indicated in Section E4.6.6.4.2, SPS has not had a mixed waste stream in the last six years. Also, Dominion has not claimed the mixed waste storage exemption in 40 CFR 266, Subpart N. As indicated in the 2013 GEIS, SPS will continue to utilize existing systems and procedures to ensure proper storage and disposal.

E9.5.12.4 Underground Storage Tanks [§62.1-44.34:19]

SPS has four underground storage tanks onsite. Two 20,000-gallon diesel tanks are maintained on the site for the emergency diesel generator fuel supply. These tanks are governed by the NRC and are exempt from registration with the state. They are buried in tornado- and missile-protected casing.

Dominion maintains two USTs within the garage, one 4,000-gallon gasoline tank and one 8,000-gallon diesel tank. These tanks are registered with the Commonwealth of Virginia. These tanks are subject to the release response and corrective action requirements specified in 9VAC25 Chapter 80. SPS is in compliance with these requirements.

E9.5.12.5 Reportable Spills [§62.1-44.34:19]

SPS is subject to the reporting provisions of State Water Control Law §62.1-44.34:19 (Article 11) as it relates to discovering the release of a regulated substance from an underground storage tank containing a petroleum product. Any such events must be reported to the VDEQ. There have been no releases at SPS that have triggered this notification from 2012-2017.

E9.5.13 POLLUTION PREVENTION ACT

In accordance with RCRA Section 3002(b) and 40 CFR 262.27, a small or large quantity generator must certify that there is a waste minimization program in place to reduce the volume and toxicity of the waste generated to the degree determined to be economically practical. SPS is meeting this requirement as procedural measures are in place to minimize hazardous waste generated to the maximum extent practical.

E9.5.14 FEDERAL INSECTICIDE, FUNGICIDE AND RODENTCIDE ACT

Commercially approved herbicides such as Pramitol® and Roundup® are applied by a licensed contractor on an as-needed basis to control vegetation. Pesticides are also applied inside buildings by a licensed contractor. Fertilizers or soil conditioners are not used at SPS. Because only contractors who have obtained a license as specified in 2VAC5-685 conduct pesticide/herbicide applications onsite, SPS is in compliance with the requirements of this act.

E9.5.15 TOXIC SUBSTANCES CONTROL ACT

The Toxic Substances Control Act of 1976 regulates PCBs [40 CFR 761] and asbestos [40 CFR 763]. Of the two, only asbestos is present at SPS, as all PCBs were removed in the late 1990s. Any asbestos removal and disposal on the site is managed in accordance with the Dominion asbestos management procedure. SPS is in compliance with all PCB and asbestos regulations applicable to the facility.

E9.5.16 HAZARDOUS MATERIALS TRANSPORTATION ACT

Because SPS ships hazardous materials that are regulated by the DOT offsite, the facility is subject to and complies with the applicable requirements of the Hazardous Materials Transportation Act described in 49 CFR, including the requirement to possess a current hazardous materials certificate of registration (Table E9.1-1).

E9.5.17 EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT

E9.5.17.1 Section 312 Reporting [40 CFR 370]

SPS is subject to and complies with Section 312 of the Emergency Planning and Community Right-to-Know Act that requires annual submittal of an emergency and hazardous chemical inventory report (Tier II) to the local emergency planning commission, the state emergency response committee, and the local fire department. This report typically includes, but is not limited to, chemicals such as ammonium hydroxide, boric acid, carbon dioxide, diesel fuel, electrohydraulic fluid, ethylene glycol, gasoline, hydrazine, hydrogen, lube oils, Nalco products, nitrogen, sodium hydroxide, and sulfuric acid.

E9.5.18 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

SPS is subject to the hazardous substance release and reporting provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as subsequently amended. Any release of reportable quantities of listed hazardous substances to the environment requires a notification to the USCG National Response Center, the VDEQ, and the Virginia Department of Emergency Management, as appropriate, and subsequent written follow-up within 15 days of the release. Based on a review of records over the six-year period 2012-2017, there have been no releases at SPS that have triggered this notification requirement.

E9.5.19 FARMLAND PROTECTION POLICY ACT

The Farmland Protection Policy Act (FPPA) only applies to federal programs. The term "federal program" under this act does not include federal permitting or licensing for activities on private or non-federal lands. Therefore, because license renewal is considered a federal licensing activity and SPS is located on non-federal lands, the FPPA is not applicable.

E9.5.20 FEDERAL AVIATION ACT

Coordination with the Federal Aviation Administration (FAA) is required when it becomes necessary to ensure that the highest structures associated with a project do not impair the safety of aviation. Submission of a letter of notification (with accompanying maps and project description) to the FAA would result in a written response from the FAA certifying that no hazard exists or recommending project changes and/or the installation of warning devices such as lighting.

At SPS, the site elevation is dominated by the 159-foot-high containment structure and the 151.2-foot high meteorological tower. No license renewal-related construction activities have been identified; therefore, no new notifications to the FAA are required.

E9.5.21 OCCUPATIONAL SAFETY AND HEALTH ACT

OSHA governs the occupational safety and health of the construction workers and the operations staff. SPS and its contractors comply with OSHA's requirements, as these are incorporated in the site's occupational health and safety practices.

E9.5.22 STATE WATER WITHDRAWAL REPORTING

In accordance with 9VAC25-200-10, et seq., the VDEQ requires that all major water withdrawers keep accurate records of water withdrawals within their facilities and report such withdrawals to the state on an annual basis. SPS withdraws surface water exempt from permitting requirements, but reports based on the monthly average flow reported in the facility's monthly discharge monitoring report. SPS permitted groundwater withdrawals are reported based on well records. SPS is in compliance with these reporting requirements.

E9.5.23 SURRY COUNTY ZONING REQUIREMENTS

The Surry County Comprehensive Plan update designates the SPS property as a general industrial district. As presented in Section E3.4, the Surry County zoning ordinance does not include established maximum permissible sound limits for receiving land use categories. Surry County zoning ordinance provisions assert that buffer zones are necessary to insure the protection and well-being of neighboring areas. The Surry County zoning ordinance requires at least a 25-foot buffer yard with small evergreen trees and one row of evergreen shrubs when property with A-R (Agricultural-Rural Residence District) zoning is located adjacent to property with M-2 zoning (General Industrial District) (SC. 2016b). SPS is in compliance with this zoning ordinance and provides approximately 2,000 feet of buffer between SPS and the nearest residence.

E9.6 ENVIRONMENTAL REVIEWS

Dominion has procedural controls in place to ensure that environmentally sensitive areas at SPS, if present, are adequately protected during site operations and project planning (Dominion. 2014d). These controls, which encompass nonradiological environmental resource areas such as land use, air quality, surface water and groundwater, terrestrial and aquatic ecology, historic and cultural resources, and waste management and pollution prevention, consist of the following:

- Appropriate local, state, and/or federal permits are obtained or modified as necessary.
- BMPs, including for stormwater, are implemented to protect wetlands, natural heritage areas, and sensitive ecosystems.
- Appropriate agencies are consulted on matters involving federally and state-listed threatened, endangered, and protected species; BMPs are implemented to minimize impacts to these species.
- Appropriate agencies are consulted on matters involving cultural resources and to ensure BMPs are implemented to minimize impacts to this resource.

In summary, Dominion's administrative controls ensure that appropriate local, state, and/or federal permits are obtained or modified as necessary, that cultural resources and threatened and endangered species are protected if present, and that other regulatory issues are adequately addressed as necessary.

E9.7 ALTERNATIVES

The discussion of alternatives in the ER shall include a discussion of whether alternatives will comply with such applicable environmental quality standard and requirements [10 CFR 51.45 (d)].

The natural gas combined cycle plant, new nuclear, and combination of natural gas combined cycle, solar PV, and DSM combination alternatives presented in Chapter 7 would be constructed and operated to comply with applicable environmental quality standards and requirements. While alternative generation would be developed and operated compliant with standards and requirements, additional environmental impacts associated with siting, construction, and operation would be realized. Continued compliant operation of SPS would not result in these additional impacts.

E10.0 REFERENCES

61 FR 28483. Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rule. Federal Register 61:28483 (June 5, 1996).

69 FR 52040. Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions. Final policy statement. Federal Register 69:52040 (August 24, 2004).

78 FR 37282. Revisions to Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. Final rule. Federal Register 78:37282 (June 20, 2013).

79 FR 48300. National Pollutant Discharge Elimination System - Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities. Environmental Protection Agency. Federal Register 79:48300 (August 15, 2014).

81 FR 31532. Generic Determinations Regarding the Environmental Impacts of Spent Fuel Storage and Disposal When Considering Nuclear Power Reactor License Applications. U.S. Nuclear Regulatory Commission. Federal Register 81:31532 (May 19, 2016).

81 FR 35701. Endangered and Threatened Species; Designation of Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of Atlantic Sturgeon. Federal Register, 81:35701-35732 (June 3, 2016).

82 FR 39160. Endangered and Threatened Species; Designation of Critical Habitat for the Endangered New York Bight, Chesapeake Bay, Carolina and South Atlantic Distinct Population Segments of Atlantic Sturgeon and the Threatened Gulf of Maine Distinct Population Segment of Atlantic Sturgeon. Final rule. Federal Register, 82:39160 (August 17, 2017).

83 FR 19108. Captain John Smith Chesapeake National Historic Trail Advisory Council Notice of Public Meeting. Meeting notice. Federal Register 83:19108 (May 01, 2018).

Argonne National Laboratory. 2013. Updated Greenhouse Gas and Criteria Air Pollutant Emission Factors of the U.S. Electric Generating Units in 2010. September 2013.

Balazik, M. T., Garman, G. C., Eenennaam, J. P., Mohler, J., & Woods, L. C. 2012 "Empirical Evidence of Fall Spawning by Atlantic Sturgeon in the James River, Virginia." Transactions of the American Fisheries Society, 141(6), 1465-1471.

Balazik, M. 2017. First Verified Occurrence of the Shortnose Sturgeon (Acipenser brevirostrum) in the James River, Virginia. National Marine Fisheries Service. Fishery Bulletin 115:196-200 (February 2, 2017),

BEA. 2017. Regional Economic Data-Virginia, Isle of Wight County, Surry County, Newport News (Independent City), James City County (Williamsburg). Retrieved from

<https://www.bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1> (accessed January 16, 2017).

BLS. 2017. Regional Unemployment Data-Virginia, Isle of Wight County, Surry County, Newport News (Independent City), Williamsburg (Independent City). Retrieved from <https://data.bls.gov/cgi-bin/dsrv?la> (accessed January 16, 2017).

CBF. 2018. Hampton Roads, Virginia: Bridging the Chesapeake Bay and Atlantic Ocean. Retrieved from <http://www.cbf.org/about-the-bay/more-than-just-the-bay/chesapeake-destinations/hampton-roads-virginia.html> (accessed March 7, 2018).

CCB. 2016. Mapping Portal, "VA Eagle Nest Locator" layer. Retrieved from: <http://www.ccbbirds.org/maps/> (accessed November 2016).

CCB. 2017. CCB Mapping Portal, "VA Eagle Nest Locator" layer. Retrieved from: <http://www.ccbbirds.org/maps/> (accessed November 2017).

CCRM. 2016. Climate Change Impacts in Virginia: A natural resource database. Retrieved from <http://ccrm.vims.edu/coastal_zone/climate_change_db/examples/environmental_page.htm> (accessed March 20, 2017).

CH2MHill. 2006. Draft Comprehensive Demonstration Study, Surry Power Station. Revision 1. November 17, 2006.

Congress.gov. 2018. H.R. 984 - Thomasina E. Jordan Indian Tribes of Virginia Federal Recognition Act of 2017. Retrieved from <https://www.congress.gov/bill/115th-congress/house-bill/984> (accessed March 7, 2018).

County Office. 2016. Find Government Offices in Your County. Retrieved from <http://www.countyoffice.org/va-williamsburg-city-hospitals/> (accessed December 29, 2016).

COV. 2016 "Comprehensive plan to be prepared and adopted; scope and purpose-Code of Virginia §15.2-2223." Retrieved from <http://law.lis.virginia.gov/vacode/title15.2/chapter22/section15.2-2223/> (accessed December 28, 2016).

Crater PDC. 2017. Rural Transportation Priority List Six-Year Improvement Program (SYIP). Retrieved from <http://www.craterpdc.org/> (accessed February 20, 2017).

CRI. 2013 "Visual Effects Assessment for the Proposed Dominion Virginia Power Surry to Skiffes Creek 500 kV Transmission Line Project and Skiffes Creek 500-230-115 kV Switching Station James City, Isle of Wight, and Surry Counties." Prepared for Dominion Virginia Power.

CSA. 1863. Army, Department of Northern Virginia. Chief Engineer's Office, Albert H Campbell, Charles E Cass ell, Walter Izard, J. Houston Patton, and C. F. N Smith. Map of Surry, Sussex and

Southampton Counties, Virginia. Map. Retrieved from the Library of Congress <https://www.loc.gov/item/gvhs01.vhs00380/> (accessed May 26, 2017).

CWF. 2016. Colonial Williamsburg 2015 Annual Report, A Year of Change. May 2016. Retrieved from <https://www.history.org/Foundation/Annualrpt14/index.cfm> (accessed February 22, 2017).

Dominion. 2006. North Anna Early Site Permit Application, Part 3, Environmental Report. Revision 9. September 2006.

Dominion. 2009a. Guidance Document: Migratory Birds. September 17, 2009.

Dominion. 2009b. Historic Resources Consultation Guidance. December 16, 2009.

Dominion. 2010a. Turbine Retrofit. Surry Power Station, Unit 1. Design Change Number 08-021. January 2010.

Dominion. 2010b. Core Isotopic Inventories for Surry Dose Consequence Analyses Based on the Alternative Source Term. Calculation No. RA-0008, Revision 0. May 3, 2010.

Dominion. 2012. Annual Update and Emissions Statements for 2011, Dominion Gravel Neck CT Station and Dominion Surry Power Station, Registration No. 50336. Submitted to Virginia Department of Environmental Quality, Piedmont Regional Office, Glen Allen, VA. March 20, 2012.

Dominion. 2013a. Guidance Document: Non-Hazardous Waste Management, Revision 1. November 4, 2013.

Dominion. 2013b. Annual Update and Emissions Statements for 2012, Dominion Gravel Neck CT Station and Dominion Surry Power Station, Registration No. 50336. Submitted to Virginia Department of Environmental Quality, Piedmont Regional Office, Glen Allen, VA. March 15, 2013.

Dominion. 2013c. Flora and Fauna Habitat Management on Transmission and Distribution Rights-of-Way in Virginia. Guidance Document. August 26, 2013.

Dominion. 2014a. Annual Update and Air Emissions Statements for 2013, Dominion Gravel Neck CT Station and Dominion Surry Power Station, Registration No. 50336. Submitted to Virginia Department of Environmental Quality, Piedmont Regional Office, Glen Allen, VA. April 15, 2014.

Dominion. 2014b. Management of Ozone Depleting Substances Including Chlorofluorocarbon (CFC) Refrigerants and Halon. May 9, 2009.

Dominion. 2014c. Guidance Document: Spill & Release Notification/Reporting. December 5, 2014.

Dominion. 2014d. Environmental Policy Statement, Dominion Policies and Procedures. June 2014.

Dominion. 2015a. Guidance Document: Hazardous Waste Management, Revision 1. December 30, 2015.

Dominion. 2015b. Gravel Neck Combustion Turbine Station and Surry Power Station: Title V Renewal Application Update, Air Operating Permit Application, Virginia Department of Environmental Quality Registration Number 50336. April 9, 2015.

Dominion. 2015c. Annual Update and Air Emissions Statements for 2014, Dominion Gravel Neck CT Station and Dominion Surry Power Station, Registration No. 50336. Submitted to Virginia Department of Environmental Quality, Piedmont Regional Office, Glen Allen, VA. April 15, 2015.

Dominion. 2016a "Surry-Skiffes Creek 500-kV and Skiffes Creek-Whealton 230-kV Projects." Retrieved from <https://www.dom.com/corporate/what-we-do/electricity/transmission-lines-and-projects/surry-skiffes-creek-500kv-and-skiffes-creek-whealton-230kv-projects> (accessed December 20, 2016).

Dominion. 2016b. Work Practice Document: Safety. Dominion Environmental Services Safety Committee. Revision 1. January 2016.

Dominion. 2016c. Surry Power Station Dredge Material Management Area (DMMA), Virginia Electric and Power Company (Schnabel Engineering DMMA Project Plans). July 2016.

Dominion. 2016d. Dominion Nuclear Engineering CAD Data Supporting Drawing No. 11448-FE-30A, Revision 9-ARRGT Plan Main & Unit Sta. Serv. Transformers, Surry Power Station, Units 1 & 2; Drawing No. 11448-FY-1B, Revision 18-Site Plan, Surry Power Station Unit 1 & 2; Drawing No. 11448-FE-30E, Revision 2-Arrangement Plan Reserve Station Service Transformer, Surry Power Station Unit 1; Drawing No. 11448-FY-5A, Revision 19-Site Utilization Plan, Surry Power Station. October 23, 2016.

Dominion. 2016e. Dominion Nuclear Engineering CAD Data Supporting Drawing No. 11448-FY-1D, Revision 36-Plot Plan, Surry Power Station; Drawing No. 11448-FY-5A, Revision 19-Site Utilization Plan, Surry Power Station. October 23, 2016.

Dominion. 2016f. Dominion Nuclear Engineering CAD Data Supporting Drawing No. 11448-FY-1B, Revision 18-Site Plan, Surry Power Station Unit 1 & 2; Drawing No. 11448-FY-1C, Revision 10-Site Plan, East River Bank, Surry Power Station, Unit 1; Drawing No. 11448-FY-1D, Revision 36-Plot Plan, Surry Power Station; Drawing No. 11448-FY-5A, Revision 19-Site Utilization Plan, Surry Power Station. October 23, 2016.

Dominion. 2016g. Dominion Nuclear Engineering CAD Data Supporting Drawing No. 11448-FY-1B, Revision 18-Site Plan, Surry Power Station Unit 1 & 2; Drawing No. 11448-FY-5A, Revision 19-Site Utilization Plan, Surry Power Station. October 23, 2016.

Dominion. 2016h. Annual Update and Air Emissions Statements for 2015, Dominion Gravel Neck CT Station and Dominion Surry Power Station, Registration No. 50336. Submitted to Virginia Department of Environmental Quality, Piedmont Regional Office, Glen Allen, VA. April 14, 2016.

Dominion. 2016i. North Anna 3 Combined License Application Part 3: Applicants' Final Safety Analysis Report - Combined License Stage. Revision 8. June 2016.

Dominion. 2016j. North Anna Combined License Application Part 3: Applicant's Environmental Report-Combined License Stage. Revision 8. June 2016.

Dominion. 2016k. Dominion Nuclear Engineering CAD Data Supporting Drawing No. 11448-FB-1E, Revision 13-Sub-Surface Drainage, Key Plan, Surry Power Station, Unit 1; Drawing No. 11448-FY-1B, Revision 18-Site Plan, Surry Power Station Unit 1 & 2; Drawing No. 11448-FY-5A, Revision 19-Site Utilization Plan, Surry Power Station. October 23, 2016.

Dominion. 2016l. Guidance Document: Invasive Species Management. October 3, 2016.

Dominion. 2017a. Guidance Document: Waste Vendor Selection & Evaluation. February 16, 2017.

Dominion. 2017b. Annual Update and Air Emissions Statements for 2016, Dominion Gravel Neck CT Station and Dominion Surry Power Station, Registration No. 50336. Submitted to Virginia Department of Environmental Quality, Piedmont Regional Office, Glen Allen, VA.

Dominion. 2017c. Electric Distribution Engineering Manual. January 2017.

Dominion. 2017d. Blue Book: Information and Requirements for Electric Service. 2017 Edition.

Dominion. 2017e. MACCS2 Model for Surry Subsequent License Renewal Application. Calculation No. SM-1801. April 19, 2017.

Dominion. 2017f. Surry Power Station Probabilistic Risk Assessment Notebook, Part V PRA Risk Analysis, PRA Input into MACCS2 for Surry Subsequent License Renewal. NOTEBK-PRA-SPS-RA.048, Revision 0. April 2017.

Dominion. 2018. Virginia Electric and Power Company's a Report of its Integrated Resource Plan Before the Virginia State Corporation Commission and North Carolina Utilities Commission. Public Version. May 1, 2018.

Dominion and Bechtel. 2002. Study of Potential Site for the Deployment of New Nuclear Plants in the United States. U.S. Department of Energy Cooperative Agreement No. DE-FC07-02ID14313. September 27, 2002. Retrieved from <http://www.portsfuture.com/(Editor)_!78/Study%20of%20Potential%20Sites%20for%20Nuclear%20Plants.pdf> (accessed August 29, 2017).

EIA. 2016. Levelized Cost of New Generation Resources in the Annual Energy Outlook 2016, Tables 1a and B1a. Retrieved from <https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf> (accessed March 16, 2017).

EIA. 2017. Approximate Heat Content of Natural Gas, Table A4. Retrieved from <https://www.eia.gov/totalenergy/data/monthly/pdf/sec13_4.pdf> (accessed March 17, 2017).

ENERCON. 2016. Record of Teleconference between P. Wells, Dominion, and D. Giron, Enercon Services, Inc. SPS Nonradioactive Waste Inc. November 17, 2016.

Energy Solutions. 2017. Waste Management Facilities. Retrieved from <http://www.energysolutions.com/waste-management/facilities/> (accessed January 12, 2017).

Enterprise Academy. 2016. About Enterprise Academy, 2016. Retrieved from <http://enterprise.nn.k12.va.us/about.html> (accessed December 29, 2016).

EPA. 1999 "Level III and IV Ecoregions of Delaware, Maryland, Pennsylvania, Virginia, and West Virginia." July 1999.

EPA. 2000. Air Pollutant Emission Factors.Vol.1, Stationary Point Sources and Area Sources, Section 3.1, Stationary Gas Turbines for Electricity Generation, AP-42. September 2000. Retrieved from <http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf>.

EPA. 2015. EPA Center for Corporate Climate Leadership, Greenhouse Gas Emissions Factors Hu "Emission Factors for Greenhouse Gas Inventories, Table 1." November 2015. Retrieved from <https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub> (accessed April 11, 2017).

EPA. 2016a. "Overview of the Drinking Water Source Sole Source Aquifer Program/Sole Source Aquifers for Drinking Water." Retrieved from <https://www.epa.gov/dwssa/overview-drinking-water-sole-source> (accessed December 20, 2016).

EPA. 2016b. "EPA Sole Source Aquifers - Data.gov" Retrieved from <https://catalog.data.gov/dataset/epa-sole-aquifers> (accessed December 20, 2016).

EPA. 2017. Energy and Environment, "Greenhouse Gas Equivalencies Calculator-Calculations and References." Retrieved from <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator> (accessed April 26, 2017).

EPRI. 2011. Mapping and Assessment of Ocean Wave Energy Resource. December 2011.

ERC. 2016. 2016 Directory of Waste-to-Energy Facilities. Retrieved from <http://energyrecoverycouncil.org/wp-content/uploads/2016/06/ERC-2016-directory.pdf> (accessed March 17, 2017).

ESH. 2016. Eastern State Hospital, 2016. Retrieved from <http://esh.dbhds.virginia.gov/main.html> (accessed December 29, 2016).

ESRI. 2016 "Living Atlas of the World-Basemaps." Retrieved from <http://doc.argis.com/en/living-atlas/#s=0&subCat=1&type=All&area=All&md=basemap:1000> (accessed November 30, 2016).

EV. 2018. Cities of Virginia. Retrieved from <https://www.encyclopediavirginia.org/Cities_of_Virginia#its1> (accessed June 21, 2018).

FEMA. 2014. Flood Insurance Study, City of Norfolk, Virginia (Independent City). August 14, 2014. Retrieved from <https://www.norfolk.gov/firmupdate> (accessed August 29, 2017).

FEMA. 2016 "FEMA Flood Map Service Center-National Flood Hazard Layer (NFHL) Data, Virginia." Retrieved from <https://msc.fema.gov/portal> (accessed November 29, 2016).

Foster, et.al. 2016. Foster, A.M., P. Fuller, A. Benson, S. Constant, D. Raikow, J. Larson, and A. Fusaro. Corbicula fluminea. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Revision date January 8, 2016. Retrieved from <https://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=92> (accessed November 2016).

FRI. 2007. Boring Log. Surry Wells & Piezometers, Surry Power Plant, Hog Island Road, Surry, Virginia. Report No. H60-0463D. January 2007.

GDNR. 2016. Blackbanded sunfish. Retrieved from <http://www.georgiawildlife.com/sites/default/files/uploads/wildlife/nongame/pdf/accounts/fishes/enneacanthus_chaetodon.pdf> (accessed November 2016).

Governing. 2016. Police Employment, Officers Per Capita Rates for U.S. Cities: Newport News, 2015. Retrieved from <http://www.governing.com/gov-data/safety-justice/police-officers-per-capita-rates-employmentfor-city-departments.html> (accessed December 29, 2016).

HDR. 2016a. Draft Entrainment Characterization Study Plan. Prepared for Dominion Resources Services, Inc. May 29, 2016.

HDR. 2016b. Draft Impingement Characterization Study Plan. Prepared for Dominion Resources Services, Inc. May 29, 2016.

HDR. 2017. 2015-2016 Impingement Characterization Study Report, Draft Final. Surry Power Station, VPDES Permit VA0004090. April 3, 2017.

Hotchkiss, Jedediah. 1871. Preliminary Map of Surry County, Virginia. Map. Retrieved from the Library of Congress <https://www.loc.gov/item/2005625190/> (accessed June 29, 2017).

HRSD. 2017. Service Area. Retrieved from <http://www.hrsd.state.va.us/servicearea.shtml> (accessed February 24, 2017).

IWC. 2016a. "Isle of Wight County, VA Comprehensive Plan, August 5, 2011." Retrieved from <http://www.co.isle-of-wight.va.us/planning-and-zoning/document-library/comprehensive-plan/> (accessed December 28, 2016).

IWC. 2016b. Isle of Wight County Sheriff's Office, 2016. Retrieved from <http://www.isleofwightsheriffsoffice.com/> (accessed December 29, 2016).

IWC. 2017a. Economic Development Community Profile, "Demographics and Quality of Life." Retrieved from <http://insidetheisle.com/publications/> (accessed on January 4, 2017).

IWC. 2017b. Isle of Wight-Smithfield-Windsor Chamber of Commerce, Business Directory. Retrieved from <http://theisle.chambermaster.com/list/> (accessed February 27, 2017).

IWCM. 2016 "Fort Huger Historic Site." Retrieved from <http://www.historicisleofwight.com/fort-huger.html> (accessed November 29, 2016).

Jorden et al. 1976. Ecological Study of the James River Segment Encompassing Hog Point. Special Scientific Report No. 78. Virginia Institute of Marine Science.

JRA. 2016 "About the James River." Retrieved from <http://jrava.org/about-the-james-river/> (accessed December 12, 2016).

LBGI. 2001 "Cultural Resource Assessment: Surry Power Station." Prepared for Dominion Resources, Inc.

LBGI. 2013 "Archaeological Survey of the BDB Storage Building Surry Power Station: Surry County, Virginia." Prepared for Dominion Resources, Inc. VDHR File No.: 2013-0742.

MACTEC. 2008. Groundwater Gauging and Automated Water-Level Monitoring Report for Surry Nuclear Power Station. January 31, 2008.

Malcolm Pirnie. 2009. Aquifer Test Report for the Upper Potomac Aquifer (Well E). March 2009.

McFarland, E. R., and T. S. Bruce. 2006 "The Virginia Coastal Plain Hydrogeologic Framework." U.S. Geological Survey Professional Paper 1731, 118 p., 25 pls. Retrieved from <http://pubs.water.usgs.gov/pp1731/>.

Military.com. 2016 "Navy: More Submarine Work Coming to Newport News Shipyard." March 30, 2016. Retrieved from <http://www.military.com/daily-news/2016/03/30/navy-more-submarine-work-coming-newport-news-shipyard.html> (accessed March 16, 2017).

MRLC. 2016 "National Land Cover Database-2011." Retrieved from <http:/www.mrlc.gov/finddata.php> (accessed November 17, 2016).

NAVSEA. 2017. Norfolk Naval Shipyard. Retrieved from <http://www.navsea.navy.mil/Home/Shipyards/Norfolk/> (accessed March 16, 2017).

NCBM. 2016 "Population Overview 2010-2036." Retrieved from <https://www.osbm.nc.gov/facts-figures/demographics> (accessed December 2, 2016).

NCEI. 2017a. Storm Events Database. Surry County, Virginia. Event type: Thunderstorm Wind. Retrieved from <https://www.ncdc.noaa.gov/stormevents/> (accessed March 13, 2017).

NCEI. 2017b. Storm Events Database. Surry County, Virginia. Event type: Tornado. Retrieved from <https://www.ncdc.noaa.gov/stormevents/> (accessed March 13, 2017).

NCEI. 2017c. Storm Events Database. Surry County, Virginia. Event type: Hurricane (Typhoon). Retrieved from <https://www.ncdc.noaa.gov/stormevents/> (accessed March 13, 2017).

NCES. 2016. National Center for Education Statistics-Common Core of Data, 2015. Retrieved from <http://nces.ed.gov/> (accessed December 22, 2016).

NCSL. 2016 "Federal State Recognized Tribes." Retrieved from <http://www.ncsl.org/research/state-tribal-institute/list-of-federal-and-state-recognized-tribes.aspx#federal> (accessed November 28, 2016).

NEI. 2007. Industry Groundwater Protection Initiative - Final Guidance Document. August 2007.

NEI. 2017. Model SLR New and Significant Assessment Approach for SAMA. NEI Report 17-04, Revision 0. June 2017.

NETL. 2010a "Life Cycle Analysis: Natural Gas Combined Cycle (NGCC) Power Plant, DOE/NETL-403-110509." Retrieved from <http://netl.doe.gov/research/energy-analysis/publications/details?pub=6c2fe989-d368-4bf5-8e5f-3bd85ff79f8f> (accessed August 26, 2014).

NETL.2010b. Estimating Freshwater Needs to Meet Future Thermoelectric Generation Requirements: 2010 Update. September 30, 2010. Retrieved from <https://www.netl.doe.gov/File%20Library/Research/Coal/energy%20systems/gasification/2010_Water_Needs_Analysis.pdf> (accessed March 17, 2017).

NMFS. 2009. Final Amendment 1 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan, Essential Fish Habitat. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division. Silver Spring, MD. Public Document.

NMFS. 2012. Surry Power Station Section 7 Consultation Letter from Daniel Morris, Acting Regional Administrator, NMFS.

NN. 2016 "Newport News Comprehensive Plan." Retrieved from <https://www.nngov.com/1763/Comprehensive-Plan> (accessed December 28, 2016).

NNEDA. 2017. Newport News-Where Great Things Are Happening. Retrieved from <http://newportnewsva.com/> (accessed June 13, 2017).

NNS. 2017. About Newport News Shipbuilding. Retrieved from <http://nns.huntingtoningalls.com/who-we-are/> (accessed January 17, 2017).

NOAA. 2015.Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus). Retrieved from <http://www.fisheries.noaa.gov/pr/species/fish/atlantic-sturgeon.html> (accessed November 2016).

NOAA. 2016a. Local Climatological Data, 2016 Annual Summary with Comparative Data for Richmond, Virginia (KRIC). Retrieved from <https://www.ncdc.noaa.gov/IPS/lcd/lcd.html> (accessed March 3, 2017).

NOAA. 2016b. Local Climatological Data, 2016 Annual Summary with Comparative Data for Norfolk, Virginia (KORF). Retrieved from <https://www.ncdc.noaa.gov/IPS/lcd/lcd.html> (accessed March 3, 2017).

NOAA. 2016c. EFH Location Query Report. Retrieved from <http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html> (accessed November 16, 2016).

NPS. 2016a. "Tribes-State-Recognized Virginia Indian Tribes." Retrieved from <https://home.nps.gov/jame/learn/historyculture/virginia-indian-tribes.htm/index.htm> (accessed December 27).

NPS. 2016b. "Boundaries-Park Boundaries." Retrieved from <https://irma.nps.gov/DataStore/> (accessed November 21, 2016).

NPS. 016c. "Data Store-Administrative Boundaries of National Park System Units Shapefile and National Register of Historic Places (NRHP) Geodatabase." Retrieved from <http://irma.nps.gov/DataStore/> (accessed November 21, 2016).

NPS. 2016d. Peregrine Falcon. Retrieved from <https://www.nps.gov/shen/learn/nature/falcon.htm> (accessed November 14, 2016).

NPS. 2017. Colonial National Historical Park and Annual Park Recreation Visitation (1904-Last Calendar Year). Retrieved from <https://www.nps.gov/colo.index.html> (accessed January 27, 2017).

NPS. 2018. National Register of Historic Places, NPGallery Digital Asset Search. Retrieved from <https://npgallery.nps.gov/nrhp> (accessed February 15, 2018).

NRC. 1972. Final Environmental Statement Related to Operation of Surry Power Station Unit 1. Docket No. 50-280, May 1972.

NRC. 1990a. Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants. NUREG-1150, Vol. 1. December 1990.

NRC. 1990b. Evaluation of Severe Accident Risks: Surry Unit 1. NUREG/CR-4551, SAND86-1309, Vol. 3, Revision 1, Part 1. October 1990.

NRC. 1996a. Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. NUREG-1440. May 1996.

NRC. 1996b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. NUREG-1437, Section C.1.4, Revision 0. May 1996.

NRC. 1997. Regulatory Analysis Technical Evaluation Handbook. NUREG/BR-0184. January 1997.

NRC. 1998. Code Manual for MACCS2: Volume 1, User's Guide. NUREG/CR-6613, SAND97-0594, Vol. 1. May 1998.

NRC. 1999. Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants. NUREG-1437, Addendum 1, Main Report, Section 6.3-Transportation, Table 9.1 Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants. August 1999.

NRC. 2002a. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Surry Power Station, Units 1 and 2. NUREG-1437, Supplement 6. November 2002.

NRC. 2002b. Generic Environmental Impacts Statement on Decommissioning of Nuclear Facilities. NUREG-0586, Supplement 1. October 2002.

NRC. 2004. Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission. NUREG/BR-0058, Revision 9. September 2004.

NRC. 2006. Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site. NUREG-1811, Vol 1.

NRC. 2007. Meteorological Monitoring Programs for Nuclear Power Plants. Regulatory Guide 1.23, Revision 1. March 2007.

NRC. 2010. Supplemental Environmental Impact Statement for the Combined License (COL) for North Anna Power Station 3. NUREG-1917. February 2010.

NRC. 2013a. Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants. NUREG-1437, Vols. 1, Revision 1. June 2013.

NRC. 2013b. Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications. Regulatory Guide 4.2, Supplement 1, Revision 1. June 2013.

NRC. 2013c. Environmental Impact Statement for Combined License (COL) for Enrico Fermi Unit 3. Final Report. NUREG-2105, Vols. 1 and 2. January 2013.

NRC. 2013d. NRR Office Instruction No. LIC-203-Procedural Guidance for Preparing Categorical Exclusions, Environmental Assessments, and Considering Environmental Issues. Revision 3. July 1, 2013.

NRC. 2013e. U.S. Nuclear Regulatory Commission Memorandum and Order regarding the Atomic Safety and Licensing Board's Referred Ruling in LBP-13-1. Commission Order CLI-13-07. October 31, 2013.

NRC. 2014a. Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel. Final Report. NUREG-2157. September 2014.

NRC. 2014b. Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants: Limerick Generating Station, Units 1 and 2-Final Report. NUREG-1437, Supplement 49. August 2014.

NRC. 2015. Reassessment of NRC's Dollar per Person-Rem Conversion Factor Policy. Draft Report for Comment. NUREG-1530, Revision 1. August 2015.

NRC. 2016a. Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Regarding LaSalle County Station, Units 1 and 2. Final Report. NUREG-1437, Supplement 57. August 2016.

NRC. 2016b. Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2014, NUREG-0713, Vol. 36. February 2016.

NREL. 2013. Land-use Requirements for Solar Power Plants in the United States. June 2013.

NuScale. 2016. NuScale Standard Plant Design Certification Application. Part 2 - Tier 2. Chapter One, Introduction and General Description of the Plant. Revision 0. December 2016.

NWF. 2013. Virginia's Climate Modeling and Species Vulnerability Assessment: How Climate Data Can Inform Management and Conservation. Retrieved from <http://www.bewildvirginia.org/climate-change/virginias-climate-vulnerability-assessment.pdf> (accessed March 21, 2017).

NYDEC. 2016a. Eastern Tiger Salamander Fact Sheet. Retrieved from <http://www.dec.ny.gov/animals/7143.html> (accessed December 8, 2016).

NYDEC. 2016b. Henslow's Sparrow Fact Sheet. Retrieved from <http://www.dec.ny.gov/animals/59554.html> (accessed November 22, 2016).

NYDEC. 2016c. Loggerhead Shrike Fact Sheet. Retrieved from <http://www.dec.ny.gov/animals/7092.html> (accessed November 14, 2016).

NYDEC. 2018. Black Rail Fact Sheet. Retrieved from <http://www.dec.ny.gov/animals/61344.html> (accessed February 9, 2018).

NYNHP. 2016.Conservation Guide for Tri-colored Bat. Retrieved from <http://www.acris.nynhp.org/report.php?id=7409> (accessed November 2016).

Portnoy, J. 2018. Trump Signs Bill Recognizing Virginia Indian Tribes. The Washington Post, January 30, 2018. Retrieved from <https://www.washingtonpost.com/local/virginia-politics/trump-signs-bill-recognizing-virginia-indian-tribes/2018/01/30/8a46b038-05d4-11e8-94e8-e8b8600ade23_story.html> (accessed February 1, 2018).

PV. 2016. Bacon's Castle. Retrieved from <http://presservationvirginia.org/visit> (accessed November 28, 2016).

RDC. 2017 "Our Services". Retrieved from <https://www.riversideonline.com/services/index.cfm> (accessed February 27, 2017).

RDH. 2016. Riverside Doctors' Hospital Williamsburg, 2016. Retrieved from <http://riversideonline.com/rdhw/about-us.cfm> (accessed December 29, 2016).

RRMC. 2017 "About Us." Retrieved from <https://www.riversideonline.com/rrmc/> (accessed March 1, 2017).

SC. 2016a. "Surry County Comprehensive Plan Update, Parts A and B." Retrieved from <http://www.surrycountyva.gov/uploads/docs/COMPREHENSIVE%20PLAN%20PART%20A. pdf> and <http://www.surrycountyva.gov/uploads/docs/COMPREHENSIVE%20PLAN%20PART%20B. pdf> (accessed December 23, 2016).

SC. 2016b "Surry County Zoning Ordinance, Parts I and II (effective March 4, 2013)." Retrieved from <http://www.surrycountyva.gov/uploads/docs/Zoning%20Ordinance%20(eff%203-4-13)%20part%20I.pdf> and <http://www.surrycountyva.gov/uploads/docs/Zoning%20Ordinance%20(eff%203-4-13)%20part%20II.pdf> (accessed December 23, 2016).

SC. 2016c. Surry County, Virginia-A Community Profile. Retrieved from <http://www.surrycountyva.gov/page/economic-development/> (accessed December 20, 2016).

SC. 2017a. Surry County Sheriff's Office. Retrieved from <http://www.surrycountyva.gov/departments/sheriff/> (accessed February 27, 2017).

SC. 2017b. Comprehensive Annual Financial Report FY 15-16. Retrieved from <http://www.surrycountyva.gov/departments/finance-&-information-technology/broadband-project-information-> (accessed February 28, 2017).

SC. 2017c. Comprehensive Annual Financial Report FY 11-12. Retrieved from <http://www.surrycountyva.gov/departments/finance-&-information-technology/broadband-project-information-> (accessed February 28, 2017).

SC. 2017d. Comprehensive Annual Financial Report FY 12-13. Retrieved from <http://www.surrycountyva.gov/departments/finance-&-information-technology/broadband-project-information-> (accessed February 28, 2017).

SC. 2017e. Comprehensive Annual Financial Report FY 13-14. Retrieved from <http://www.surrycountyva.gov/departments/finance-&-information-technology/broadband-project-information-> (accessed February 28, 2017).

SC. 2017f. Comprehensive Annual Financial Report FY 14-15. Retrieved from <http://www.surrycountyva.gov/departments/finance-&-information-technology/broadband-project-information-> (accessed February 28, 2017).

SCS. 2016. Stormwater Pollution Prevention Plan for the Surry Power Station and Gravel Neck Combustion Turbine Facility (SWPPP). Report to Dominion Generation Electric Environmental Services and Projects. Williamsburg, Virginia.

SCVA. 2017 "GIS Viewer-Parcel Ownership and Parcel Boundary Data." Retrieved from <http://www.surrycountyva.gov/news/article/february/22/2010/surry-county-gis-avialable> (accessed February 21, 2017).

SCVT. 2016 "National Register of Historic Places in Surry County, VA." Retrieved from <https://surrycountytourism.com/index.html> (accessed November 30, 2016).

SMC. 2016. Health Horizon Services, Inc.-Locations and Hours. Retrieved from <http://hhsinc.net/#> (accessed December 29, 2016).

SPS. 2001. Application for Renewed Operating Licenses, Surry Power Station, Units 1 and 2, Appendix E, Applicant's Environmental Report-Operating License Renewal Stage, Surry Power Station, Units 1 and 2, Virginia Electric & Power Company. Richmond, Virginia. May 2001.

SPS. 2008. Modification of Virginia Pollutant Discharge Elimination System (VPDES) Permit Number VA0004090. Surry Power Station. January 7, 2008.

SPS. 2010. Surry/Gravel Neck Power Stations, Ground Water Withdrawal Permit GW0003900. Response to DEQ's Comments. August 12, 2010.

SPS. 2011. Surry Power Station, Units 1 and 2 Annual Radioactive Effluent Release Report for Year 2010. April 29, 2011.

SPS. 2012. Surry Power Station, Units 1 and 2 Annual Radioactive Effluent Release Report for Year 2011. April 25, 2012.

SPS. 2013a. Surry Power Station, Units 1 and 2 Annual Radioactive Effluent Release Report for Year 2012. April 26, 2013.

SPS. 2013b. Surry Power Station, Units 1 and 2 Annual Radiological Environmental Operating Report for Year 2012. April 26, 2013.

SPS. 2014a. Surry Power Station, Units 1 and 2 Annual Radiological Environmental Operating Report for Year 2013. April 26, 2014.

SPS. 2014b. Surry Power Station, Units 1 and 2 Annual Radioactive Effluent Release Report for Year 2013. April 26, 2014.

SPS. 2015a. Dominion-Surry Power Station Ground Water Withdrawal Permit# GW0003901 Revised Ground Water Conservation & Management Plan. November 24, 2015.

SPS. 2015b. Surry Power Station, Units 1 and 2 Annual Radiological Environmental Operating Report for Year 2014. April 20, 2015.

SPS. 2015c. Surry Power Station, Units 1 and 2 Annual Radioactive Effluent Release Report for Year 2014. April 20, 2015.

SPS. 2016a. Surry Power Station Updated Final Safety Analysis Report, Revision 48.02. November 30, 2016.

SPS. 2016b. Design Change: SU-15-01065 Revision 005. August 30, 2016.

SPS. 2016c. Surry Power Station and Gravel Neck, Virginia Pollutant Discharge Elimination System (VPDES) Permit Number VA0004090. February 29, 2016.

SPS. 2016d. Surry Power Station, Units 1 and 2 Annual Radiological Environmental Operating Report for Year 2015. May 2, 2016.

SPS. 2016e. Surry Power Station, Units 1 and 2 Annual Radioactive Effluent Release Report for Year 2015. May 2, 2016.

SPS. 2017a. Surry Power Station, Units 1 and 2 Annual Radioactive Effluent Release Report for Year 2016. Undated report for year from January 1, 2016 to December 31, 2016.

SPS. 2017b. Surry Power Station Radiological Environmental Monitoring Program for Year 2016. Undated report for year from January 1, 2016 to December 31, 2016.

Swearingen, J.M. and S. Adams. 2008. Fact Sheet: Japanese Stiltgrass. National Park Service. Retrieved from: <https://www.nps.gov/plants/alien/fact/pdf/mivi1.pdf> (accessed November 10, 2016).

SWPE. 2016. "Busch Gardens Williamsburg Virginia Theme Park." Retrieved from <https://seaworldparks.com/en/buschgardens-williamsburg/> (accessed December 23, 2016).

TEA. 2016. TEA, AECOM 2015 Theme Index, Global Attractions Attendance Report. Retrieved from <www://www.teaconnect.org/Resources/Theme-Index/> (accessed January 27, 2017).

Thayer, D. D. and I.A. Pfingsten. 2016. Alternanthera philoxeroides. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Revision date: May 16, 2016. Retrieved from <https://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=227> (accessed November 10, 2016).

Thayer, D. D., I.A. Pfingsten, L. Cao, and L. Berent. 2016. Potamogeton crispus. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. Revision date: March 18, 2016. Retrieved from <https://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=1134> (accessed November 2016).

TRB. 2010. Highway Capacity Manual (HCM).

TVA. 2016. Clinch River Nuclear Site Early Site Permit Application Part 3, Environmental Report, Revision 0.

USACE. 1999. The Highway Methodology Workbook Supplement, Wetland Functions and Values, A Descriptive Approach. New England District.

USACE. 2013. CENAO-REG 13-RP-02 Regional Permit. Effective Date: August 14, 2013. Expiration Date: August 14, 2018

USACE. 2016. Surry Power Station Dredge Permit. Number NAO-2008-1451/VMRC#16-V0710. June 20, 2016.

USACops. 2016. USACOPS-Virginia Police Departments, Sheriff's Offices, and Other Law Enforcement Agencies. Retrieved from <http://www.usacops.com/va/newportn.html> (accessed December 29, 2016).

USCB. 2015. American Fact Finder. Table ID S0804, "Means of Transportation to Work by Selected Characteristics for Workplace Geography, 1-Year Estimates, Transportation and Warehousing, and Utilities". Retrieved from <https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml#> (accessed April 13, 2017).

USCB. 2016a. "American Fact Finder, 2000 and 2010 census counts and 2015 ACS 1-year estimates County NC and VA". Retrieved from <http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml> (accessed November 16, 2016).

USCB. 2016b. "American Fact Finder, 2000, 2010, 2011-2015 ACS 5-year estimates Place NC and VA". Retrieved from <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t> (accessed December 16, 2016).

USCB. 2016c "Geographic Terms and Concepts-American Indian, Alaska Native and Hawaiian." Retrieved from https://www.census.gov/geo/reference/gtc/gtc_aiannha.html#tdsa (accessed November 22, 2016).

USCB. 2016d. "TIGER/Line Shapefiles, 2010, 2015, and 2016". Retrieved from <http://www.census.gov/cgi-bin/geo/shapefiles2010/main> (accessed October 6, 2016).

USCB. 2016e. American FactFinder-Housing Characteristics 2000, 2010, 2011 through 2015. Retrieved from <https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml> (accessed December 21, 2016).

USCB. 2016f. "American Fact Finder, 2011-2015 ACS 5-year estimates, State NC and VA." Retrieved from <https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#none> (accessed December 14, 2016).

USCB. 2016g. "Special Release-Census Blocks with Population and Housing Unit Counts 2010 NC and VA". Retrieved from <http://www.census.gov/geo/maps-data/data/tiger.html> (accessed November 16, 2016).

USCB. 2016h. "American Fact Finder, 2011-2015 ACS 5-year estimates Block Groups, NC and VA." Retrieved from <https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml> (accessed December 14, 2016).

USDA. 1986. Soil Survey of Isle of Wight County, Virginia, USDA Natural Resource Conservation Service. Issued September 1986.

USDA. 2016a "Geospatial Data Gateway-Geospatial Data Warehouse." Retrieved from <https://gdg.sc.egov.usda.gov> (accessed October 6, 2016).

USDA. 2016b. "Census Volume1, Chapter 2: County Level Data, 2012." Retrieved from <https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/Virginia/> (accessed December 20, 2016).

USDA. 2016c. "NRCS Web Soil Survey, Soil Survey Geographic (SSURGO) Database-Surry County, Virginia." Retrieved from <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm?TARGET_APP=Web_Soil_Survey_application_sbwftvp1ovxbs0gqmkbjkxrx> (accessed November 29, 2016).

USDA. 2016d "National Agriculture Imagery Program (NAIP) Imager Web Map Service (WMS), 2014 Virginia 1-Meter Aerial Imagery." Retrieved from <https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/> (accessed November 21, 2016).

USDOI. 1998. [1990; 1992]"Guidelines for Evaluating and Documenting Traditional Cultural Properties." National Register of Historic Places, Bulletin No. 38. Retrieved from <http://www.nps.gov/nr/publications/bulletins/nrb38/> (accessed November 11, 2014).

USDOI. 2016a "Bureau of Indian Affairs-Indian Lands of Federally Recognized Tribes of the United States." Retrieved from <https://www.bia.gov/> (accessed November 28, 2016).

USDOI. 2016b. "Bureau of Indian Affairs-2015 Pamunkey Indian Tribe VA." Retrieved from <https://www.bia.gov/WhoWeAre/AS-IA/OFA/DecidedCases/Petition323/index.htm> (accessed November 28, 2016).

USDOT. 2016. "National Transportation Atlas Databases (NTAD) 2015." Retrieved from <http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_atlas_database/2015/index.html> (accessed November 17, 2016).

USFA. 2016. U.S. Fire Administration-Fire Department Registry. Retrieved from <https://apps.usfa.fema.gov/registry/> (accessed December 27, 2016).

USFWS. 2010. Sensitive Joint Vetch Aeschynomene virginica. Retrieved from <https://www.fws.gov/northeast/pdf/Sensitive_jointvetch.pdf> (accessed November 2016).

USFWS. 2011a. Chesapeake Bay Coastal Program. Retrieved from <https://www.fws.gov/chesapeakebay/coastpgm.html> (accessed February 27, 2017).

USFWS. 2011b. Roseate Tern: North American Subspecies Sterna dougallii dougallii. Retrieved from <https://www.fws.gov/northeast/pdf/roseatetern0511.pdf> (accessed December 11, 2016).

USFWS. 2012. Rufa Red Knot Listing. Retrieved from <https://www.fws.gov/northeast/redknot/pdf/DRAFT_QAs_red_knot_finallisting_120814_FINAL.pdf> (accessed November 10, 2016).

USFWS. 2015a. Bald Eagle Fact Sheet. Retrieved from <https://www.fws.gov/midwest/Eagle/recovery/biologue.html> (accessed November 14, 2016).

USFWS. 2015b. Northern Long-Eared Bat. Retrieved from <https://www.fws.gov/Midwest/endangered/mammals/nleb/pdf/NLEBFactSheet01April2015.pdf> (accessed November 10, 2016).

USFWS. 2015c. Email correspondence from S. Hoskin, USFWS, to M. Overton, Dominion Energy. December 9, 2015.

USFWS. 2016a. Species Profile for Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus). Retrieved from <https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E0A7> (accessed December 2016).

USFWS. 2016b. "National Wetlands Inventory State Downloads, Virginia Geodatabase." Retrieved from <https://www.fws.gov/wetlands/Data/State-Downloads.html> (accessed November 14, 2016).

USFWS. 2016c. Species by County Report. Retrieved from <https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=51181> (accessed November 6, 2016).

USFWS. 2016d. All About Piping Plovers. Retrieved from <https://www.fws.gov/plover/facts.html> (accessed February 12, 2018).

USFWS. 2016e. Red-cockaded woodpecker. Retrieved from <https://www.fws.gov/rcwrecovery/rcw.html> (accessed November 10, 2016).

USFWS. 2016f. Small Whorled Pogonia Isotria medeoloides. Retrieved from <https://www.fws.gov/midwest/Endangered/plants/pdf/smallwhorledpogoniafctsht.pdf> (accessed November 10, 2016).

USFWS. 2016g. Species Profile for Bachman's sparrow (Aimophila aestivalis). Retrieved from <http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B07F#crithab> (accessed November 10, 2016).

USFWS. 2016h. Fire Management Species Profile: Bachman's Sparrow (Peucaea aestivalis). Retrieved from <https://www.fws.gov/southeastfire/documents/Bachmans-Sparrow_Fire-Mgmt.pdf> (accessed November 10, 2016).

USFWS. 2017a. Critical Habitat Mapper for Threatened and Endangered Species. Retrieved from <https://fws.maps.arcgis.com/home/item.html?id=9d8de5e265ad4fe09893cf75b8dbfb77> (accessed February 20, 2017).

USFWS. 2017b. Dominion Resources Services, Inc., dba Environmental Services. Depredation Permit MB705136-0. Effective 04/01/2017. April 10, 2017.

USGS. 2008. Private Domestic Well Characteristics and the Distribution of Domestic Withdrawals among Aquifers in the Virginia Coastal Plain. Scientific Investigations Report 2007-5250.

USGS. 2015 "Incorporating Induced Seismicity in the 2014 United States National Seismic Hazard Model-Results of the 2014 Workshop and Sensitivity Studies, Open-File Report 2015-1070." Retrieved from <https://pubs.usgs.gov/of/2015/1070/pdf/ofr2015-1070.pdf/> (accessed February 6, 2017).

USGS. 2016a. "National Hydrography Dataset (NHD)-Virginia Geodatabase." Retrieved from <http://nhd.usgs.gov/> (accessed November 17, 2016).

USGS. 2016b "Water Resources NSDI Node-Physiographic Divisions of the Conterminous U.S." Retrieved from <https://water.usgs.gov/GIS/metadata/usgswrd/XML/physio.xml> (accessed December 16, 2016).

USGS. 2016c. "Mineral Resources Online Spatial Data-Virginia Geological Map Data." Retrieved from <http://mrdata.usgs.gov/> (accessed November 21, 2016).

USGS. 2016d "National Water Information System: Web Interface-USGS Gage 0204222, James River above Weyanoke Point near Charles City, Virginia." Retrieved from https://waterdata.usgs.gov/nwis/uv?site_no=02042222, accessed December 20, 2016.

USGS. 2016e. "National Water Information System: Web Interface-USGS Gage 02035000, James River at Cartersville, Virginia." Retrieved from https://waterdata.usgs.gov/nwis/uv?site_no=0203500, accessed December 20, 2016.

USGS. 2016f. National Water Information System: Web Interface - Active Water Wells. Retrieved from <https://maps.waterdata.usgs.gov/mapper/index.html> (accessed December 15, 2016).

USGS. 2016g. "TopoView-Historical Topographic Maps Portal." Retrieved from <https://ngmdb.usgs.gov/maps/topoview> (accessed December 28, 2016).

USGS. 2017a. "Earthquake Archive Search & URL Builder." Retrieved from <http://earthquake.usgs.gov/earthquakes/search/> (accessed February 6, 2017).

USGS. 2017b. National Water Information System: Estimated Use of Water in the United States, County-Level Data for 2010. Retrieved from <https://water.usgs.gov/watuse/data/2010/> (accessed February 13, 2017).

USGS. 2018. "Earthquake Archive Search & URL Builder." Retrieved from <http://earthquake.usgs.gov/earthquakes/search/> (accessed May 29, 2018).

U.S. Navy. 2011. Radiation Health Protection Manual. NAVMED P-5055. February 2011.

U.S. Navy. 2017a. Welcome to Naval Station Newport. Retrieved from <https://www.cnic.navy.mil/regions/cnrma/installations/ns_newport.html> (accessed March 16, 2017).

U.S. Navy. 2017b. Naval Station Norfolk, About. Retrieved from <http://cnic.navy.mil/regions/cnrma/installations/ns_norfolk/about.html> (accessed March 16, 2017).

USTA. 2016 "U.S. Travel and Tourism Overview, 2015." Retrieved from <https://www.ustravel.org/> (accessed December 2, 2016).

Utility Dive. 2017 "Dominion Energy Scouting for pumped storage sites in Virginia." June 27, 2017. Retrieved from <http://www.utilitydive.com/news/dominion-energy-scouting-for-pumped-storage-sites-in-virginia/445855/> (accessed August 29, 2017).

UVA. 2016. University of Virginia, Weldon Cooper Center for Public Service. "Total Population Projections for Virginia and its Localities, 2020-2040." Retrieved from <http://www.coopercenter.org/demographics> (accessed December 2, 2016).

VaFWIS. 2016. Listed Species Information Report. Retrieved from <http://vafwis.org/fwis/?Title=VaFWIS+Species+Information> (accessed November 2016).

VB. 2016. Virginia Business.com. Jefferson Lab is One of Two Contenders for Collider. January 28, 2016.

VDCR. 2014. Virginia Invasive Plant Species List. Natural Heritage Technical Document 14-11. Retrieved from <http://www.dcr.virginia.gov/natural-heritage/invsppdflist> (accessed May 31, 2018).

VDCR. 2016a. Overview of the Physiography and Vegetation of Virginia. Retrieved from <http://www.dcr.virginia.gov/natural-heritage/natural-communities/document/ncoverviewphys-veg.pdf> (accessed November 9, 2016).

VDCR. 2016b. The Natural Communities of Virginia Classification of Ecological Community Groups. Retrieved from <http://www.dcr.virginia.gov/natural-heritage/natural-communities/nccluster1> (accessed November 2016).

VDCR. 2016c. Natural Heritage Resources Factsheet Migratory Songbird Habitat in Virginia's Coastal Plain. Retrieved from <http://www.dcr.virginia.gov/natural-heritage/document/fsonghabitat.pdf> (accessed November 6, 2016).

VDCR. 2016d. Listed Species by County. Retrieved from <https://vanhde.org/species-search> (accessed November 8, 2016).

VDCR. 2017. Chippokes Plantation State Park and Master Plan Executive Summary. Retrieved from <http://www.dcr.virginia.gov/state-parks/chippokes-plantation#general_information> (accessed January 26, 2017).

VDEQ. 2007. Certificate to Operate Surry Power Station WWTP. August 23, 2007.

VDEQ. 2013a. Groundwater Withdrawal Permit, Surry Nuclear Power Station, Surry Co. DEQ Permit #GW0003901. October 18, 2013.

VDEQ. 2013b. Technical Evaluation - Office of Ground Water Withdrawal Permitting: Surry Nuclear Power Station.

VDEQ. 2013c. 2013 Water Quality Monitoring Strategy. Retrieved from <http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/DEQsWaterQualityMonitoringStrategy.aspx> (accessed March 21 and 23, 2017).

VDEQ. 2015. Commonwealth of Virginia, State Water Resources Plan. October 2015.

VDEQ. 2016a "VDEQ-Waste Permits." Retrieved from <http://www.deq.virginia.gov/Programs/LandProtectionRevitalization/PermittingCompliance/WastePermits.aspx> (accessed December 28, 2016).

VDEQ. 2016b. Correspondence from Pamela F. Faggert, Dominion, Dominion-Surry Power Station and Gravel Neck VPDES Permit No. VA000-4090 Response to Oct. 4, 2016 Warning Letter. October 20, 2016.

VDEQ. 2016c. Status of Virginia's Water Resources: A Report on Virginia's Water Resources Management Activities. October 2016.

VDEQ. 2016d. TMDL Program List of Prioritized Impaired Waters for 2016-2022. Retrieved from <http://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/Priorities/PN/2016Revisions/Priorities-City_County.pdf> (accessed December 14, 2017).

VDEQ. 2016e. Physiographic Provinces of Virginia. Retrieved from <http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterProtectionSteeringCommittee/PhysiographicProvincesofVirginia.aspx> (accessed November 8, 2016).

VDEQ. 2017a. Draft 2016 305(b)/303(d) Water Quality Assessment Integrated Report. August 7, 2017. Retrieved from <http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2016305b303dIntegratedReport.aspx> (accessed December 14, 2017).

VDEQ. 2017b. State Water Resource Plan. Retrieved from <http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/WaterSupplyPlanning/StateWaterResourcesPlan.aspx> (accessed February 26, 2017).

VDEQ. 2017c "What is the Virginia Coastal Zone Management Program?" Retrieved from <http://www.deq.virginia.gov/Programs/CoastalZoneManagement/DescriptionBoundary.aspx> (accessed March 10, 2017).

VDEQ. 2018. Title V Federal Operating Permit and Permit to Operate Pursuant to 9 V AC 5 Chapter 80 of the Virginia Regulations for the Control and Abatement of Air Pollution. Piedmont Regional Office, 4949-A Cox Road, Glen Allen, Virginia 23060. December 29, 2017.

VDEQ. n.d.VPDES Permit Fact Sheet. VA0004090. Surry Power Station & Gravel Neck. No date.

VDGIF. 2015. Virginia's Wildlife Action Plan. Retrieved from <http://bewildvirginia.org/wildlife-action-plan/> (accessed December 2, 2016).

VDGIF. 2016a "VDGIF Wildlife Management Area (WMA Boundaries)." Retrieved from <https://www.dgif.virginia.gov/gis/data/> (accessed November 23, 2016).

VDGIF. 2016b. James River-Tidal. Retrieved from <https://www.dgif.virginia.gov/waterbody/james-river-tidal/> (accessed November 10, 2016).

VDGIF. 2016c. Peregrine Falcon Recovery and Management Program. Retrieved from <https://www.dgif.virginia.gov/wildlife/birds/peregrine-falcon/> (accessed November 14, 2016).

VDGIF. 2016d. NLEP Winter Habitat and Roost Trees. Retrieved from <http://dgif-virginia.maps.arcgis.com/apps/webappviewer/index.html?id=32ea4ee4935942c092e41ddcd19e5ec5> (accessed November 17, 2016).

VDGIF. 2016e. Kemp's Ridley sea turtle (Lepidochelys kempii). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/kemps-ridley-sea-turtle/> (accessed December 9, 2016).

VDGIF. 2016f. Leatherback sea turtle (Dermochelys coriacea). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/leatherback-sea-turtle/> (accessed December 9, 2016).

VDGIF. 2016g. Loggerhead sea turtle (Caretta caretta). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/loggerhead-sea-turtle/> (accessed December 9, 2016).

VDGIF. 2016h. Barking treefrog (Hyla gratiosa). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/barking-treefrog/> (accessed November 8, 2016).

VDGIF. 2016i. Mabee's salamander (Amybstoma mabeei). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/mabees-salamander/> (accessed November 8, 2016).

VDGIF. 2016j. Little brown bat (Myotis lucifugus lucifugus). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/little-brown-bat/> (accessed November 14, 2016).

VDGIF. 2016k. Rafinesque's eastern big-eared bat (Corynorhinus rafinesquii macrotis). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/rafinesques-eastern-big-eared-bat/> (accessed November 14, 2016).

VDGIF. 2016l. Canebrake Rattlesnake (Crotalus horridus, Coastal Plain population). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/canebrake-rattlesnake/> (accessed November 11, 2016).

VDGIF. 2016m. Eastern chicken turtle (Deirochelys reticularia reticularia). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/eastern-chicken-turtle/> (accessed December 2016).

VDGIF. 2016n. Northern diamond-backed terrapin (Malaclemys terrapin terrapin). Retrieved from: <https://www.dgif.virginia.gov/wildlife/information/northern-diamond-backed-terrapin/> (accessed November 11, 2016).

VDGIF. 2016o. Spotted turtle (Clemmys guttata). Retrieved from <https://www.dgif.virginia.gov/wildlife/information/spotted-turtle/> (accessed November 11, 2016).

VDGIF. 2016p. VDGIF Wildlife Management Area. Retrieved from <https://www.dgif.virginia.gov/gis/data/> (accessed November 23, 2016).

VDHR. 2001. "First People: The Early Indians of Virginia: Ancient History of Virginia 15,000 B.C.-Present." Virginia Department of Historic Resources. Retrieved from <http://www.dhr.virginia.gov/arch_NET/timeline/time_line.htm> (accessed October 12, 2015).

VDHR. 2016. "RE: Surry Independent Spent Fuel Storage Installation - Additional Concrete Storage Pad Surry County, VA." Virginia Department of Historic Resources. DHR File No. 2016-0995.

VDHR. 2017. Virginia Cultural Resource Information System. Retrieved from <http://dhr.virginia.gov/vcris/vcrisHome.htm> (accessed August 29, 2017).

VDOT. 2016a "Jamestown-Scotland Ferry." Retrieved from <http://www.virginiadot.org/travel/ferry-jamestown.asp> (accessed December 20, 2016).

VDOT. 2016b. Surry County Annual Average Daily Traffic (AADT) Count-2001, 2005, 2010, and 2015. Retrieved from <http://www.virginiadot.org/info/ct-TrafficCounts.asp> (accessed December 20, 2016).

VHHA. 2016. Virginia Hospital & Healthcare Association-Virginia Hospitals. Retrieved from <http://www.vhha.com/about/virginia-hospitals> (accessed December 27, 2016).

Virginia Power. 2000. Surry Severe Accident Mitigation Alternative (SAMA) Assessment. Calculation No. SM-1256, Revision 1. September 5, 2000.

VISC. 2005. Virginia Invasive Species Management Plan. Virginia Department of Conservation and Recreation Division of Natural Heritage. Richmond.

VMRC. 2011. Virginia Marine Resources Commission "Pertaining to Enlargement of Restricted Area - Dominion Power/Nuclear Power Station" Regulation 4 VAC 20-1060-10 ET SEQ. Effective February 1, 2011.

VMRC. 2017. Chesapeake Bay Map showing VDH Shellfish Condemnation Zones. Retrieved from <https://webapps.mrc.virginia.gov/public/maps/chesapeakebay_map.php> (accessed May 2017).

VNC. 2016. "2015 North Carolina Visitor Profile." Retrieved from <https://partners.visitnc.com/research> (accessed December 2, 2016).

VSCC. 2015. Virginia State Corporation Commission "Case Number PUE-2012-00029" Retrieved from <http://www.scc.virginia.gov/docketsearch/DOCS/34%4000!.pdf> (accessed September 24, 2018).

VTA. 2016. "The Economic Impact of Domestic Travel on Virginia Counties 2015." Retrieved from <http://www.vatc.org/home/> (accessed December 2, 2016).

Williamsburg. 2016 "City of Williamsburg Comprehensive Plan 2013." Retrieved from <http://www.williamsburgva.gov/i-want-to/department-i-z/planning/2013-comprehensive-plan> (accessed December 28, 2016).

WM. 2016. About William & Mary. Retrieved from <http://www.wm.edu/about/index.php> (accessed December 29, 2016).

Attachment A: NRC NEPA Issues for License Renewal

Intentionally Blank

NRC NEPA Issues for License Renewal of Nuclear Power Plants

Surry Power Station Environmental Report

Dominion has prepared this environmental report in accordance with the requirements of NRC regulation 10 CFR 51.53. NRC included in the regulation the list of 78 National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants that were identified in the 2013 GEIS (Appendix B to Subpart A of 10 CFR Part 51, Table B-1).

The table below, lists the 78 issues from 10 CFR Part 51, Appendix B, Table B-1 and identifies the section in this environmental report in which Dominion addresses each applicable issue.

Table A-1. Surry Power Station Environmental Report Cross-Reference of License Renewal NEPA Issues.

No.	Issue[a]	Category	Section of ER	GEIS Cross Reference (Section / Page)[b]
	Land Use			
1	Onsite land use	1	4.1.1	4.2.1.1/4-6
2	Offsite land use	1	4.1.2	4.2.1.1/4-7
3	Offsite land use in transmission line rights-of-way[c]	1	4.0.1	4.2.1.1/4-6
	Visual Resources			
4	Aesthetic impacts	1	4.1.3	4.2.1.2/4-9
	Air Quality			
5	Air quality (all plants)	1	4.2.1	4.3.1.1/4-14
6	Air quality effects of transmission lines	1	4.2.2	4.3.1.1/4-14
	Noise			
7	Noise impacts	1	4.3	4.3.1.2/4-19
	Geologic Environment			
8	Geology and soils	1	4.4	4.4/4-29
	Surface Water Resources			
9	Surface water use and quality (non-cooling system impacts)	1	4.0.1/5.2	4.5.1.1/4-30
10	Altered current patterns at intake and discharge structures	1	4.0.1/5.2	4.5.1.1/4-36
11	Altered salinity gradients	1	4.0.1/5.2	4.5.1.1/4-36
12	Altered thermal stratification of lakes[c]	1	4.0.1	4.5.1.1/4-37
13	Scouring caused by discharged cooling water	1	4.0.1/5.2	4.5.1.1/4-38
14	Discharge of metals in cooling system effluent	1	4.0.1/5.2	4.5.1.1/4-38
15	Discharge of biocides, sanitary wastes, and minor chemical spills	1	4.0.1/5.2	4.5.1.1/4-39
16	Surface water use conflicts (plants with once-through cooling systems)	1	4.0.1/5.2	4.5.1.1/4-40
17	Surface water use conflicts (plants with cooling ponds, or cooling towers using makeup water from a river)	2	4.5.1	4.5.1.1/4-41
18	Effects of dredging on surface water quality	1	4.0.1/5.2	4.5.1.1/4-42
19	Temperature effects on sediment transport capacity	1	4.0.1/5.2	4.5.1.1/4-43
	Groundwater Resources			
20	Groundwater contamination and use (non-cooling system impacts)	1	4.0.1/5.2	4.5.1.2/4-45
21	Groundwater use conflicts (plants that withdraw <100 gpm)[c]	1	4.0.1	4.5.1.2/4-47
22	Groundwater use conflicts (plants that withdraw >100 gpm)	2	4.5.3	4.5.1.2/4-48

No.	Issue[a]	Category	Section of ER	GEIS Cross Reference (Section / Page)[b]
23	Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	2	4.5.2	4.5.1.2/4-48
24	Groundwater quality degradation resulting from water withdrawals	1	4.0.1/5.2	4.5.1.2/4-49
25	Groundwater quality degradation (plants with cooling ponds in salt marshes) [c]	1	4.0.1	4.5.1.2/4-50
26	Groundwater quality degradation (plants with cooling ponds at inland sites)	2	4.5.4	4.5.1.2/4-51
27	Radionuclides released to groundwater	2	4.5.5	4.5.1.2/4-51
	Terrestrial Resources			
28	Effects on terrestrial resources (non-cooling system impacts)	2	4.6.5	4.6.1.1/4-59
29	Exposure of terrestrial organism to radionuclides	1	4.0.1/5.2	4.6.1.1/4-61
30	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	1	4.0.1/5.2	4.6.1.1/4-64
31	Cooling tower impacts on vegetation (plants with cooling towers) [c]	1	4.0.1	4.6.1.1/4-69
32	Bird collisions with plant structures and transmission lines	1	4.0.1/5.2	4.6.1.1/4-70
33	Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.4	4.6.1.1/4-75
34	Transmission line ROW management impacts on terrestrial resources	1	4.0.1/5.2	4.6.1.1/4-75
35	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0.1/5.2	4.6.1.1/4-80
	Aquatic Resources			
36	Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.1	4.6.1.2/4-87
37	Impingement and entrainment of aquatic organisms (plants with cooling towers) [c]	1	4.0.1	4.6.1.2/4-92
38	Entrainment of phytoplankton and zooplankton (all plants)	1	4.0.1/5.2	4.6.1.2/4-93
39	Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.2	4.6.1.2/4-94
40	Thermal impacts on aquatic organisms (plants with cooling towers) [c]	1	4.0.1	4.6.1.2/4-96
41	Infrequently reported thermal impacts (all plants)	1	4.0.1/5.2	4.6.1.2/4-97
42	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	1	4.0.1/5.2	4.6.1.2/4-100

No.	Issue[a]	Category	Section of ER	GEIS Cross Reference (Section / Page)[b]
43	Effects of non-radiological contaminants on aquatic organisms	1	4.0.1/5.2	4.6.1.2/4-103
44	Exposure of aquatic organisms to radionuclides	1	4.0.1/5.2	4.6.1.2/4-105
45	Effect of dredging on aquatic organisms	1	4.0.1/5.2	4.6.1.2/4-107
46	Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.3	Issue applies to a feature (cooling towers) that Surry does not have.
47	Effects on aquatic resources (non-cooling system impacts)	1	4.0.1/5.2	4.6.1.2/4-110
48	Impacts of transmission line ROW management on aquatic resources	1	4.0.1/5.2	4.6.1.2/4-112
49	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses	1	4.0.1/5.2	4.6.1.2/4-110
	Special Status Species and Habitats			
50	Threatened, endangered, and protected species and essential fish habitat	2	4.6.6	4.6.1.3/4-115
	Historic and Cultural Resources			
51	Historic and cultural resources	2	4.7	4.7.1/4-122
	Socioeconomics			
52	Employment and income, recreation and tourism	1	4.8.1	4.8.1.1/4-127
53	Tax revenues	1	4.8.2	4.8.1.1/4-128
54	Community services and education	1	4.8.3	4.8.1.1/4-129
55	Population and housing	1	4.8.4	4.8.1.1/4-130
56	Transportation	1	4.8.5	4.8.1.1/4-131
	Human Health			
57	Radiation exposures to the public	1	4.0.1/5.2	4.9.1.1.1/4-140
58	Radiation exposures to plant workers	1	4.0.1/5.2	4.9.1.1.1/4-136
59	Human health impacts from chemicals	1	4.0.1/5.2	4.9.1.1.2/4-147
60	Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)	2	4.9.1	4.9.1.1.3/4-149
61	Microbiological hazards to plant workers	1	4.0.1/5.2	4.9.1.1.3/4-149
62	Chronic effects of electromagnetic fields	NA	4.0.3	4.9.1.1.4/4-150
63	Physical occupational hazards	1	4.0.1/5.2	4.9.1.1.5/4-156
64	Electric shock hazards	2	4.9.2	4.9.1.1.5/4-156
	Postulated Accidents			
5	Design-basis accidents	1	4.0.1/5.2	4.9.1.2/4-158
66	Severe accidents	2	4.15	4.9.1.2/4-158
	Environmental Justice			
67	Minority and low-income populations	2	4.10.1	4.10.1/4-167

No.	Issue[a]	Category	Section of ER	GEIS Cross Reference (Section / Page)[b]
	Waste Management			
68	Low-level waste storage and disposal	1	4.11.1	4.11.1.1/4-171
69	On-site storage of spent nuclear fuel	1	4.11.2	4.11.1.2/4-172
70	Off-site radiological impacts of spent nuclear fuel and high-level waste disposal	1	4.11.3	4.11.1.3/4-175
71	Mixed waste storage and disposal	1	4.11.4	4.11.1.4/4-178
72	Non-radioactive waste storage and disposal	1	4.11.5	4.11.1.5/4-179
	Cumulative Impacts			
73	Cumulative Impacts	2	4.12	4.13/4-243
	Uranium Fuel Cycle			
74	Off-site radiological impacts – individual impacts from other than the disposal of spent fuel and high-level waste	1[d]	4.13.1	4.12.1.1/4-193
75	Off-site radiological impacts – collective impacts from other than the disposal of spent fuel and high- level waste	1	4.13.2	4.12.1.1/4-194
76	Non-radiological Impacts of the Uranium Fuel Cycle	1	4.13.3	4.12.1.1/4-194
77	Transportation	1	4.13.4	4.12.1.1/4-196
	Termination of Nuclear Power Plant Operations and Decommissioning			
78	Termination of plant operations and decommissioning	1	4.14	4.12.2.1/4-201

a. 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)
b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437, Rev 1).
c. The issue is not applicable to SPS; it concerns a plant feature or operation that SPS does not have or utilize.
d. SECY-14-0072 (July 21, 2014)
NA = not applicable (The categorization and impact finding definitions do not apply to the issue.)
NEPA = National Environmental Policy Act

Attachment B: VPDES Permit

Intentionally Blank

COMMONWEALTH of VIRGINIA

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

Michael P. Murphy
Regional Director

DEPARTMENT OF ENVIRONMENTAL QUALITY
PIEDMONT REGIONAL OFFICE
4949-A Cox Road, Glen Allen, Virginia 23060
(804) 527-5020 Fax (804) 527-5106
www.deq.virginia.gov

February 29, 2016

Cathy C. Taylor, Director
Electric Environmental Services
Virginia Electric and Power Company
5000 Dominion Boulevard
Glen Allen, Virginia 23060

Send via email: cathy.c.taylor@dom.com

Subject: VPDES Permit No. VA0004090, Surry Power Station and Gravel Neck Reissuance

Dear Ms. Taylor:

Your VPDES permit is enclosed. As indicated in the fact sheet, your permit has changed. Please thoroughly read the reissued permit as you are responsible for complying with all conditions of the permit. The first DMR required by this permit for monthly monitoring is due on April 10, 2016 for the monitoring period of March 2016. The first DMR required by this permit for every two month monitoring is due on May 10, 2016 for the monitoring period of March-April 2016. The first DMR required by this permit for quarterly monitoring is due on July 10, 2016 for the monitoring period of April 1, 2016-June 30, 2016. The first DMR required by this permit for semi-annual monitoring is due on January 10, 2017 for the monitoring period of July 1, 2016-December 31, 2016. The first DMR required by this permit for annual monitoring is due on January 10, 2018 for the monitoring period of January 1, 2017-December 31, 2017. If you still have DMR data to report as required by the previous permit please submit it as an attachment to the first DMR required by this permit. Monitoring results on the DMRs should be reported to the same number of significant digits as are included in the permit limit for the parameter. An electronic DMR is available through eDMR.

Please note that if this permit is to be reissued in five years, there are specific testing requirements associated with the Form 2A reissuance application that are different from the testing requirements in your permit. In order to provide the necessary data for Form 2A, you may need to begin additional sampling during the term of this permit prior to receiving a reissuance reminder letter from this agency. Please look at Form 2A Part D (Expanded Effluent Testing Data) and Part E (Toxicity Testing Data) for the sampling requirements. Furthermore, the 316(b) alternate schedule condition in Part I.E.3 requires submittal at least 270 prior to expiration date of this permit of applicable information detailed in 40CFR 122.21(r). This is a significant amount of information including multiple year studies and analyses. It is recommended that these studies begin as soon as possible in an effort to meet the required submittal date.

As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty days from the date of service (the date you actually received this decision or the date it was mailed to you, whichever occurred first) within which to appeal this decision by filing a notice of appeal in accordance with the Rules of the Supreme Court of Virginia with the Director, Department of Environmental Quality. In the event that this decision is served on you by mail, three days are added to that period.

Alternatively, any owner under §§ 62.1 - 44.16, 62.1 - 44.17, and 62.1 - 44.19 of the State Water Control Law aggrieved by any action of the State Water Control Board taken without a formal hearing, or by inaction of the Board, may demand in writing a formal hearing of such owner's grievance, provided a petition requesting such hearing is filed with the Board. Said petition must meet the requirements set forth in 9VAC25-230-130 (Procedural Rule No. 1 – Petition for formal hearing). In cases involving actions of the Board, such petition must be filed within thirty days after notice of such action is mailed to such owner by certified mail.

If you have any questions, please contact Brian Wrenn at brian.wrenn@deq.virginia.gov or 804-527-5015.

Sincerely,

Emilee C. Adamson
Planning and Water Permit Manager
Piedmont Regional Office

Enclosures: General Permit, Fact Sheet

cc: DEQ-PRO Inspector: Heather.Deihls@deq.virginia.gov
DEQ-PRO Compliance Auditor: Patrick.Bishop@deq.virginia.gov
DEQ-CO VPDES Permits: Elleanore.daub@deq.virginia.gov
Phyllis G. Wells: Phyllis.g.wells@dom.com

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Permit No. VA0004090

Effective Date: March 1, 2016
Expiration Date: February 28, 2021

AUTHORIZATION TO DISCHARGE UNDER THE
VIRGINIA POLLUTANT DISCHARGE ELIMINATION SYSTEM
AND
THE VIRGINIA STATE WATER CONTROL LAW

In compliance with the provisions of the Clean Water Act as amended and pursuant to the State Water Control Law and regulations adopted pursuant thereto, the following owner is authorized to discharge in accordance with the information submitted with the permit application, and with this permit cover page, Part I and Part II, as set forth herein.

Owner:	Dominion Virginia Electric and Power Company
Facility Name:	Surry Power Station & Gravel Neck
County:	Surry
Facility Location:	5570 Hog Island Road, Surry VA 23883

The owner is authorized to discharge to the following receiving stream(s):

	Process Discharges	Stormwater				
	Outfall 001	Outfall 002	Outfall 050	Outfall 051	Outfall 052	Outfall 053
Stream Name:	James River	Unnamed Tributary to James River	Unnamed Tributary to James River	Unnamed Tributary to Hog Island Creek	James River	James River
Basin:	James River (Lower)	James River (Lower)	James River (Lower)	James River (Lower)	James River (Lower)	James River (Lower)
Subbasin:	NA	NA	NA	N/A	NA	NA
Section:	1	1a	1a	1	1	1
Class:	II	III	III	III	II	II
Special Standards:	a, bb	None	None	None	a, bb	a, bb

Deputy Regional Director, Department of Environmental Quality

26 FEBRUARY 2016
Date

A. LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from Outfall 001 – Units 1 and 2 condenser cooling water and internal discharge Outfalls 101 through 122. This discharge shall be limited and monitored at Outfall 001 as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY[a]	SAMPLE TYPE
Flow (MGD)	NL	NA	NA	NL	Continuous	Recorded [b]
pH (Standard Units) [c]	NA	NA	6.0	9.0	2 per Month	Grab
Total Residual Chlorine (mg/L) [d][e]	0.0080	NA	NA	0.016	1 per Day	Grab
Heat Rejected (BTU/HR)	Heat rejected shall not exceed a daily maximum of 12.6×10^9				Continuous	Recorded
Intake pH (Standard Units) [f]	NA	NA	NL	NL	2 per Month	Grab
Intake Total Suspended Solids (TSS) (mg/L) [f]	NL	NA	NA	NL	1 per 6 Months	Grab
Thallium, Total (µg/L)	NL	NA	NA	NL	1 per Year	Grab

"NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting, however, are required.

(a) Monitoring frequency periods encompassing multiple months shall be in accordance with I.C.23 of this permit.
(b) A continuous record of cooling water pump operation satisfies this requirement.
(c) Should the pH of Outfall 001 fall outside the minimum or maximum limitation, the discharge will be considered to be in compliance with the permit if it is within ± 0.5 pH units of the pH measured concurrently in the intake.
(d) See Part I.C.6 for compliance reporting.
(e) If chlorine is purposely introduced to the cooling water or to contributing waste streams, Total Residual Chlorine effluent samples shall be taken during the period in which the resulting residual chlorine is discharged through Outfall 001.
(f) Intake samples for Total Suspended Solids (TSS) and pH shall be collected at the high-level intake screens. Sampling for TSS at the intake shall coincide with the TSS effluent samples taken at Outfalls 102, 103, 106, 116, and 117.

A. LIMITATIONS AND MONITORING REQUIREMENTS

2. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from internal discharge outfall serial number 101 –Sewage Treatment Plant. This discharge shall be limited and monitored at internal Outfall 101 as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY	SAMPLE TYPE
Flow (MGD) [(a)]	NL	NA	NA	NL	Continuous	Recorded
pH (Standard Units)	NA	NA	6.0	9.0	1 per Day	Grab
Biochemical Oxygen Demand (BOD_5) (mg/L) [(b)]	30 [(c)]	NA	NA	45	1 per 2 Months[(d)]	4 HC
TSS (mg/L)	30 [(c)]	NA	NA	45	1 per 6 Months[(d)]	4 HC
Enterococci (n/100 mL) [(e)(f)]	35 geometric mean	NA	NA	NA	4 Days per Month (between 10 a.m. and 4 p.m.) once per year	Grab
Fecal coliform (n/100 mL) [(e)(f)]	200 geometric mean	NA	NA	NA	4 Days per Month (between 10 a.m. and 4 p.m.) once per year	Grab
Total Phosphorous (TP) (mg/L)	NL	NA	NA	NL	1 per Year	Grab
Total Kjeldahl Nitrogen (TKN) (mg/L)	NL	NA	NA	NL	1 per Year	Grab
Nitrite + Nitrate (mg/L)	NL	NA	NA	NL	1 per Year	Grab
Total Nitrogen (TN) (mg/L)	NL	NA	NA	NL	1 per Year	Calculated[(g)]

"NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting, however, are required.

(a) The design flow of this treatment facility is 0.085 MGD. See Part I.C.18 for additional flow requirements.
(b) See Part I.C.7 for additional instructions regarding effluent monitoring frequencies.
(c) These limitations are expressed in two significant figures.
(d) Monitoring frequency periods encompassing multiple months shall be in accordance with I.C.23 of this permit.

(e) See Part I.B. for additional Total Residual Chlorine and bacterial monitoring requirements.
(f) "4 Days per Month" means four samples collected at least 7 days apart during the same calendar month. The "once per year" modifier means that samples only need to be collected during one calendar month of the year.
(g) Total Nitrogen, which is the sum of the TKN and Nitrite + Nitrate, shall be derived from the results of those tests.

3. At least 85% removal for BOD_5 and TSS must be attained for effluent discharged through Outfall 101.

A. LIMITATIONS AND MONITORING REQUIREMENTS

4. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from the following internal discharge outfalls:

Outfall serial number 102 – Turbine Sump A
Outfall serial number 103 – Turbine Sump B
Outfall serial number 106 – Turbine Sump C

These discharges shall be limited and monitored at the above internal outfall locations as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY[(a)(b)]	SAMPLE TYPE
Flow (MGD)	NL	NA	NA	NL	1 per 6 Months	Estimate
pH (Standard Units)	NA	NA	NL	NL	1 per 6 Months	Grab
TSS – Net Increase (mg/L) [(c)(d)]	30 [(e)]	NA	NA	100[(e)]	1 per 6 Months	Grab
Oil and Grease (mg/L) [(d)]	15 [(e)]	NA	NA	20 [(e)]	1 per 6 Months	Grab
TP (mg/L)	NL	NA	NA	NL	1 per Year	Grab
TKN (mg/L)	NL	NA	NA	NL	1 per Year	Grab
Nitrite + Nitrate (mg/L)	NL	NA	NA	NL	1 per Year	Grab
TN (mg/L)	NL	NA	NA	NL	1 per Year	Calculated[(f)]

"NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting, however, are required.

(a) See Part I.C.7 for additional instructions regarding effluent monitoring frequencies.
(b) Monitoring frequency periods encompassing multiple months shall be in accordance with I.C.23 of this permit.
(c) "Net Increase" is defined as the effluent TSS concentration from internal Outfalls 102, 103, and 106, minus the intake TSS concentration associated with Outfall 001.
(d) See Part I.C.6 for compliance reporting.
(e) These limitations are expressed in two significant figures.
(f) Total Nitrogen, which is the sum of the TKN and Nitrite + Nitrate, shall be derived from the results of those tests.

A. LIMITATIONS AND MONITORING REQUIREMENTS

5. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from the following internal discharge outfalls:

Outfall serial number 104 – Station Reverse Osmosis Reject and Backwash
Outfall serial number 107 – Package Boilers A and B
Outfall serial number 109 – Radwaste Facility
Outfall serial number 110 – Unit 1A Waste Neutralization Sump
Outfall serial number 111 – Unit 1B Waste Neutralization Sump
Outfall serial number 112 – Unit 2A Waste Neutralization Sump
Outfall serial number 113 – Unit 2B Waste Neutralization Sump
Outfall serial number 114 – Unit 1 Steam Generator Blowdown
Outfall serial number 115 – Unit 2 Steam Generator Blowdown
Outfall serial number 118 – Unit 1 Condenser Hotwell Drain
Outfall serial number 119 – Unit 2 Condenser Hotwell Drain
Outfall serial number 120 – Low Conductivity Sump
Outfall serial number 121 – Unit 1 Steam Generator Hydrolance
Outfall serial number 122 – Unit 2 Steam Generator Hydrolance

These discharges shall be limited and monitored at the above internal outfall locations as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY[a][b]	SAMPLE TYPE
Flow (MGD)	NL	NA	NA	NL	1 per 6 Months	Estimate
pH (Standard Units)	NA	NA	NL	NL	1 per 6 Months	Grab
TSS (mg/L) [d]	30 [c]	NA	NA	100[c]	1 per 6 Months	Grab
Oil and Grease (mg/L) [d]	15 [c]	NA	NA	20 [c]	1 per 6 Months	Grab
TP (mg/L)	NL	NA	NA	NL	1 per Year	Grab
TKN (mg/L)	NL	NA	NA	NL	1 per Year	Grab
Nitrite + Nitrate (mg/L)	NL	NA	NA	NL	1 per Year	Grab
TN (mg/L)	NL	NA	NA	NL	1 per Year	Calculated[e]

"NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting, however, are required.

(a) See Part I.C.7 for additional instructions regarding effluent monitoring frequencies.
(b) Monitoring frequency periods encompassing multiple months shall be in accordance with I.C.23 of this permit.
(c) These limitations are expressed in two significant figures.
(d) See Part I.C.6 for compliance reporting.
(e) Total Nitrogen, which is the sum of the TKN and Nitrite + Nitrate, shall be derived from the results of those tests.

A. LIMITATIONS AND MONITORING REQUIREMENTS

6. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from internal discharge outfall serial number 105 – Station Oil Storage Tank Dike. This discharge shall be limited and monitored at internal Outfall 105 as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS[a]	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY[b]	SAMPLE TYPE
Flow (MGD)	NL	NA	NA	NL	1 per 6 Months	Estimate
pH (Standard Units)	NA	NA	NL	NL	1 per 6 Months	Grab
TSS (mg/L)	30 [c]	NA	NA	100[c]	1 per 6 Months	Grab
Total Petroleum Hydrocarbons (TPH) (mg/L)[d][e]	NL	NA	NA	NA	1 per 6 Months	Grab
Oil and Grease (mg/L) [e]	15 [c]	NA	NA	20[c]	1 per 6 Months	Grab
TP (mg/L)	NL	NA	NA	NL	1 per Year	Grab
TKN (mg/L)	NL	NA	NA	NL	1 per Year	Grab
Nitrite + Nitrate (mg/L)	NL	NA	NA	NL	1 per Year	Grab
TN (mg/L)	NL	NA	NA	NL	1 per Year	Calculated[f]

"NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting, however, are required.

(a) A sample shall be taken at the required frequency during each monitoring period that a discharge occurs. For months in which no discharge occurs, the permittee shall continue to submit the required monthly DMR with the statement “No Discharge” indicated within the reporting sheet.
(b) Monitoring frequency periods encompassing multiple months shall be in accordance with I.C.23 of this permit.
(c) These limitations are expressed in two significant figures.
(d) TPH is the sum of individual gasoline range organics and diesel range organics or TPH-GRO and TPH-DRO to be measured by EPA SW 846 Method 8015C (2000) or EPA SW 846 Method 8015C (2007) for gasoline and diesel range organics, or by EPA SW 846 Methods 8260B (1996) and 8270D (2007).
(e) See Part I.C.6 for compliance reporting.
(f) Total Nitrogen, which is the sum of the TKN and Nitrite + Nitrate, shall be derived from the results of those tests.

7. There shall be no discharge of tank bottom waters from Outfall 105.

A. LIMITATIONS AND MONITORING REQUIREMENTS

8. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from internal discharge outfall serial number 108 – Settling Pond. This discharge shall be limited and monitored at internal Outfall 108 as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS[a]	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY[b]	SAMPLE TYPE
Flow (MGD)	NL	NA	NA	NL	1 per 3 Months	Measured
pH (Standard Units)	NA	NA	NL	NL	1 per 3 Months	Grab
TSS (mg/L) [c]	30 [d]	NA	NA	100[d]	1 per 3 Months	Grab
Total Organic Carbon (mg/L)	NA	NA	NA	110[d]	1 per 6 Months	Grab
TPH (mg/L) [c] [e]	NL	NA	NA	NA	1 per Year	Grab
Oil and Grease (mg/L) [c]	15 [d]	NA	NA	20[d]	1 per 3 Months	Grab
TP (mg/L)	NL	NA	NA	NL	1 per Year	Grab
TKN (mg/L)	NL	NA	NA	NL	1 per Year	Grab
Nitrite + Nitrate (mg/L)	NL	NA	NA	NL	1 per Year	Grab
TN (mg/L)	NL	NA	NA	NL	1 per Year	Calculated[f]

"NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting, however, are required.

(a) A sample shall be taken at the required frequency during each monitoring period that a discharge occurs. For months in which no discharge occurs, the permittee shall continue to submit the required monthly DMR with the statement “No Discharge” indicated within the reporting sheet.
(b) See Part I.C.7 for additional instructions regarding effluent monitoring frequencies.
(c) See Part I.C.6 for compliance reporting.
(d) These limitations are expressed in two significant figures.
(e) TPH is the sum of individual gasoline range organics and diesel range organics or TPH-GRO and TPH-DRO to be measured by EPA SW 846 Method 8015C (2000) or EPA SW 846 Method 8015C (2007) for gasoline and diesel range organics, or by EPA SW 846 Methods 8260B (1996) and 8270D (2007).
(f) Total Nitrogen, which is the sum of the TKN and Nitrite + Nitrate, shall be derived from the results of those tests.

A. LIMITATIONS AND MONITORING REQUIREMENTS

9. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from the following internal discharge outfalls:

Outfall serial number 116 – Unit 1 Recirculation Spray Heat Exchanger
Outfall serial number 117 – Unit 2 Recirculation Spray Heat Exchanger

These discharges shall be limited and monitored at the above internal outfall locations as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY[(a)(b)]	SAMPLE TYPE
Flow (MGD)	NL	NA	NA	NL	1 per 6 Months	Estimate
pH (Standard Units)	NA	NA	NL	NL	1 per 6 Months	Grab
TSS – Net Increase (mg/L) [(c) (d)]	30 [(e)]	NA	NA	100[(e)]	1 per 6 Months	Grab
Oil and Grease (mg/L)	15 [(e)]	NA	NA	20 [(e)]	1 per 6 Months	Grab

“NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting, however, are required.

(a) See Part I.C.7 for additional instructions regarding effluent monitoring frequencies.
(b) Monitoring frequency periods encompassing multiple months shall be in accordance with I.C.23 of this permit.
(c) “Net Increase” is defined as the effluent TSS concentration from internal Outfalls 116 and 117 minus the intake TSS concentration associated with Outfall 001.
(d) See Part I.C.6 for compliance reporting.
(e) These limitations are expressed in two significant figures.

A. STORMWATER MONITORING

10. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge stormwater from outfall serial number 002 – Gravel Neck Gas Turbine Dike. This discharge shall be limited and monitored at Outfall 002 as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS[a]	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY[b]	SAMPLE TYPE
Flow (MGD)	NL	NA	NA	NL	1 per 6 Months	Estimate
Copper, Dissolved (µg/L) [c]	NL	NA	NA	NL	1 per 6 Months	Grab
Zinc, Dissolved (µg/L) [c]	NL	NA	NA	NL	1 per 6 Months	Grab
Total Organic Carbon (mg/L)	NA	NA	NA	NL	1 per 6 Months	Grab
TP (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Grab
TKN (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Grab
Nitrite + Nitrate (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Grab
TN (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Calculated[e]
TSS (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Grab

"NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting, however, are required.

(a) A sample shall be taken at the required frequency during each monitoring period that a discharge occurs. For sampling periods in which no discharge occurs, the permittee shall continue to submit the required monthly DMR with the statement “No Discharge” indicated within the reporting sheet.
(b) Monitoring frequency periods encompassing multiple months shall be in accordance with I.C.23 of this permit.
(c) See Part I.C.6 for compliance reporting.
(d) Semi-Annual nutrient monitoring is only required for the first two years of the permit, resulting in a total of 4 samples.
(e) Total Nitrogen, which is the sum of the TKN and Nitrite + Nitrate, shall be derived from the results of those tests.

11. There shall be no discharge of tank bottom waters from Outfall 002.

A. STORMWATER MONITORING

12. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge stormwater runoff from outfalls:

Outfall serial number 050 – Central Drainage Area
Outfall serial number 051 – East Central Drainage Area
Outfall serial number 052 – North Side of Intake Drainage Area
Outfall serial number 053 – South Side of Intake Drainage Area

These discharges shall be limited and monitored at the above outfall locations as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS[a]	
	MONTHLY AVERAGE	WEEKLY AVERAGE	MINIMUM	MAXIMUM	FREQUENCY[b]	SAMPLE TYPE
Flow (MGD)[c]	NL	NA	NA	NL	1 per 6 Months	Estimate
Iron, Total (mg/L)	NA	NA	NA	NL	1 per 6 Months	Grab
TP (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Grab
TKN (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Grab
Nitrite + Nitrate (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Grab
TN (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Calculated[e]
TSS (mg/L)	NL	NA	NA	NL	1 per 6 Months[d]	Grab

"NA" means not applicable.
"NL" means no limitation is established. Monitoring and reporting however, are required.

(a) A sample shall be taken at the required frequency during each monitoring period that a discharge occurs. For months in which no discharge occurs, the permittee shall continue to submit the required monthly DMR with the statement “No Discharge” indicated within the reporting sheet.
(b) Monitoring frequency periods encompassing multiple months shall be in accordance with I.C.23 of this permit.
(c) Estimate of the total volume of the discharge during the storm event.
(d) Semi-Annual nutrient and sediment monitoring is only required for the first two years of the permit, resulting in a total of 4 samples.
(e) Total Nitrogen, which is the sum of the TKN and Nitrite + Nitrate, shall be derived from the results of those tests.

13. See Part I.D.3.d for documentation, monitoring, and report requirements for substantially identical outfalls.

B. Additional Total Residual Chlorine and Bacterial Limitations and Monitoring Requirements – Outfall 101 (Sewage Treatment Plant)

1. The permittee shall monitor the TRC at the outlet of each operating chlorine contact tank three (3) times per day at 4 hour intervals by grab sample.

2. No more than nine (9) of all samples taken at the outlet of each operating chlorine contact tank shall be less than **1.5 mg/L** for any one calendar month.

3. No TRC sample collected at each outlet of any operating chlorine contact tank shall be less than **0.60 mg/L**.

4. If dechlorination facilities exist all samples above shall be collected prior to dechlorination.

5. If disinfection is by a method other than chlorination, Enterococci and Fecal coliform shall be limited and monitored by the permittee as specified below, and this requirement, if applicable, shall substitute for the TRC and Enterococci/Fecal coliform requirements delineated elsewhere in Part I.A.3 of this permit.

	MONTHLY AVERAGE	FREQUENCY	SAMPLE TYPE
Enterococci	35 N/100 mL (Geometric Mean)	2 per Week (between 10 am – 4 pm)	Grab
Fecal Coliform	200 N/100 mL (Geometric Mean)	2 per Week (between 10 am – 4 pm)	Grab

C. Other Requirements or Special Conditions

1. Notification Levels
The permittee shall notify the Department as soon as they know or have reason to believe:

a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following notification levels:
(1) One hundred micrograms per liter (100 µg/L);
(2) Two hundred micrograms per liter (200 µg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/L) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1.0 mg/L) for antimony;
(3) Five (5) times the maximum concentration value reported for that pollutant in the permit application; or
(4) The level established by the Board.

b. That any activity has occurred or will occur which would result in any discharge, on a nonroutine or infrequent basis, of a toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following notification levels:
(1) Five hundred micrograms per liter (500 µg/L);
(2) One milligram per liter (1.0 mg/L) for antimony;
(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application; or
(4) The level established by the Board.

2. Materials Handling and Storage
Any and all product, materials, industrial wastes, and/or other wastes resulting from the purchase, sale, mining, extraction, transport, preparation, and/or storage of raw or intermediate materials, final product, by-product or wastes, shall be handled, disposed of, and/or stored in such a manner and consistent with Best Management Practices so as not to permit a discharge of such product, materials, industrial wastes, and/or other wastes to State waters, except as expressly authorized.

3. Licensed Operator Requirement (Sewage Treatment Plant)
The permittee shall employ or contract at least one Class III licensed wastewater works operator for sewage treatment facility. The license shall be issued in accordance with Title 54.1 of the Code of Virginia and the regulations of the Board for Waterworks and Wastewater Works Operators and Onsite Sewage System Professionals. The permittee shall notify the Department in writing whenever he is not complying, or has grounds for anticipating he will not comply with this requirement. The notification shall include a statement of reasons and a prompt schedule for achieving compliance.

4. TMDL/Nutrient Reopener
This permit may be modified or, alternatively, revoked and reissued:

   a. If any approved wasteload allocation procedure, pursuant to Section 303(d) of the Clean Water Act, imposes wasteload allocations, limits or conditions on the facility that are not consistent with the permit requirements;

   b. To incorporate technology-based effluent concentration limitations for nutrients in conjunction with the installation of nutrient control technology, whether by new construction, expansion or upgrade, or

   c. To incorporate alternative nutrient limitations and/or monitoring requirements, should:

      (1) the State Water Control Board adopt new nutrient standards for the water body receiving the discharge, including the Chesapeake Bay or its tributaries, or

      (2) a future water quality regulation or statute requiring new or alternative nutrient control.

5. Operations and Maintenance Manual Requirement
The permittee shall maintain a current Operations and Maintenance (O&M) Manual for the treatment works that is in accordance with Virginia Pollutant Discharge Elimination System Regulations, 9VAC25-31 and Sewage Collection and Treatment Regulations, 9VAC25-790.

   The O&M Manual and subsequent revisions shall include the manual effective date and meet Part II.K.2 and Part II.K.4 Signatory Requirements of the permit. Any changes in the practices and procedures followed by the permittee shall be documented in the O&M Manual no later than 90 days following the effective date of the changes. The permittee shall operate the treatment works in accordance with the O&M Manual and shall make the O&M manual available to Department personnel for review during facility inspections. No later than 30 days following a request by DEQ, the current O&M Manual shall be submitted to the DEQ Regional Office for review and approval.

   The O&M manual shall detail the practices and procedures which will be followed to ensure compliance with the requirements of this permit. This manual shall include, but not necessarily be limited to, the following items, as appropriate:

   a. Permitted outfall locations and techniques to be employed in the collection, preservation, and analysis of effluent samples taken for compliance with this permit;

   b. Procedures for measuring and recording the duration and volume of treated wastewater discharged;

   c. Discussion of Best Management Practices, if applicable;

   d. Discussion of treatment works design, treatment works operation, routine preventative maintenance of units within the treatment works, critical spare parts inventory and record keeping;

   e. Plan for the management and/or disposal of waste solids and residues;

f. Hours of operation and staffing requirements for the plant to ensure effective operation of the treatment works and maintain permit compliance;

g. List of facility, local and state emergency contacts; and,

h. Procedures for reporting and responding to any spills/overflows/treatment works upsets.

6. Compliance Reporting

a. The quantification levels (QL) shall be less than or equal to the following concentrations:

Effluent Characteristic	Quantification Level
BOD_5	2 mg/L
TSS	1.0 mg/L
Oil & Grease	5.0 mg/L
Total Petroleum Hydrocarbons	0.5 mg/L
Total Residual Chlorine	0.10 mg/L
Dissolved Copper	1.6 µg/L
Dissolved Zinc	22 µg/L
Total Iron	1.0 µg/L

The QL is defined as the lowest concentration used to calibrate a measurement system in accordance with the procedures published for the method. It is the responsibility of the permittee to ensure that proper quality assurance/quality control (QA/QC) protocols are followed during the sampling and analytical procedures. QA/QC information shall be documented to confirm that appropriate analytical procedures have been used and the required QLs have been attained. The permittee shall use any method in accordance with Part II.A of this permit.

b. Reporting:
Monthly Average -- Compliance with the monthly average limitations and/or reporting requirements for the parameters listed in subsection a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis shall be treated as zero. All concentration data equal to or above the QL used for the analysis shall be treated as it is reported. An arithmetic average shall be calculated using all reported data for the month, including the defined zeros. This arithmetic average shall be reported on the Discharge Monitoring Report (DMR) as calculated. If all data are below the QL used for the analysis (QL must be less than or equal to the QL listed in a. above), then the average shall be reported as "<QL". If reporting for quantity is required on the DMR and the reported monthly average concentration is <QL, then report "<QL" for the quantity. Otherwise use the reported concentration data (including the defined zeros) and flow data for each sample day to determine the daily quantity and report the monthly average of the calculated daily quantities.

For Total Phosphorus, all daily concentration data below the quantification level (QL) for the analytical method used should be treated as half the QL. All daily concentration data equal to or above the QL for the analytical method used shall be treated as it is reported.

For Total Nitrogen (TN), if none of the daily concentration data for the respective species (i.e., TKN, Nitrates/Nitrites) are equal to or above the QL for the respective analytical methods used, the daily TN concentration value reported shall equal one half of the largest QL used for the respective species. If one of the data is equal to or above the QL, the daily TN concentration value shall be treated as that data point is reported. If more than one of the data is above the QL, the daily TN concentration value shall equal the sum of the data points as reported.

Weekly Average -- Compliance with the weekly average limitations and/or reporting requirements for the parameters listed in subsection a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis (QL must be less than or equal to the QL listed in a. above) shall be treated as zero. All concentration data equal to or above the QL used for the analysis shall be treated as reported. An arithmetic average shall be calculated using all reported data, including the defined zeros, collected within each complete calendar week and entirely contained within the reporting month. The maximum value of the weekly averages thus determined shall be reported on the DMR. If all data are below the QL used for the analysis, then the weekly average shall be reported as "<QL". If

reporting for quantity is required on the DMR and the reported weekly average concentration is <QL, then report "<QL" for the quantity. Otherwise use the reported concentration data (including the defined zeros) and flow data for each sample day to determine the daily quantity and report the maximum weekly average of the calculated daily quantities.

Daily Maximum -- Compliance with the daily maximum limitations and/or reporting requirements for the parameters listed in subsection a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis (QL must be less than or equal to the QL listed in a. above) shall be treated as zero. All concentration data equal to or above the QL used for the analysis (QL must be less than or equal to the QL listed in a. above) shall be treated as reported. An arithmetic average shall be calculated using all reported data, including the defined zeros, collected within each day during the reporting month. The maximum value of these daily averages thus determined shall be reported on the DMR as the Daily Maximum. If all data are below the QL used for the analysis (QL must be less than or equal to the QL listed in a. above), then the maximum value of the daily averages shall be reported as "<QL". If reporting for quantity is required on the DMR and the reported daily maximum concentration is <QL, then report "<QL" for the quantity. Otherwise use the reported daily average concentrations (including the defined zeros) and corresponding daily flows to determine daily average quantities and report the maximum of the daily average quantities during the reporting month.

For Total Phosphorus, all daily concentration data below the quantification level (QL) for the analytical method used should be treated as half the QL. All daily concentration data equal to or above the QL for the analytical method used shall be treated as it is reported.

For Total Nitrogen (TN), if none of the daily concentration data for the respective species (i.e., TKN, Nitrates/Nitrites) are equal to or above the QL for the respective analytical methods used, the daily TN concentration value reported shall equal one half of the largest QL used for the respective species. If one of the data is equal to or above the QL, the daily TN concentration value shall be treated as that data point is reported. If more than one of the data is above the QL, the daily TN concentration value shall equal the sum of the data points as reported.

c. **Single Datum** -- Any single datum required shall be reported as "<QL" if it is less than the QL used for the analysis (QL must be less than or equal to the QL listed in a. above). Otherwise the numerical value shall be reported.

d. **Significant Digits** -- The permittee shall report at least the same number of significant digits as the permit limit for a given parameter. Regardless of the rounding convention used by the permittee (i.e., 5 always rounding up or to the nearest even number), the permitttee shall use the convention consistently, and shall ensure that consulting laboratories employed by the permittee use the same convention.

7. Effluent Monitoring Frequencies

If the facility permitted herein is issued a Notice of Violation for any of the parameters listed below, then the following monitoring frequencies shall become effective upon written notice from DEQ, and remain in effect until the permit's expiration date:

Effluent Characteristic	Outfalls	
	102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122	101
Flow	1 per Month	
pH	1 per Month	
TSS	1 per Month	
Oil and Grease	1 per Month	
BOD_5		1 per Week

No other effluent limitations or monitoring requirements are affected by this special condition.

8. Oil Storage Groundwater Monitoring Reopener
As this facility currently manages ground water in order to maintain compliance with 9 VAC 25-91-10 et seq., the *Facility and Aboveground Storage Tank Regulation* (AST Regulation), this permit does not presently impose ground water monitoring requirements. However, this permit may be modified or alternately revoked and reissued to include ground water monitoring if it is not utilized by the permittee to fulfill the requirements of the AST Regulation.

9. Tank Bottom Waters & Pump and Haul Activities
All pump and haul activities involving the removal of tank bottom waters from the bulk storage tanks shall require that a report detailing the following be prepared and submitted to the Department of Environmental Quality by the 10th of the month following the activity:

   a. The name of the contractor responsible for hauling the waste.

   b. The date and time the contractor hauled the waste.

   c. The final destination and disposition of the waste.

   d. The disposal quantity of waste.

10. Intake Trash Racks
Debris collected on the intake trash racks shall not be returned to the waterway.

11. No Discharge of PCBs
There shall be no discharge of polychlorinated biphenyl compounds (PCBs) such as those commonly used for transformer fluid. Compliance with this requirement will be determined using EPA Method 608.

12. Discharges of Uncontaminated Water
There shall be no discharge of chemically contaminated process wastewater from the following points:

   a. Backwash waters from the low level intake screen.

   b. Backwash waters from the high level intake screen.

   c. Discharges from the circulation water pump pit sumps.

   d. Units 1 and 2 condensate tank.

   e. Primary grade water heater well pit.

   f. Units 1 and 2 primary grade water tank.

   g. Chill water drain.

   h. Emergency condensate tank.

   i. Ground water relief system around the Unit 1 and 2 Containment and the Auxiliary and Fuel Building slabs.

13. Discharge of Chlorine in Cooling Water
Total residual chlorine may not be discharged from any single generating unit for more than two hours per day unless the discharger demonstrates to the Department of Environmental Quality that discharge for more than two hours is required for macroinvertebrate control. Simultaneous multi-unit chlorination is permitted.

14. Radioactivity Regulated by NRC
All limitations and monitoring requirements for radioactivity in the wastewater shall be regulated by the Nuclear Regulatory Commission.

15. No Discharge of Tank Bottom Waters
There shall be no discharge of tank bottom waters.

16. Water Quality Criteria Reopener
Should effluent monitoring indicate the need for any water quality-based limitations, this permit may be modified or alternatively revoked and reissued to incorporate appropriate limitations.

17. Treatment Works Closure Plan
If the permittee plans an expansion or upgrade to replace the existing treatment works, or if the facility is permanently closed, the permittee shall submit to the DEQ Regional Office a closure plan for the existing treatment works. The plan shall address the following information as a minimum: Verification of elimination of sources and/or alternate treatment scheme; treatment, removal and final disposition of residual wastewater and solids; removal/demolition/disposal of structures, equipment, piping and appurtenances; site grading, and erosion and sediment control; restoration of site vegetation; access control; fill materials; and proposed land use (post-closure) of the site. The plan should contain proposed dates for beginning and completion of the work. The plan must be approved by the DEQ prior to implementation. Once approved, the plan shall become an enforceable part of this permit and closure shall be implemented in accordance with the approved plan. No later than 14 calendar days following closure completion, the permittee shall submit to the DEQ Piedmont Regional Office written notification of the closure completion date and a certification of closure in accordance with the approved plan.

18. 95% Capacity Reopener (Sewage Treatment Plant)
A written notice and a plan of action for ensuring continued compliance with the terms of this permit shall be submitted to the DEQ, Piedmont Regional Office when the monthly average flow influent to the sewage treatment works reaches 95 percent of the design capacity authorized in this permit for each month of any three consecutive month period**.** The written notice shall be submitted within 30 days and the plan of action shall be received at the Piedmont Regional Office no later than 90 days from the third consecutive month for which the flow reached 95 percent of the design capacity. The plan shall include the necessary steps and a prompt schedule of implementation for controlling any current or reasonably anticipated problem resulting from high influent flows. Failure to submit an adequate plan in a timely manner shall be deemed a violation of the permit.

19. CTC, CTO Requirement (Sewage Treatment Plant)
The permittee shall, in accordance with the DEQ Sewage Collection and Treatment Regulation (9VAC25-790), obtain a Certificate to Construct (CTC), and a Certificate to Operate (CTO) from the DEQ Office of Wastewater Engineering (for Water Quality Improvement Funded (WQIF) projects) or from the DEQ Piedmont Regional Office (for non WQIF projects) prior to constructing wastewater treatment works and operating the treatment works, respectively. Non-compliance with the CTC or CTO shall be deemed a violation of the permit.

Upon issuance of a CTC for nutrient removal wastewater treatment technology, DEQ staff shall initiate modification, or alternately, revocation and reissuance, of this permit, to include annual concentration limits based on the nutrient removal technology listed in the CTC. Upon issuance of a CTO, any nutrient removal facilities installed shall be operated to achieve design effluent Total Nitrogen and Total Phosphorus concentrations.

20. Reliability Class (Sewage Treatment Plant)
The permitted sewage treatment works shall meet Reliability Class II.

21. Sludge Reopener (Sewage Treatment Plant)
The Board may promptly modify or revoke and reissue this permit if any applicable standard for sewage sludge use or disposal promulgated under Section 405(d) of the Clean Water Act is more stringent than any requirements for sludge use or disposal in this permit, or controls a pollutant or practice not limited in this permit.

22. Sludge Use and Disposal (Sewage Treatment Plant)
The permittee shall conduct all sewage sludge use or disposal activities in accordance with the Sludge Management Plan (SMP) approved with the issuance of this permit. Any proposed changes in the sewage sludge use or disposal practices or procedures followed by the permittee shall be documented and submitted for DEQ approval no later than 90 days prior to the effective date of the changes. Upon approval, the revised SMP becomes an enforceable part of the permit. The permit

may be modified or alternatively revoked and reissued to incorporate limitations or conditions necessitated by substantive changes in sewage sludge use or disposal practices.

23. Monitoring Frequencies Encompassing Multiple Months

Monitoring frequency periods encompassing multiple months shall be in accordance with the monitoring and reporting schedule specified below:

Monitoring Frequency	Monitoring Period		DMR Due Date
	From	To	
1 per Year	January 1	December 31	January 10
1 per 6 Months	January 1	June 30	July 10
	July 1	December 31	January 10
1 per 3 Months	January 1	March 31	April 10
	April 1	June 30	July 10
	July 1	September 30	October 10
	October 1	December 31	January 10
1 per 2 Months	January 1	February 28 (or 29)	March 10
	March 1	April 30	May 10
	May 1	June 30	July 10
	July 1	August 31	September 10
	September 1	October 31	November 10
	November 1	December 31	January 10

24. Concept Engineering Report (CER)

Prior to constructing any industrial wastewater treatment works, the permittee shall submit a Concept Engineering Report (CER) to the DEQ Piedmont Regional Office. DEQ written approval shall be secured prior to constructing any wastewater treatment works. The permittee shall construct the wastewater treatment works in accordance with the approved CER. No later than 14 days following completion of construction of any project for which a CER has been approved, written notification shall be submitted to the DEQ Piedmont Regional Office certifying that, based on an inspection of the project, construction was completed in accordance with the approved CER. The written notification shall be certified by a professional engineer licensed in the Commonwealth of Virginia or signed in accordance with Part II.K of this permit. The installed wastewater treatment works shall be operated to achieve design treatment and effluent concentrations. Approval by the Department of Environmental Quality does not relieve the owner of the responsibility for the correction of design and/or operational deficiencies. Noncompliance with the CER shall be deemed a violation of this permit.

Upon approval of a CER for the installation of nutrient removal technology, DEQ staff shall initiate modification, or alternatively, revocation and reissuance, of this permit to include annual concentration limits based on the technology proposed in the CER. Upon completion of construction in accordance with a CER that has been approved by the DEQ Piedmont Regional Office, any nutrient removal facilities installed shall be operated to achieve design effluent Total Nitrogen and Total Phosphorus concentrations.

25. Whole Effluent Toxicity (WET) Monitoring Program

a. Biological Monitoring:

In accordance with the schedule in Part I.C.25.c of this permit, the permittee shall perform annual toxicity testing using 24-hour flow-proportioned composite samples of final effluent from Outfall 001.

(1) The chronic test to use is the Chronic Static Renewal 7-Day Survival, Growth, and Fecundity Test using *Americamysis bahia.*

(2) These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival, growth, and fecundity. Results which cannot be determined (i.e., a “less than” NOEC value) are not acceptable, and a retest shall be

performed. The test NOEC should be expressed using Chronic Toxic Units (TU_c), which are determined by dividing the NOEC value into 100 (100/NOEC), the TU_c result shall be reported with each toxicity report submittal. The LC_{50} at 48 hours and the IC_{25} with the NOEC's shall also be included in the test report.

b. The test dilutions should be able to assess effluent toxicity with the following endpoint(s):

Chronic NOEC of **48%**, equivalent to a TU_c of **2.08**.

The test data will be evaluated statistically by DEQ for reasonable potential at the conclusion of the permit term, or sooner if toxicity has been noted. Should DEQ evaluation of the data indicate that a limit is needed, the permit may be modified or, alternatively, revoked and reissued to include a WET limit and compliance schedule. Following written notification from DEQ of the need for including a WET limitation, the toxicity tests in Part I.C.26.a may be discontinued.

The permittee may provide additional samples to address data variability; these data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40 CFR 136.3

c. Reporting Schedule:
The permittee shall submit a copy of each toxicity test report specified in this Toxics Management Program in accordance with the following schedule:

Compliance Date	Submittal Date
01/01/2017 - 12/31/2017	By 01/10/2018
01/01/2018 - 12/31/2018	By 01/10/2019
01/01/2019 - 12/31/2019	By 01/10/2020
01/01/2020 - 12/31/2020	By 01/10/2021
01/10/2021 - 12/31/2021	By 01/10/2022

26. Dredge Sediment Pond Discharge
The permittee is authorized to discharge water from the sediments management pond to the Intake Canal. The discharge shall not cause or contribute to the violation of the Water Quality standards at Outfall 001.

27. Beyond Design Basis (BDB) Pumps Testing Discharge
The permittee is authorized to discharge Beyond Design Basis pumps test water to the Intake Canal and to the Settling Basin (Outfall 108). Condensate water will be used to test the pumps.

D. Stormwater Management Conditions

1. Form 2F Sampling:
The completed Part VII of Form 2F for Outfall 002 and Outfalls 050, 051, and 052 (representative of Outfall 053) shall be submitted with the permit reissuance application. Additionally, the permittee shall submit a report with the permit reissuance application which identifies all industrial activities, as defined in 9VAC25-151 (*General VPDES Permit for Discharge of Stormwater Associated with Industrial Activity*), which occur within the drainage areas contributing to the stormwater outfalls identified in Part I.A.10 and Part I.A.12 of this permit. Should stormwater monitoring, or additional industrial activities identified by the permittee, indicate the need for revisions to the stormwater requirements contained in Part D of this permit, this permit may be modified or alternatively revoked and reissued to incorporate appropriate stormwater requirements.

2. Stormwater Management Evaluation
The Stormwater Pollution Prevention Plan (SWPPP), which is to be developed and maintained in accordance with subsection I.D.4 below, shall have a goal of reducing pollutants discharges from all the regulated industrial activity stormwater outfalls.

a. Pollutant Specific Screening

One goal of the SWPPP shall place emphasis on reducing, to the maximum extent practicable, the following pollutants in the outfalls noted below:

Outfall No.	Pollutants	Comparative Value
002	Dissolved Copper	7.3 µg/L
002	Dissolved Zinc	72 µg/L

b. The effectiveness of the SWPPP will be evaluated via the required monitoring for all parameters listed in Part I.A.10 and Part I.A.12 of this permit for the regulated stormwater outfalls, including the specific pollutants noted in a. above. Monitoring results that are above the comparative value for the specific pollutants in a. above will justify the need to reexamine the SWPPP for the affected outfall. In addition, the permittee shall amend the SWPPP whenever there is a change in the facility or its operation which materially increases the potential for activities to result in a discharge of significant amounts of pollutants.

No later than February 10 of each year, the permittee shall submit to the DEQ Piedmont Regional Office an annual report which includes the pollutant-specific monitoring data from the outfalls included in this condition along with a summary of any steps taken to modify the SWPPP based on the monitoring data.

3. Stormwater Special Conditions

a. Sample Type.

For all stormwater monitoring required in Part I.A.10 and Part I.A.12 or other applicable sections of this permit, a minimum of one grab sample shall be taken. Unless otherwise specified, all such samples shall be collected from the discharge resulting from a storm event that occurs at least 72 hours from the previously measurable storm event (a "measurable storm event" is defined as a storm event that results in an actual discharge from the site). The required 72-hour storm event interval is waived where the permittee documents that less than a 72-hour interval is representative for local storm events during the season when sampling is being conducted. The grab sample shall be taken during the first 30 minutes of the discharge. If the collection of a grab sample during the first 30 minutes is impracticable, a grab sample can be taken during the first three hours of the discharge, and the permittee shall submit with the monitoring report a description of why a grab sample during the first 30 minutes was impracticable. If stormwater discharges associated with industrial activity commingle with process or non-process water, then where practicable permittees must attempt to sample the stormwater discharge before it mixes with the non-stormwater discharge.

b. Recording of Results.

For each measurement or sample taken pursuant to the storm event monitoring requirements of this permit, the permittee shall record and report with the Discharge Monitoring Reports (DMRs) the following information:

(1) The date and duration (in hours) of the storm event(s) sampled;

(2) The rainfall total (in inches) of the storm event which generated the sampled discharge; and

(3) The duration between the storm event sampled and the end of the previous measurable storm event.

c. Sampling Waiver.

When a permittee is unable to collect stormwater samples required in Part I.A.10 and Part I.A.12 or other applicable sections of this permit within a specified sampling period due to adverse climatic conditions, the permittee shall collect a substitute sample from a separate qualifying event in the next period and submit these data along with the data for the routine sample in that period. Adverse weather conditions that may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricane, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).

d. Representative Outfalls – Substantially Identical Discharges.

If the facility has two or more outfalls that discharge substantially identical effluents, based on similarities of the industrial activities, significant materials, size of drainage areas, and stormwater management practices occurring within the drainage areas of the outfalls, the permittee may conduct monitoring on the effluent of just one of the outfalls and report that the observations also apply to the substantially identical outfall(s). The substantially identical outfall monitoring provisions apply to quarterly visual monitoring, benchmark monitoring and impaired waters monitoring. The substantially identical outfall monitoring provisions are not available for numeric effluent limits monitoring.

The permittee shall include the following information in the SWPPP, and in any DMRs that are required to be submitted to the DEQ:

(1) The locations of the outfalls;

(2) Why the outfalls are expected to discharge substantially identical effluents, including evaluation of monitoring data, where available; and

(3) Estimates of the size of the drainage area (in square feet) for each of the outfalls.

e. Quarterly Visual Examination of Stormwater Quality.

(1) The permittee must perform and document a quarterly visual examination of a stormwater discharge associated with industrial activity from each outfall, except discharges exempted below. The examination(s) must be made at least once in each of the following three-month periods: January through March, April through June, July through September, and October through December. The visual examination shall be made during normal working hours. If no storm event resulted in runoff from the facility during a monitoring quarter, the permittee is excused from visual monitoring for that quarter provided that documentation is included with the monitoring records indicating that no runoff occurred. The documentation must be signed and certified in accordance with Part II.K of this permit.

(2) Visual examinations must be made of samples collected in accordance with Part I.D.3.a. The examination must document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution. The examination must be conducted in a well-lit area. No analytical tests are required to be performed on the samples.

(3) The visual examination reports must be maintained on-site with the Stormwater Pollution Prevention Plan (SWPPP). The report must include the outfall location, the examination date and time, examination personnel, the nature of the discharge (i.e., runoff or snow melt), visual quality of the stormwater discharge (including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution), and probable sources of any observed stormwater contamination.

f. Authorized Non-stormwater Discharges.

(1) The following non-stormwater discharges are authorized by this permit:

(a) Discharges from fire fighting activities;

(b) Fire hydrant flushings;

(c) Potable water including water line flushings;

(d) Uncontaminated condensate from air conditioners, coolers, and other compressors and from the outside storage of refrigerated gases or liquids;

(e) Irrigation drainage;

(f) Landscape watering provided all pesticides, herbicides, and fertilizer have been applied in accordance with the approved labeling;

(g) Pavement wash waters where no detergents are used and no spills or leaks of toxic or hazardous materials have occurred (unless all spilled material has been removed);

(h) Routine external building washdown which does not use detergents;

(i) Uncontaminated ground water or spring water;

(j) Foundation or footing drains where flows are not contaminated with process materials;

(k) Incidental windblown mist from cooling towers that collects on rooftops or adjacent portions of the facility, but NOT intentional discharges from the cooling tower (e.g., "piped" cooling tower blowdown or drains);

(l) Demineralized water; and

(m) Untreated river water.

(2) All other non-stormwater discharges are not authorized and shall either be eliminated or covered under a separate VPDES permit.

g. Releases of Hazardous Substances or Oil in Excess of Reportable Quantities.

The discharge of hazardous substances or oil in the stormwater discharge(s) from the facility shall be prevented or minimized in accordance with the stormwater pollution prevention plan for the facility. This permit does not authorize the discharge of hazardous substances or oil resulting from an on-site spill. This permit does not relieve the permittee of the reporting requirements of 40 CFR 110, 40 CFR 117 and 40 CFR 302 or § 62.1-44.34:19 of the Code of Virginia. Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR 110, 40 CFR 117 or 40 CFR 302 occurs during a 24-hour period:

(1) The permittee is required to notify the Department in accordance with the requirements of Part II.G as soon as he or she has knowledge of the discharge;

(2) Where a release enters a municipal separate storm sewer system (MS4), the permittee shall also notify the owner or the MS4; and

(3) The stormwater pollution prevention plan required by this permit must be reviewed to identify measures to prevent the reoccurrence of such releases and to respond to such releases, and the plan must be modified where appropriate.

h. Water Quality Protection

The discharges authorized by this permit shall be controlled as necessary to meet applicable water quality standards. DEQ expects that compliance with the conditions in this permit will control discharges as necessary to meet applicable water quality standards.

i. Corrective actions

(1) Data exceeding benchmarks concentration values.

(a) If the benchmark monitoring result exceeds the benchmark concentration value for that parameter, the permittee shall review the SWPPP and modify it as necessary to address any deficiencies that caused the exceedance. Revisions to the SWPPP shall be completed within 30 days after an exceedance is discovered. When control measures need to be modified or added (distinct from regular preventive maintenance of existing control measures described in Part I.D.4.c), implementation shall be completed before the next anticipated storm event if possible, but no later than 60 days after the exceedance is discovered, or as otherwise provided or approved by the DEQ Piedmont Regional Office. In cases where construction is necessary to implement control measures, the permittee shall include a schedule in the SWPPP that provides for the completion of the control measures as expeditiously as practicable, but no later than three years after the exceedance is discovered. Where a construction compliance schedule is included in the SWPPP, the plan shall include appropriate nonstructural and temporary controls to be implemented in the affected portion(s) of the facility prior to completion of the permanent control measures. Any control measure modifications shall be documented and dated, and retained with the SWPPP, along with the amount of

time taken to modify the applicable control measures or implement additional control measures.

(b) Natural background pollutant levels. If the concentration of a pollutant exceeds a benchmark concentration value, and the permittee determines that exceedance of the benchmark is attributable solely to the presence of that pollutant in the natural background, corrective action is not required provided that:

(i) The concentration of the benchmark monitoring result is less than or equal to the concentration of that pollutant in the natural background;

(ii) The permittee documents and maintains with the SWPPP the supporting rationale for concluding that benchmark exceedances are in fact attributable solely to natural background pollutant levels. The supporting rationale shall include any data previously collected by the facility or others (including literature studies) that describe the levels of natural background pollutants in the facility's stormwater discharges; and

(iii) The permittee notifies the DEQ Piedmont Regional Office on the DMR that the benchmark exceedances are attributable solely to natural background pollutant levels. Natural background pollutants include those substances that are naturally occurring in soils or groundwater. Natural background pollutants do not include legacy pollutants from earlier activity on the facility's site, or pollutants in run-on from neighboring sources which are not naturally occurring.

(2) Corrective actions. The permittee shall take corrective action whenever:

(a) Routine facility inspections, comprehensive site compliance evaluations, inspections by local, state or federal officials, or any other process, observation or event result in a determination that modifications to the stormwater control measures are necessary to meet the permit requirements; or

(b) There is any exceedance of an effluent limitation (including coal pile runoff), or TMDL wasteload allocation; or

(c) The DEQ Piedmont Regional Office determines, or the permittee becomes aware, that the stormwater control measures are not stringent enough for the discharge to meet applicable water quality standards.

The permittee shall review the SWPPP and modify it as necessary to address any deficiencies. Revisions to the SWPPP shall be completed within 30 days following the discovery of the deficiency. When control measures need to be modified or added (distinct from regular preventive maintenance of existing BMPs described in Part I.D.4.c), implementation shall be completed before the next anticipated storm event if possible, but no later than 60 days after the deficiency is discovered, or as otherwise provided or approved by the DEQ Piedmont Regional Office. In cases where construction is necessary to implement control measures, the permittee shall include a schedule in the SWPPP that provides for the completion of the control measures as expeditiously as practicable, but no later than three years after the deficiency is discovered. Where a construction compliance schedule is included in the SWPPP, the plan shall include appropriate nonstructural and/or temporary controls to be implemented in the affected portion(s) of the facility prior to completion of the permanent control measure. The amount of time taken to modify a control measure or implement additional control measures shall be documented in the SWPPP.

Any corrective actions taken shall be documented and retained with the SWPPP. Reports of corrective actions shall be signed in accordance with Part II.K.

(3) Follow-up reporting. If at any time monitoring results indicate that discharges from the facility exceed an effluent limitation or a TMDL wasteload allocation, or the DEQ Piedmont Regional Office determines that discharges from the facility are causing or contributing to an exceedance of a water quality standard, immediate steps shall be taken to eliminate the exceedances in accordance with the above Part I.D.3.i(2) (Corrective actions). Within 30 calendar days of implementing the relevant corrective action(s), an exceedance report shall be submitted to the DEQ Piedmont Regional Office. The following information shall be included in the report: permit number; facility name, address and location; receiving water;

monitoring data from the event; an explanation of the situation; description of what has been done and the intended actions (should the corrective actions not yet be complete) to further reduce pollutants in the discharge; and an appropriate contact name and phone number.

j. Additional Requirements for Salt Storage.
Storage piles of salt or piles containing salt used for deicing or other commercial or industrial purposes shall be enclosed or covered to prevent exposure to precipitation. The permittee shall implement appropriate measures (e.g., good housekeeping, diversions, containment) to minimize exposure resulting from adding to or removing materials from the pile. All salt storage piles shall be located on an impervious surface. All runoff from the pile, and/or runoff that comes in contact with salt, including under drain systems, shall be collected and contained within a bermed basin lined with concrete or other impermeable materials, or within an underground storage tank(s), or within an above ground storage tank(s), or disposed of through a sanitary sewer (with the permission of the treatment facility). A combination of any or all of these methods may be used. In no case shall salt contaminated stormwater be allowed to discharge directly to the ground or to state waters.

4. Stormwater Pollution Prevention Plan
A stormwater pollution prevention plan (SWPPP) shall be developed and implemented for the facility. The SWPPP is intended to document the selection, design and installation of control measures, including BMPs to eliminate or reduce the pollutants in all stormwater discharges from the facility and to meet applicable effluent limitations and water quality standards.

Permittees shall implement the provisions of the stormwater pollution prevention plan as a condition of this permit.

The stormwater pollution prevention plan requirements of this permit may be fulfilled, in part, by incorporating by reference other plans or documents such as a spill prevention control and countermeasure (SPCC) plan developed for the facility under Section 311 of the Clean Water Act, or best management practices (BMP) programs otherwise required for the facility, provided that the incorporated plan meets or exceeds the plan requirements of Part I.D.4.b (Contents of the Plan). All plans incorporated by reference into the stormwater pollution prevention plan become enforceable under this permit. If a plan incorporated by reference does not contain all of the required elements of the SWPPP of Part I.D.4.b the permittee shall develop the missing SWPPP elements and include them in the required plan.

a. Deadlines for Plan Preparation and Compliance.

(1) The facility shall prepare and implement any revisions to the SWPPP as expeditiously as practicable, but not later than 90 days from the effective date of the permit.

(2) Measures That Require Construction. In cases where construction is necessary to implement measures required by the plan, the plan shall contain a schedule that provides compliance with the plan as expeditiously as practicable, but no later than 3 years after the effective date of this permit. Where a construction compliance schedule is included in the plan, the schedule shall include appropriate nonstructural and/or temporary controls to be implemented in the affected portion(s) of the facility prior to completion of the permanent control measure.

b. Contents of the Plan.
The contents of the SWPPP shall comply with the requirements listed below**.** The plan shall include, at a minimum, the following items:

(1) Pollution Prevention Team. The plan shall identify the staff individuals by name or title who comprise the facility's stormwater pollution prevention team. The pollution prevention team is responsible for assisting the facility or plant manager in developing, implementing, maintaining, revising, and ensuring compliance with the facility's SWPPP. Specific responsibilities of each staff individual on the team shall be identified and listed.

(2) Site Description. The SWPPP shall include the following:

(a) Activities at the Facility. A description of the nature of the industrial activities at the facility.

(b) General Location Map. A general location map (e.g., USGS quadrangle or other map) with enough detail to identify the location of the facility and the receiving waters within one mile of the facility.

(c) Site Map. A site map identifying the following:

(i) The boundaries of the property and the size of the property (in acres);

(ii) The location and extent of significant structures and impervious surfaces (roofs, paved areas and other impervious areas);

(iii) Locations of all stormwater conveyances including ditches, pipes, swales, and inlets, and the directions of stormwater flow (use arrows to show which ways stormwater will flow);

(iv) Locations of all existing structural and source control measures, including BMPs;

(v) Locations of all surface water bodies, including wetlands;

(vi) Locations of potential pollutant sources identified under Part I.D.4.b(3);

(vii) Locations where significant spills or leaks identified under Part I.D.4.b(4) have occurred;

(viii) Locations of the following activities where such activities are exposed to precipitation: fueling stations; vehicle and equipment maintenance and cleaning areas; loading and unloading areas; locations used for the treatment, storage or disposal of wastes; liquid storage tanks; processing and storage areas; access roads, rail cars and tracks; transfer areas for substances in bulk; and machinery;

(ix) Locations of stormwater outfalls and an approximate outline of the area draining to each outfall, and location of municipal storm sewer systems, if the stormwater from the facility discharges to them;

(x) Location and description of all non-stormwater discharges;

(xi) Location of any storage piles containing salt used for deicing or other commercial or industrial purposes; and

(xii) Locations and sources of run-on to the site from adjacent property, where the run-on contains significant quantities of pollutants; and

(xiii) Locations of all stormwater monitoring points.

(d) Receiving Waters and Wetlands. The name of all surface waters receiving discharges from the site, including intermittent streams, dry sloughs, and arroyos. Provide a description of wetland sites that may receive discharges from the facility. If the facility discharges through a municipal separate storm sewer system (MS4), identify the MS4 operator, and the receiving water to which the MS4 discharges.

(3) Summary of Potential Pollutant Sources. The plan shall identify each separate area at the facility where industrial materials or activities are exposed to stormwater. Industrial materials or activities include, but are not limited to: material handling equipment or activities, industrial machinery, raw materials, industrial production and processes, intermediate products, byproducts, final products, and waste products. Material handling activities include, but are not limited to: the storage, loading and unloading, transportation, disposal, or conveyance of any raw material, intermediate product, final product or waste product. For each separate area identified, the description shall include:

(a) Activities in the area. A list of the industrial activities exposed to stormwater (e.g., material storage, equipment fueling and cleaning, cutting steel beams);

(b) Pollutants. A list of the pollutant(s) or pollutant constituents (e.g., crankcase oil-zinc, sulfuric acid, cleaning solvents, etc.) associated with each activity. The pollutant list

shall include all significant materials handled, treated, stored or disposed that have been exposed to stormwater in the three years prior to the date this SWPPP was prepared or amended. The list shall include any hazardous substances or oil at the facility.

(4) Spills and Leaks. The SWPPP shall clearly identify areas where potential spills and leaks that can contribute pollutants to stormwater discharges can occur and their corresponding outfalls. The plan shall include a list of significant spills and leaks of toxic or hazardous pollutants that actually occurred at exposed areas, or that drained to a stormwater conveyance during the three-year period prior to the date this SWPPP was prepared or amended. The list shall be updated if significant spills or leaks occur in exposed areas of the facility during the term of the permit. Significant spills and leaks include, but are not limited to, releases of oil or hazardous substances in excess of reportable quantities.

(5) Sampling Data. The plan shall include a summary of existing stormwater discharge sampling data taken at the facility. The summary shall include, at a minimum, any data collected during the previous permit term.

(6) Stormwater Controls

(a) Control measures shall be implemented for all the areas identified in Part I.D.4.b(3) (Summary of Potential Pollutant Sources) to prevent or control pollutants in stormwater discharges from the facility. Regulated stormwater discharges from the facility include stormwater run-on that commingles with stormwater discharges associated with industrial activity at the facility. The SWPPP shall describe the type, location and implementation of all control measures for each area where industrial materials or activities are exposed to stormwater. Selection of control measures shall take into consideration:

(i) That preventing stormwater from coming into contact with polluting materials is generally more effective, and less costly, than trying to remove pollutants from stormwater;

(ii) Control measures generally shall be used in combination with each other for most effective water quality protection;

(iii) Assessing the type and quantity of pollutants, including their potential to impact receiving water quality, is critical to designing effective control measures;

(iv) That minimizing impervious areas at the facility can reduce runoff and improve groundwater recharge and stream base flows in local streams (however, care must be taken to avoid ground water contamination);

(v) Flow attenuation by use of open vegetated swales and natural depressions can reduce in-stream impacts of erosive flows;

(vi) Conservation or restoration of riparian buffers will help protect streams from stormwater runoff and improve water quality; and

(vii) Treatment interceptors (e.g., swirl separators and sand filters) may be appropriate in some instances to minimize the discharge of pollutants.

(b) Nonnumeric technology-based effluent limits. The permittee shall implement the following types of control measures to prevent and control pollutants in the stormwater discharges from the facility, unless it can be demonstrated and documented that such controls are not relevant to the discharges (e.g., there are no storage piles containing salt).

(i) Good Housekeeping. The permittee shall keep clean all exposed areas of the facility that are potential sources of pollutants to stormwater discharges. Typical problem areas include areas around trash containers, storage areas, loading docks, and vehicle fueling and maintenance areas. The plan shall include a schedule for regular pickup and disposal of waste materials, along with routine inspections for leaks and conditions of drums, tanks and containers.

(ii) Eliminating and Minimizing Exposure. To the extent practicable, manufacturing, processing and material storage areas (including loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations) shall be located inside, or protected by a storm-resistant covering to prevent exposure to rain, snow, snowmelt, and runoff. Note: Eliminating exposure at all industrial areas may make the facility eligible for the "Conditional Exclusion for No Exposure" provision of 9VAC25-31-120 E, thereby eliminating the need to have a permit.

(iii) Preventive Maintenance. The permittee shall have a preventive maintenance program that includes regular inspection, testing, maintenance and repairing of all industrial equipment and systems to avoid situations that could result in leaks, spills and other releases of pollutants in stormwater discharge from the facility. This program is in addition to the specific control measure maintenance required under Part I.D.4.c (Maintenance of BMPs).

(iv) Spill Prevention and Response Procedures. The plan shall describe the procedures that will be followed for preventing and responding to spills and leaks, including:

(A) Preventive measures such as barriers between material storage and traffic areas, secondary containment provisions, and procedures for material storage and handling.

(B) Response procedures, including notification of appropriate facility personnel, emergency agencies, and regulatory agencies, and procedures for stopping, containing and cleaning up spills. Measures for cleaning up hazardous material spills or leaks shall be consistent with applicable RCRA regulations at 40 CFR Part 264 and 40 CFR Part 265. Employees who may cause, detect or respond to a spill or leak shall be trained in these procedures and have necessary spill response equipment available. If possible, one of these individuals shall be a member of the Pollution Prevention Team;

(C) Procedures for plainly labeling containers (e.g., “used Oil,” “Spent Solvents,” “Fertilizers and Pesticides,” etc.) that could be susceptible to spillage or leakage to encourage proper handling and facilitate rapid response if spills or leaks occur; and

(D) Contact information for individuals and agencies that must be notified in the event of a spill shall be included in the SWPPP, and in other locations where it will be readily available.

(v) Routine Facility Inspections. Facility personnel who possess the knowledge and skills to assess conditions and activities that could impact stormwater quality at the facility, and who can also evaluate the effectiveness of control measures shall regularly inspect all areas of the facility where industrial materials or activities are exposed to stormwater. These inspections are in addition to, or as part of, the comprehensive site evaluation required under Part I.D.4.d. At least one member of the Pollution Prevention Team shall participate in the routine facility inspections.

The inspection frequency shall be specified in the plan based upon a consideration of the level of industrial activity at the facility, but shall be a minimum of quarterly unless more frequent intervals are specified elsewhere in the permit or written approval is received from the Department for less frequent intervals. At least once each calendar year, the routine facility inspection must be conducted during a period when a stormwater discharge is occurring.

Any deficiencies in the implementation of the SWPPP that are found shall be corrected as soon as practicable, but not later than within 30 days of the inspection, unless permission for a later date is granted in writing by the Director. The results of the inspections shall be documented in the SWPPP, and shall include at a minimum;

(A) The inspection date and time;

(B) The name and signature of the inspector(s);

(C) Weather information and a description of any discharges occurring at the time of the inspection;

(D) Any previously unidentified discharges of pollutants from the site;

(E) Any control measures needing maintenance or repairs;

(F) Any failed control measures that need replacement;

(G) Any incidents of noncompliance observed; and

(H) Any additional control measures needed to comply with the permit requirements.

(vi) Employee Training. The permittee shall implement a stormwater employee training program for the facility. The SWPPP shall include a schedule for all types of necessary training, and shall document all training sessions and the employees who received the training. Training shall be provided for all employees who work in areas where industrial materials or activities are exposed to stormwater, and for employees who are responsible for implementing activities identified in the SWPPP (e.g., inspectors, maintenance personnel, etc.). The training shall cover the components and goals of the SWPPP, and include such topics as spill response, good housekeeping, material management practices, control measures operation and maintenance, etc. The SWPPP shall include a summary of any training performed.

(vii) Sediment and Erosion Control. The plan shall identify areas at the facility that, due to topography, land disturbance (e.g., construction, landscaping, site grading), or other factors, have a potential for soil erosion. The permittee shall identify and implement structural, vegetative, and stabilization control measures to prevent or control on-site and off-site erosion and sedimentation. Flow velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel if the flows would otherwise create erosive conditions.

(viii) Management of Runoff. The plan shall describe the stormwater runoff management practices (i.e., permanent structural control measures) for the facility. These types of control measures are typically used to divert, infiltrate, reuse, or otherwise reduce pollutants in stormwater discharges from the site.

Structural control measures may require a separate permit under § 404 of the CWA and the Virginia Water Protection Permit Program Regulation (9VAC25-210) before installation begins.

(ix) Dust suppression and vehicle tracking of industrial materials. The permittee shall implement control measures to minimize the generation of dust and off-site tracking of raw, final, or waste materials. Stormwater collected on site may be used for the purposes of dust suppression or for spraying stockpiles. Potable water, well water and uncontaminated reuse water may also be used for this purpose. There shall be no direct discharge to surface waters from dust suppression activities or as a result of spraying stockpiles.

c. Maintenance.

The SWPPP shall include a description of procedures and a regular schedule for preventive maintenance of all control measures, and shall include a description of the back-up practices that are in place should a runoff event occur while a control measure is off-line. The effectiveness of nonstructural control measures shall also be maintained by appropriate means (e.g., spill response supplies available and personnel trained, etc.).

All control measures identified in the SWPPP shall be maintained in effective operating condition and shall be observed at least annually during active operation (i.e., during a

stormwater runoff event) to ensure that they are functioning correctly. Where discharge locations are inaccessible, nearby downstream locations shall be observed. The observations shall be documented in the SWPPP.

If site inspections required by Part I.D.4.b(6)(b)(v) (Routine Facility Inspections) or Part I.D.4.d (Comprehensive Site Compliance Evaluation) identify control measures that are not operating effectively, repairs or maintenance shall be performed before the next anticipated storm event. If maintenance prior to the next anticipated storm event is not possible, maintenance shall be scheduled and accomplished as soon as practicable. In the interim, back-up measures shall be employed and documented in the SWPPP until repairs or maintenance is complete. Documentation shall be kept with the SWPPP of maintenance and repairs of control measures, including the date(s) of regular maintenance, date(s) of discovery of areas in need of repair or replacement, date(s) for repairs, date(s) that the control measure(s) returned to full function, and the justification for any extended maintenance or repair schedules.

d. Comprehensive Site Compliance Evaluation.

The permittee shall conduct comprehensive site compliance evaluations at least once each calendar year. The evaluations shall be done by qualified personnel who possess the knowledge and skills to assess conditions and activities that could impact stormwater quality at the facility, and who can also evaluate the effectiveness of control measures. The personnel conducting the evaluations may be either facility employees or outside personnel hired by the facility.

(1) Scope of the Compliance Evaluation. Evaluations shall include all areas where industrial materials or activities are exposed to stormwater, as identified in Part I.D.4.b(3). The personnel shall evaluate:

(a) Industrial materials, residue or trash that may have or could come into contact with stormwater;

(b) Leaks or spills from industrial equipment, drums, barrels, tanks or similar containers that have occurred within the past three years;

(c) Off-site tracking of industrial or waste materials or sediment where vehicles enter or exit the site;

(d) Tracking or blowing of raw, final, or waste materials from areas of no exposure to exposed areas;

(e) Evidence of, or the potential for, pollutants entering the drainage system;

(f) Evidence of pollutants discharging to surface waters at all facility outfalls, and the condition of and around the outfall, including flow dissipation measures to prevent scouring;

(g) Review of stormwater related training performed, inspections completed, maintenance performed, quarterly visual examinations, and effective operation of control measures including BMPs;

(h) Results of both visual and any analytical monitoring done during the past year shall be taken into consideration during the evaluation.

(2) Based on the results of the evaluation, the SWPPP shall be modified as necessary (e.g., show additional controls on the map required by Part I.D.4.b(2)(c); revise the description of controls required by Part I.D.4.b(6) to include additional or modified BMPs designed to correct problems identified). Revisions to the SWPPP shall be completed within 30 days following the evaluation, unless permission for a later date is granted in writing by the Director. If existing control measures need to be modified or if additional BMPs are necessary, implementation shall be completed before the next anticipated storm event, if practicable, but not more than 60 days after completion of the comprehensive site evaluation, unless permission for a later date is granted in writing by the Department;

(3) Compliance Evaluation Report. A report shall be written summarizing the scope of the evaluation, name(s) of personnel making the evaluation, the date of the evaluation, and all observations relating to the implementation of the SWPPP, including elements stipulated in Part I.D.4.d(1)(a) through (h) above. Observations shall include such things as: the location(s) of discharges of pollutants from the site; location(s) of previously unidentified sources of pollutants; location(s) of control measures that need to be maintained or repaired; location(s) of failed control measures that need replacement; and location(s) where additional control measures are needed. The report shall identify any incidents of noncompliance that were observed. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the SWPPP and this permit. The report shall be signed in accordance with Part II.K and maintained with the SWPPP.

(4) Where compliance evaluation schedules overlap with routine inspections required under Part I.D.4.b(6)(b)(v) the annual compliance evaluation may be used as one of the routine inspections.

e. Signature and Plan Review.

(1) Signature and location. The SWPPP, including revisions to the SWPPP to document any corrective actions taken as required by Part I.D.3.i shall be signed in accordance with Part II K, dated, and retained on-site at the facility covered by this permit in accordance with Part II.B.2. All other changes to the SWPPP, and other permit compliance documentation, shall be signed and dated by the person preparing the change or documentation.

(2) Availability. The permittee shall retain a copy of the current SWPPP required by this permit at the facility, and it shall be immediately available to the department, EPA or the operator of an MS4 receiving discharges from the site at the time of an onsite inspection or upon request.

(3) Required Modifications. The permittee shall modify the SWPPP whenever necessary to address any corrective actions required by Part I.D.3.i. Changes to the SWPPP shall be made in accordance with the corrective action deadlines in Part I.D.3.i(2), and shall be signed and dated in accordance with Part II.K.

The Director may notify the permittee at any time that the SWPPP, control measures, or other components of the facility's stormwater program do not meet one or more of the requirements of this permit. The notification shall identify specific provisions of the permit that are not being met, and may include required modifications to the stormwater program, additional monitoring requirements, and special reporting requirements. The permittee shall make any required changes to the SWPPP within 60 days of receipt of such notification, unless permission for a later date is granted in writing by the Director, and shall submit a written certification to the Director that the requested changes have been made.

f. Maintaining an Updated SWPPP.

(1) The permittee shall review and amend the SWPPP as appropriate whenever:

(a) There is construction or a change in design, operation, or maintenance at the facility that has a significant effect on the discharge, or the potential for the discharge, of pollutants from the facility;

(b) Routine inspections or compliance evaluations determine that there are deficiencies in the control measures including BMPs;

(c) Inspections by local, state, or federal officials determine that modifications to the SWPPP are necessary;

(d) There is a spill, leak or other release at the facility; or

(e) There is an unauthorized discharge from the facility.

(2) SWPPP modifications shall be made within 30 calendar days after discovery, observation or event requiring a SWPPP modification. Implementation of new or modified control

measures (distinct from regular preventive maintenance of existing control measures described in Part I.D.4.c) shall be initiated before the next storm event if possible, but no later than 60 days after discovery, or as otherwise provided or approved by the Director. The amount of time taken to modify a control measure or implement additional control measures shall be documented in the SWPPP.

(3) If the SWPPP modification is based on a release or unauthorized discharge, include a description and date of the release, the circumstances leading to the release, actions taken in response to the release, and measures to prevent the recurrence of such releases. Unauthorized releases and discharges are subject to the reporting requirements of Part II.G of this permit.

5. Specific Benchmark Monitoring:

The permittee is required to monitor the facility stormwater discharges for the pollutants of concern listed in Table 1. Benchmark concentration values, as included in Table 1 of this permit, are not effluent limitations. Exceedance of a benchmark concentration does not constitute a violation of this permit and does not indicate that violation of a water quality standard has occurred; however, it does signal that modifications to the SWPPP are necessary, unless justification is provided in the comprehensive site compliance evaluation (Part I.D.4.d). In addition, exceedance of benchmark concentrations may indicate the requirement for more specific pollution prevention controls.

Table 1. Benchmark Monitoring Requirements

Pollutants of Concern	Benchmark Concentration
Iron (total)	1.0 mg/L

6. Discharges To Waters Subject To TMDL Wasteload Allocations

a. Facilities in the Chesapeake Bay Watershed

Owners of facilities in the Chesapeake Bay watershed shall monitor their industrial stormwater discharges for total suspended solids (TSS), total nitrogen (TN), and total phosphorus (TP) to characterize the contributions from their facility's specific industrial sector for these parameters. Samples shall be collected during each of the first four monitoring periods (i.e., the first two years of permit coverage). Monitoring periods are specified in Part I.A.10 and Part I.A.12. Samples shall be collected and analyzed in accordance with Part I.A.10.a, d, and e and Part I.A.12.a, d, and e. Monitoring results shall be reported in accordance with Part I.C.6 and Part II.C, and retained in accordance with Part II.B.

b. Chesapeake Bay TMDL wasteload allocations and Chesapeake Bay TMDL action plans

(1) EPA's Chesapeake Bay TMDL (December 29, 2010) includes wasteload allocations for VPDES permitted industrial stormwater facilities as part of the regulated stormwater aggregate load. EPA used data submitted by Virginia with the Phase I Chesapeake Bay TMDL Watershed Implementation Plan, including the number of industrial stormwater permits per county and the number of urban acres regulated by industrial stormwater permits, as part of their development of the aggregate load. Aggregate loads for industrial stormwater facilities were appropriate because actual facility loading data were not available to develop individual facility wasteload allocations.

Virginia estimated the loadings from industrial stormwater facilities using actual and estimated facility acreage information, and TP, TN, and TSS loading values from the Northern Virginia Planning District Commission (NVPDC) Guidebook for Screening Urban Nonpoint Pollution Management Strategies, prepared for the Metropolitan Washington Council of Governments. Annandale, VA. November, 1979. The loading values used were as follows:

TP - High (80%) imperviousness industrial; 1.5 lb/ac/yr

TN - High (80%) imperviousness industrial; 12.3 lb/ac/yr

TSS - High (80%) imperviousness industrial; 440 lb/ac/yr

The actual facility area information, and the TP, TN and TSS data collected for this permit will be used by DEQ to quantify the nutrient and sediment loads from VPDES permitted industrial stormwater facilities, and will be submitted to EPA to aid them in further refinements to their Chesapeake Bay TMDL model. The loading information will also be used by DEQ to determine any additional load reductions needed for industrial stormwater facilities for the next reissuance of this permit.

(2) Data analysis and Chesapeake Bay TMDL action plans. The permittee shall analyze the nutrient and sediment data collected in accordance with subdivision 6.b(1) of this subsection to determine if additional action is needed for this permit term. The permittee shall average the data collected at the facility for each of the pollutants of concern (POC) (e.g., TP, TN and TSS) and compare the results to the loading values for TP, TN and TSS presented in subdivision 6.b(1) of this subsection. To calculate the facility loadings, the permittee shall use either the actual annual average rainfall data for the facility location (in inches/year) or the Virginia annual average rainfall of 44.3 inches/year.

The following formula or a site specific, DEQ-approved calculation shall be used to determine the loading value:

$$\mathbf{L = 0.226 \times R \times C} \qquad \text{Equation (1)}$$

where:

L = the Pollutant of Concern (POC) loading value (lb/acre/year)

C = the POC average concentration of all facility samples (mg/L)

0.226 = unit conversion factor

R = annual runoff (in/yr), calculated as: $R = P \times P_j \times R_v$

where:

P = annual rainfall (in/yr) [use the Virginia annual average of 44.3 in/yr, or site specific annual rainfall for your area of the State]

P_j = the fraction of annual events that produce runoff (usually 0.9)

R_v = the runoff coefficient, which can be expressed as: $R_v = 0.05 + (0.9 \times I_a)$

I_a = the impervious fraction [the ratio of facility impervious area to the total facility area]

or, I_a = AREAIMPERVIOUS / AREATOTAL

Substituting in Equation (1):

$$\mathbf{L = 0.226 \times P \times P_j \times (0.05 + (0.9 \times I_a)) \times C} \qquad \text{Equation (2)}$$

(3) If the calculated facility loading value for TP, TN or TSS is less than the corresponding loading value presented in subdivision 6.b(1) of this subsection, then the calculations demonstrating that no reduction is necessary **shall be submitted within 90 days from the end of the second year's monitoring period**. The calculations shall include a site map with the total site area, the areas associated with industrial activity and the total impervious area.

If the calculated facility loading value for TP, TN or TSS exceeds the corresponding loading value presented in subdivision 6.b(1) of this subsection, then the permittee shall develop and submit a Chesapeake Bay TMDL Action Plan to DEQ for review and approval The plan shall include a site map with the total site area, the areas associated with industrial activity and the total impervious area. The permittee shall implement the applicable elements of the approved plan over the remaining term of this permit and achieve all the necessary reductions by June 30, 2024. . **The plan shall be submitted within 90 days from the end of the second year's monitoring period**. The action plan shall include:

(a) A determination of the total pollutant load reductions for TP, TN and TSS (as appropriate) necessary to reduce the annual loads from industrial activities. This shall

be determined by calculating the difference between the loading values listed in subdivision 6.b(1) of this subsection, and the average of the sampling data for TP, TN or TSS (as appropriate) for the entire facility. The reduction applies to the total difference calculated for each pollutant of concern;

(b) The means and methods, such as management practices and retrofit programs, that will be utilized to meet the required reductions determined in subdivision 6.b(3)(a) of this subsection, and a schedule to achieve those reductions by June 30, 2024. The schedule should include annual benchmarks to demonstrate the ongoing progress in meeting those reductions;

(c) The permittee may consider utilization of any pollutant trading or offset program in accordance with §§ 62.1-44.19:20 through 62.1-44.19:23 of the Code of Virginia, governing trading and offsetting, to meet the required reductions.

(4) Permittees required to develop and implement a Chesapeake Bay TMDL Action Plan shall submit an annual report to the department by June 30th of each year describing the progress in meeting the required reductions.

7. Discharges Through A Regulated MS4 To Waters Subject To The Chesapeake Bay TMDL
In addition to the requirements of this permit, any facility with industrial activity discharges through a regulated MS4 that is notified by the MS4 operator that the locality has adopted ordinances to meet the Chesapeake Bay TMDL shall incorporate measures and controls into their SWPPP to comply with applicable local TMDL ordinance requirements.

8. Expansion Of Facilities That Discharge To Waters Subject To The Chesapeake Bay TMDL
Virginia's Phase I Chesapeake Bay TMDL Watershed Implementation Plan (November 29, 2010), states that the wasteloads from any expansion of an existing permitted facility discharging stormwater in the Chesapeake Bay watershed cannot exceed the nutrient and sediment loadings that were discharged from the expanded portion of the land prior to the land being developed for the expanded industrial activity.

a. For any industrial activity area expansions (i.e., construction activities, including clearing, grading and excavation activities) that commence on or after July 1, 2014 (the effective date of this permit), the permittee shall document in the SWPPP the information and calculations used to determine the nutrient and sediment loadings discharged from the expanded land area prior to the land being developed, and the measures and controls that were employed to meet the no net increase of stormwater nutrient and sediment loads as a result of the expansion of the industrial activity. Any land disturbance that is exempt from permitting under the VPDES construction stormwater general permit regulation (9VAC25-880) is exempt from this requirement.

b. The permittee may use the VSMP water quality design criteria to meet the requirements of subdivision a of this subsection. Under this criteria, the total phosphorus load shall not exceed the greater of:

(1) The total phosphorus load that was discharged from the expanded portion of the land prior to the land being developed for the industrial activity or

(2) 0.41 pounds per acre per year.

Compliance with the water quality design criteria may be determined utilizing the Virginia Runoff Reduction Method or another equivalent methodology approved by the board. Design specifications and pollutant removal efficiencies for specific BMPs can be found on the Virginia Stormwater BMP Clearinghouse website at http://www.vwrrc.vt.edu/swc.

c. The permittee may consider utilization of any pollutant trading or offset program in accordance with §§ 62.1-44.19:20 through 62.1-44.19:23 of the Code of Virginia, governing trading and offsetting, to meet the no net increase requirement.

E. §316(b) Phase II Conditions

1. Interim §316(b) Best Technology Available (BTA)
The permittee shall implement interim Best Technology Available (BTA) measures to minimize impingement and entrainment (I&E) mortality and adverse impacts. Each operating cooling water intake structure (CWIS) shall utilize a modified traveling screen, low-pressure screen wash system, and a fish return system in a manner that minimizes the impingement and entrainment (I&E) of aquatic species.

2. Impingement and Entrainment Control Technology Preventative Maintenance
The Operations and Maintenance (O&M) Manual for the permitted facility shall include a description of procedures and a regular schedule for preventative maintenance of all I&E control technologies and measures. In addition, the O&M Manual shall include a description of mitigation protocols and practices to implement should a water withdrawal event occur while an I&E technology or measure is off-line. The O&M Manual shall be updated to incorporate the information required by this condition by no later than 90 days following the effective date of this permit. All I&E control technologies and measures shall be maintained in effective operating condition. The permittee shall maintain documentation of maintenance and repairs of I&E control technologies and measures, including, but not limited to: the date(s) of regular maintenance, date(s) of discovery of areas in need of repair or replacement, date(s) for repairs, and date(s) the control technologies returned to full function.

3. Alternate Schedule for Submittal of 40 CFR §122.21(r) Information
The permittee shall, by no later than 270 days prior to the expiration date of this permit, submit to the DEQ Regional Office all applicable information described in 40CFR §122.21(r).

4. Monitoring Requirements

The permittee shall conduct visual inspections or employ remote monitoring devices during the period any cooling water intake structure is in operation. Inspections shall be conducted no less frequently than weekly to ensure that any technologies operated to comply with impingement mortality and entrainment requirements, any additional measures necessary to protect listed threatened and endangered species and designated critical habitat, and other standards for minimizing adverse environmental impact as established in this permit, are maintained and operated to function as designed.

Inspection documentation shall include at a minimum:

a. Date, time, and location of the inspection or remote monitoring period;

b. The name(s) and signature(s) of the inspector(s);

c. A description of water withdrawal volumes or rates occurring at the time of the inspection;

d. Where available, head loss across the intake screen(s);

e. If adverse weather conditions exist, a description of the adverse weather conditions;

f. Any technologies needing maintenance, repair, or replacement.

The requirement to conduct visual or remote inspections is waived when no water is withdrawn through all cooling water intake structures during an entire inspection period. For each cooling water intake structure, the permittee shall document the date(s) when no water is withdrawn through the respective intake structure.

When adverse weather conditions prevent visual inspections or remote monitoring from being safely conducted during a given inspection period, the visual inspection or remote monitoring requirements may be waived provided the permittee prepares documentation explaining the reasons why a visual inspection or remote monitoring could not be safely conducted. Adverse weather conditions are those that are dangerous or create inaccessibility for personnel, and may include such events as local flooding, high winds, electrical storms, or situations that otherwise make an inspection impracticable, such as drought or extended frozen conditions.

Any deficiencies found during a visual inspection or remote monitoring event shall be corrected as soon as possible, but no later than 30 days following discovery, unless permission for a later date is granted by DEQ in writing.

All documentation relating to visual inspections or remote monitoring, or the inability to safely conduct such monitoring due to adverse weather conditions, shall be signed and certified in accordance with Part II.K of this permit and shall be made available to DEQ personnel for review during facility inspections or no later than 30 days following receipt of a request by DEQ.

5. Annual Certification Statement Requirements
The permittee shall annually prepare a written statement certifying either: a) operations of any unit at the permitted facility that impacts cooling water withdrawals or operation of any cooling water intake structure have been substantially modified, or b) no substantial changes have occurred in the operations of any unit at the permitted facility that impacts cooling water withdrawals or operation of any cooling water intake structure.

   If substantially modified operations have occurred, the permittee must provide with the annual certification statement a summary of those changes. In addition, the permittee must submit revisions to the information required at 40 CFR §122.21(r) with the next application for reissuance of this permit.

   Certification statements shall be signed in accordance with Part II.K of this permit and submitted to the DEQ Piedmont Regional Office by no later than each February 10 for the period covering the preceding calendar year.

6. Measures to protect Federally-listed Threatened or Endangered (T&E) species, designated critical habitat, and fragile species or shellfish
The permittee shall operate each cooling water intake structure and cooling system in a manner designed to minimize incidental take, reduce or remove more than minor detrimental effects to Federally-listed threatened, endangered, or fragile species and designated critical habitat, including prey base.

   The permittee shall prepare, on a calendar year basis, a report providing an assessment of the efficiency/effectiveness of the facility's control measures. The report shall include a compilation of all federally-listed threatened or endangered species found to have been impinged or entrained during the reporting year, including the total number and type of organisms (listed by taxa), and life stage cycle (egg, larva, juvenile, adult) impacted by injury or death. The assessments and compiled data shall be submitted to the DEQ-Regional Office by no later than each February 10 for the preceding calendar year.

7. Federal Endangered Species Act Compliance
Nothing in this permit authorizes take for the purposes of a facility's compliance with the Endangered Species Act.

PART II. CONDITIONS APPLICABLE TO ALL VPDES PERMITS

A. MONITORING

1. Samples and measurements required by this permit shall be taken at the permit designated or approved location and be representative of the monitored activity.

   a. Monitoring shall be conducted according to procedures approved under Title 40 Code of Federal Regulations Part 136 or alternative methods approved by the U.S. Environmental Protection Agency, unless other procedures have been specified in this permit.

   b. The permittee shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will insure accuracy of measurements.

   c. Samples taken shall be analyzed by a laboratory certified under 1VAC30-45, Certification for Noncommercial Environmental Laboratories, or 1VAC30-46, Accreditation for Commercial Environmental Laboratories.

2. Any pollutant specifically addressed by this permit that is sampled or measured at the permit designated or approved location more frequently than required by this permit shall meet the requirements in A 1 a through c above and the results of this monitoring shall be included in the calculations and reporting required by this permit.

3. Operational or process control samples or measurements shall not be taken at the designated permit sampling or measurement locations. Operational or process control samples or measurements do not need to follow procedures approved under Title 40 Code of Federal Regulations Part 136 or be analyzed in accordance with 1VAC30-45, Certification for Noncommercial Environmental Laboratories, or 1VAC30-46, Accreditation for Commercial Environmental Laboratories.

B. RECORDS

1. Records of monitoring information shall include:

   a. The date, exact place, and time of sampling or measurements;

   b. The individual(s) who performed the sampling or measurements;

   c. The date(s) and time(s) analyses were performed;

   d. The individual(s) who performed the analyses;

   e. The analytical techniques or methods used; and

   f. The results of such analyses.

2. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years, the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the permittee, or as requested by the Board.

C. REPORTING MONITORING REQUIREMENTS

1. The permittee shall submit the results of the monitoring required by this permit by hard copy or by E-DMR not later than the 10th day of the month after the required monitoring period, unless another reporting schedule is specified elsewhere in this permit. Monitoring results sent by hard copy shall be submitted to:

DEQ - Piedmont Regional Office
4949-A Cox Road
Glen Allen, VA 23060

2. Monitoring results shall be reported on a Discharge Monitoring Report (DMR) or on forms provided, approved, or specified by the Department.

3. Calculations for all limits which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

D. DUTY TO PROVIDE INFORMATION

The permittee shall furnish to the Department, within a reasonable time, any information which the Board may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Board may require the permittee to furnish, upon request, such plans, specifications, and other pertinent information as may be necessary to determine the effect of the wastes from his discharge on the quality of state waters, or such other information as may be necessary to accomplish the purposes of the State Water Control Law. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.

E. COMPLIANCE SCHEDULE REPORTS

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. UNAUTHORIZED DISCHARGES

Except in compliance with this permit, or another permit issued by the Board, it shall be unlawful for any person to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances; or

2. Otherwise alter the physical, chemical or biological properties of such state waters and make them detrimental to the public health, or to animal or aquatic life, or to the use of such waters for domestic or industrial consumption, or for recreation, or for other uses.

G. REPORTS OF UNAUTHORIZED DISCHARGES

Any permittee who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance into or upon state waters in violation of Part II F 1; or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters in violation of Part II F 1, shall notify the Department of the discharge immediately upon discovery of the discharge, but in no case later than 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the Department, within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;

2. The cause of the discharge;

3. The date on which the discharge occurred;

4. The length of time that the discharge continued;

5. The volume of the discharge;

6. If the discharge is continuing, how long it is expected to continue;

7. If the discharge is continuing, what the expected total volume of the discharge will be; and

8. Any steps planned or taken to reduce, eliminate and prevent a recurrence of the present discharge or any future discharges not authorized by this permit. Discharges reportable to the Department under the immediate reporting requirements of other regulations are exempted from this requirement.

H. REPORTS OF UNUSUAL OR EXTRAORDINARY DISCHARGES

If any unusual or extraordinary discharge including a bypass or upset should occur from a treatment works and the discharge enters or could be expected to enter state waters, the permittee shall promptly notify, in no case later than 24 hours, the Department by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse affects on aquatic life and the known number of fish killed. The permittee shall reduce the report to writing and shall submit it to the Department within five days of discovery of the discharge in accordance with Part II I 2. Unusual and extraordinary discharges include but are not limited to any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;
2. Breakdown of processing or accessory equipment;
3. Failure or taking out of service some or all of the treatment works; and
4. Flooding or other acts of nature.

I. REPORTS OF NONCOMPLIANCE

The permittee shall report any noncompliance which may adversely affect state waters or may endanger public health.

1. An oral report shall be provided within 24 hours from the time the permittee becomes aware of the circumstances. The following shall be included as information which shall be reported within 24 hours under this paragraph:
   a. Any unanticipated bypass; and
   b. Any upset which causes a discharge to surface waters.
2. A written report shall be submitted within 5 days and shall contain:
   a. A description of the noncompliance and its cause;
   b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
   c. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

   The Board may waive the written report on a case-by-case basis for reports of noncompliance under Part II I. if the oral report has been received within 24 hours and no adverse impact on state waters has been reported.
3. The permittee shall report all instances of noncompliance not reported under Parts II I.1 or 2, in writing, at the time the next monitoring reports are submitted. The reports shall contain the information listed in Part II I.2.

NOTE: The immediate (within 24 hours) reports required in Parts II G, H and I shall be made to the Department's Regional Office at pro.SSO-UD@deq.virginia.gov or (804) 572-5020. For telephone reports outside normal working hours (before 8:30 am and after 5:00 pm Monday through Friday and anytime Saturday through Sunday), follow the instructions on the voicemail to reach the appropriate staff. For emergencies, the Virginia Department of Emergency Management maintains a 24 hour telephone service at 1-800-468-8892.

J. NOTICE OF PLANNED CHANGES

1. The permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:
   a. The permittee plans alteration or addition to any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced:

(1) After promulgation of standards of performance under Section 306 of Clean Water Act which are applicable to such source; or

(2) After proposal of standards of performance in accordance with Section 306 of Clean Water Act which are applicable to such source, but only if the standards are promulgated in accordance with Section 306 within 120 days of their proposal;

b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations nor to notification requirements specified elsewhere in this permit; or

c. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

2. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

K. SIGNATORY REQUIREMENTS

1. Applications. All permit applications shall be signed as follows:

a. For a corporation: by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means: (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulation; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

c. For a municipality, state, federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a federal agency includes: (i) The chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

2. Reports, etc. All reports required by permits, and other information requested by the Board shall be signed by a person described in Part II K 1, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described in Part II K 1;

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

c. The written authorization is submitted to the Department.

3. Changes to authorization. If an authorization under Part II K 2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part II K 2 shall be submitted to the Department prior to or together with any reports, or information to be signed by an authorized representative.

4. Certification. Any person signing a document under Parts II K 1 or 2 shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

L. DUTY TO COMPLY

The permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the State Water Control Law and the Clean Water Act, except that noncompliance with certain provisions of this permit may constitute a violation of the State Water Control Law but not the Clean Water Act. Permit noncompliance is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if this permit has not yet been modified to incorporate the requirement.

M. DUTY TO REAPPLY

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. All permittees with a currently effective permit shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Board. The Board shall not grant permission for applications to be submitted later than the expiration date of the existing permit.

N. EFFECT OF A PERMIT

This permit does not convey any property rights in either real or personal property or any exclusive privileges, nor does it authorize any injury to private property or invasion of personal rights, or any infringement of federal, state or local law or regulations.

O. STATE LAW

Nothing in this permit shall be construed to preclude the institution of any legal action under, or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any other state law or regulation or under authority preserved by Section 510 of the Clean Water Act. Except as provided in permit conditions on "bypassing" (Part II U), and "upset" (Part II V) nothing in this permit shall be construed to relieve the permittee from civil and criminal penalties for noncompliance.

P. OIL AND HAZARDOUS SUBSTANCE LIABILITY

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Sections 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law.

Q. PROPER OPERATION AND MAINTENANCE

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate licensed operator staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

R. DISPOSAL OF SOLIDS OR SLUDGES

Solids, sludges or other pollutants removed in the course of treatment or management of pollutants shall be disposed of in a manner so as to prevent any pollutant from such materials from entering state waters.

S. DUTY TO MITIGATE

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

T. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

U. BYPASS

1. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility. The permittee may allow any bypass to occur which does not cause effluent limits to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Parts II U 2 and U 3.

2. Notice
   a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, prior notice shall be submitted, if possible at least ten days before the date of the bypass.
   b. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Part II I.

3. Prohibition of bypass.

   a. Bypass is prohibited, and the Board may take enforcement action against a permittee for bypass, unless:
      (1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
      (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
      (3) The permittee submitted notices as required under Part II U 2.

   b. The Board may approve an anticipated bypass, after considering its adverse effects, if the Board determines that it will meet the three conditions listed above in Part II U 3 a.

V. UPSET

1. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limits if the requirements of Part II V 2 are met. A determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is not a final administrative action subject to

judicial review.

2. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An upset occurred and that the permittee can identify the cause(s) of the upset;

   b. The permitted facility was at the time being properly operated; and

   c. The permittee submitted notice of the upset as required in Part II I 2.

   d. The permittee complied with any remedial measures required under Part II S.

3. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

W. INSPECTION AND ENTRY

The permittee shall allow the Director, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act and the State Water Control Law, any substances or parameters at any location.

For purposes of this section, the time for inspection shall be deemed reasonable during regular business hours, and whenever the facility is discharging. Nothing contained herein shall make an inspection time unreasonable during an emergency.

X. PERMIT ACTIONS

Permits may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

Y. TRANSFER OF PERMITS

1. Permits are not transferable to any person except after notice to the Department. Except as provided in Part II Y 2, a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued, or a minor modification made, to identify the new permittee and incorporate such other requirements as may be necessary under the State Water Control Law and the Clean Water Act.

2. As an alternative to transfers under Part II Y 1, this permit may be automatically transferred to a new permittee if:

   a. The current permittee notifies the Department at least 30 days in advance of the proposed transfer of the title to the facility or property;

   b. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

   c. The Board does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Part II Y 2 b.

Z. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

Attachment C: Threatened and Endangered Species Consultation Letters

Intentionally Blank

Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

August 3, 2017

Ms. Julie Crocker, Endangered Species Coordinator
National Marine Fisheries Service (NMFS)
Greater Atlantic Regional Fisheries Office
Protected Resources Division
55 Republic Drive
Gloucester, MA 01930

RE: Virginia Electric and Power Company - Surry Power Station Units 1 and 2 Subsequent License Renewal

Dear Ms. Crocker,

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential impact on species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA), important plant and animal habitats, including critical habitats as defined by the ESA, and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

In recognition of the fact that the environmental impacts of an existing facility were assessed during the original licensing process, and that license renewal is unlikely to have significant additional or different impacts, the regulations identify categories of topics that may be governed by a Generic Environmental Impact Statement (GEIS). The regulations also identify issues that require site-specific analysis in the ER for the renewal. The NRC has also issued guidance relating to the environmental analysis required as part of the renewal process, including development of the GEIS.

As part of the renewal process, the NRC may request a consultation with your agency regarding the license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input regarding the effects that extending the license term may have on listed species (or candidates proposed for listing) and important plant and animal habitats within the station's immediate environs. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed, and a brief discussion of the station, its operations during the extended license term, and listed and candidate species in the station's vicinity is provided below.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

The Hog Island Tract of the Hog Island Wilderness Management Area (HIWMA) is adjacent to the northern boundary of SPS at the tip of Gravel Neck Peninsula. The 2,900 acres of the Hog Island Tract are primarily tidal marshes and diked impoundments that are interspersed with pine forests. The Carlisle and Stewart Tracts of the HIWMA, approximately 1,000 acres in extent, are southeast of SPS. These parcels are primarily upland forested areas, but also contain tidal marshes along Lawnes Creek. All three tracts of the HIWMA are owned by the Virginia Department of Game and Inland Fisheries (VDGIF) and support a rich variety of wildlife. The tidal flats and marshes provide habitat for large numbers and numerous species of migratory shore birds, wading birds, and waterfowl.

Marine or anadromous species potentially occurring near the SPS site or within counties occurring in a 6-mile radius of the site (Surry, James City, York, and Isle of Wight Counties) that are currently federally or state listed as threatened or endangered are included in the table below:

Common Name	**Scientific Name**	**Federal Legal Status**	**State Legal Status**
Atlantic Sturgeon	*Acipenser oxyrinchus*	Endangered	Endangered
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Endangered
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened

During the license renewal term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the

independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment, or sensitive species, plants or habitats. The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to listed marine species and important aquatic habitats within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Manager, Generation Environmental Services

Attachments:

Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

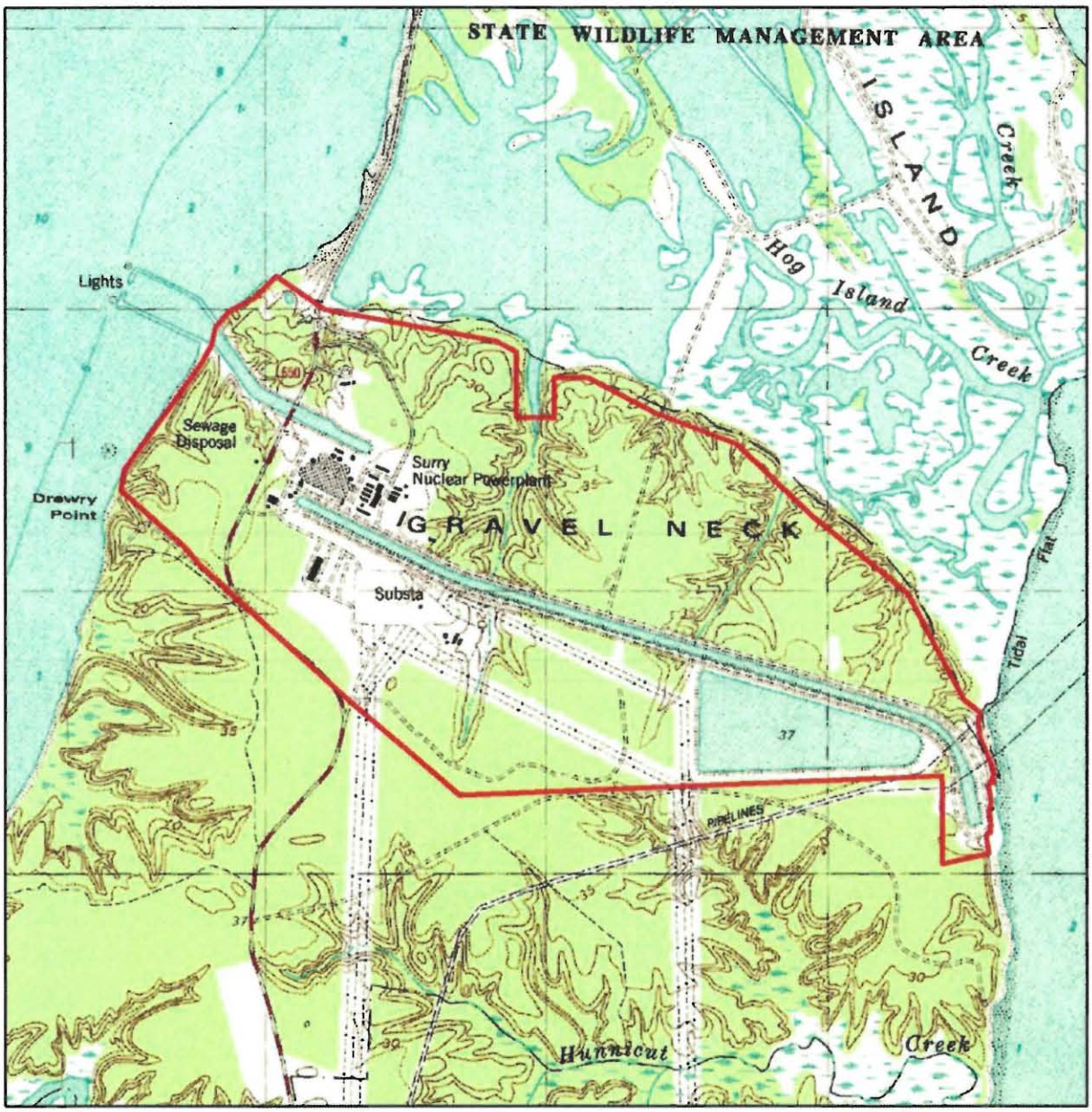
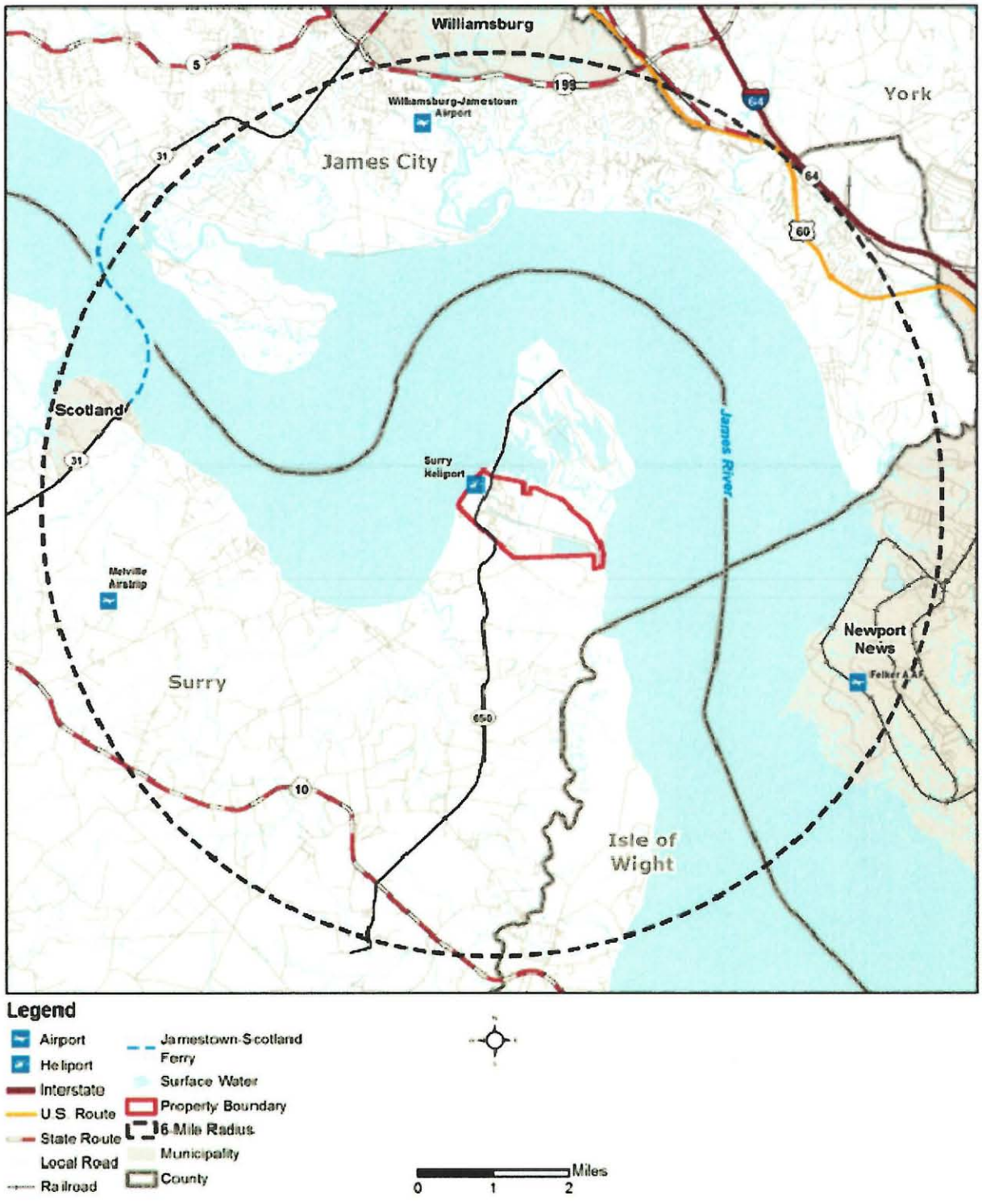


Figure 6-mile Vicinity



Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

August 3, 2017

Ms. Cindy Schultz
U.S. Fish and Wildlife Service
Ecological Services
Virginia Field Office
6669 Short Lane
Gloucester, Virginia 23061

RE: Virginia Electric and Power Company - Surry Power Station Units 1 and 2 Subsequent License Renewal

Dear Ms. Schultz:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential impact on species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA) and important plant and animal habitats, including critical habitats as defined by the ESA and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

In recognition of the fact that the environmental impacts of an existing facility were assessed during the original licensing process, and that license renewal is unlikely to have significant additional or different impacts, the regulations identify categories of topics that may be governed by a Generic Environmental Impact Statement (GEIS). The regulations also identify issues that require site-specific analysis in the ER for the renewal. The NRC has also issued guidance relating to the environmental analysis required as part of the renewal process, including development of the GEIS.

As part of the renewal process, the NRC may request a consultation with your agency regarding the license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input regarding the effects that extending the license term may have on listed species (or candidates proposed for listing) and important plant and animal habitats within the station's immediate environs. Figures depicting the station site and the vicinity within a 6-mile radius of the station and a table of listed species in the station's vicinity are enclosed, and a brief discussion of the station and its operations during the extended license term is provided below.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

The Hog Island Tract of the Hog Island Wilderness Management Area (HIWMA) is adjacent to the northern boundary of SPS at the tip of Gravel Neck Peninsula. The 2,900 acres of the Hog Island Tract are primarily tidal marshes and diked impoundments that are interspersed with pine forests. The Carlisle and Stewart Tracts of the HIWMA, approximately 1,000 acres in extent, are southeast of SPS. These parcels are primarily upland forested areas, but also contain tidal marshes along Lawnes Creek. All three tracts of the HIWMA are owned by the Virginia Department of Game and Inland Fisheries (VDGIF) and support a rich variety of wildlife. The tidal flats and marshes provide habitat for large numbers and numerous species of migratory shore birds, wading birds, and waterfowl.

Species potentially occurring near the SPS site, or within counties occurring in a 6-mile radius of the site (Surry, James City, York, and Isle of Wight Counties) that are currently federally or state listed (or proposed for listing) as threatened or endangered are included in the enclosed table.

During the license renewal term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment, or sensitive species, plants or habitats. The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to listed species and important species habitats within the

immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Manager, Generation Environmental Services

Attachments:

Table of Protected Species Potentially Occurring in the SPS Vicinity
Figure SPS Site
Figure 6-mile Vicinity

Table of Protected Species Potentially Occurring in the SPS Vicinity

Common Name	Scientific Name	Federal Legal Status	State Legal Status
AMPHIBIANS			
Barking Treefrog[ab]	*Hyla gratiosa*	None	LT
Eastern Tiger Salamander[d]	*Ambystoma tigrinum*	None	LE
Mabee's Salamander[b]	*Ambystoma mabeei*	None	LT
Birds			
Bachman's Sparrow[b]	*Peucaea aestivalis*	None	LT
Bald Eagle[c]	*Haliaeetus leucocephalus*	DL	None
Black Rail[b]	*Laterallus jamaicensis*	None	LE
Henslow's Sparrow[b]	*Ammodramus henslowii*	None	LT
Loggerhead Shrike[b]	*Lanius ludovicianus*	None	LT
Migrant Loggerhead Shrike[b]	*Lanius ludovicianus migrans*	None	LT
Peregrine Falcon[b]	*Falco peregrinus*	DL	LT
Piping Plover[d]	*Charadrius melodus*	LT	LT
Red Knot[b]	*Calidris canutus rufa*	LT	LT
Red-cockaded Woodpecker[b]	*Picoides borealis*	LE	LE
Roseate Tern[d]	*Sterna dougallii dougalli*	LE	LE
FISH			
Atlantic Sturgeon[ab]	*Acipenser oxyrinchus*	LE	LE
Blackbanded Sunfish[ab]	*Enneacanthus chaetodon*	None	LE
MAMMALS			
Little Brown Bat[b]	*Myotis lucifugus lucifugus*	None	LE
Northern Long-eared Bat[bc]	*Myotis septentrionalis*	LT	LT
Rafinesque's Eastern Big-eared Bat[b]	*Corynorhinus rafinesquii macrotis*	None	LE
Tri-colored Bat[b]	*Perimyotis subflavus*	None	LE
Reptiles			
Canebrake Rattlesnake[b]	*Crotalus horridus*	None	LT
Eastern Chicken Turtle[d]	Deirochelys reticularia reticularia	None	LE
Kemp's Ridley Sea Turtle[d]	*Lepidochelys kempii*	LE	LE
Leatherback Sea Turtle[d]	*Dermochelys coriacea*	LE	LE

Common Name	Scientific Name	Federal Legal Status	State Legal Status
Loggerhead Sea Turtle[d]	*Caretta caretta*	LT	LT
Northern Diamond-backed Terrapin[b]	*Malaclemys terrapin terrapin*	None	CC
Spotted Turtle[b]	*Clemmys guttata*	None	CC
VASCULAR PLANTS			
Sensitive Joint-vetch[ac]	*Aeschynomene virginica*	LT	LT
Small Whorled Pogonia[d]	*Isotria medeoloides*	LT	LE

[a] Listed by the Virginia Department of Conservation and Recreation Natural Heritage as occurring or likely to occur in Surry County, Virginia

[b] Listed by the VDGIF as occurring or likely to occur in Surry County, Virginia

[c] Listed by the USFWS as occurring or likely to occur in Surry County, Virginia

[d] Not listed as occurring in Surry County by the VDGIF or the USFWS

DL = Delisted LE = Listed Endangered LT = Listed Threatened CC = Collection Concern

Figure SPS Site

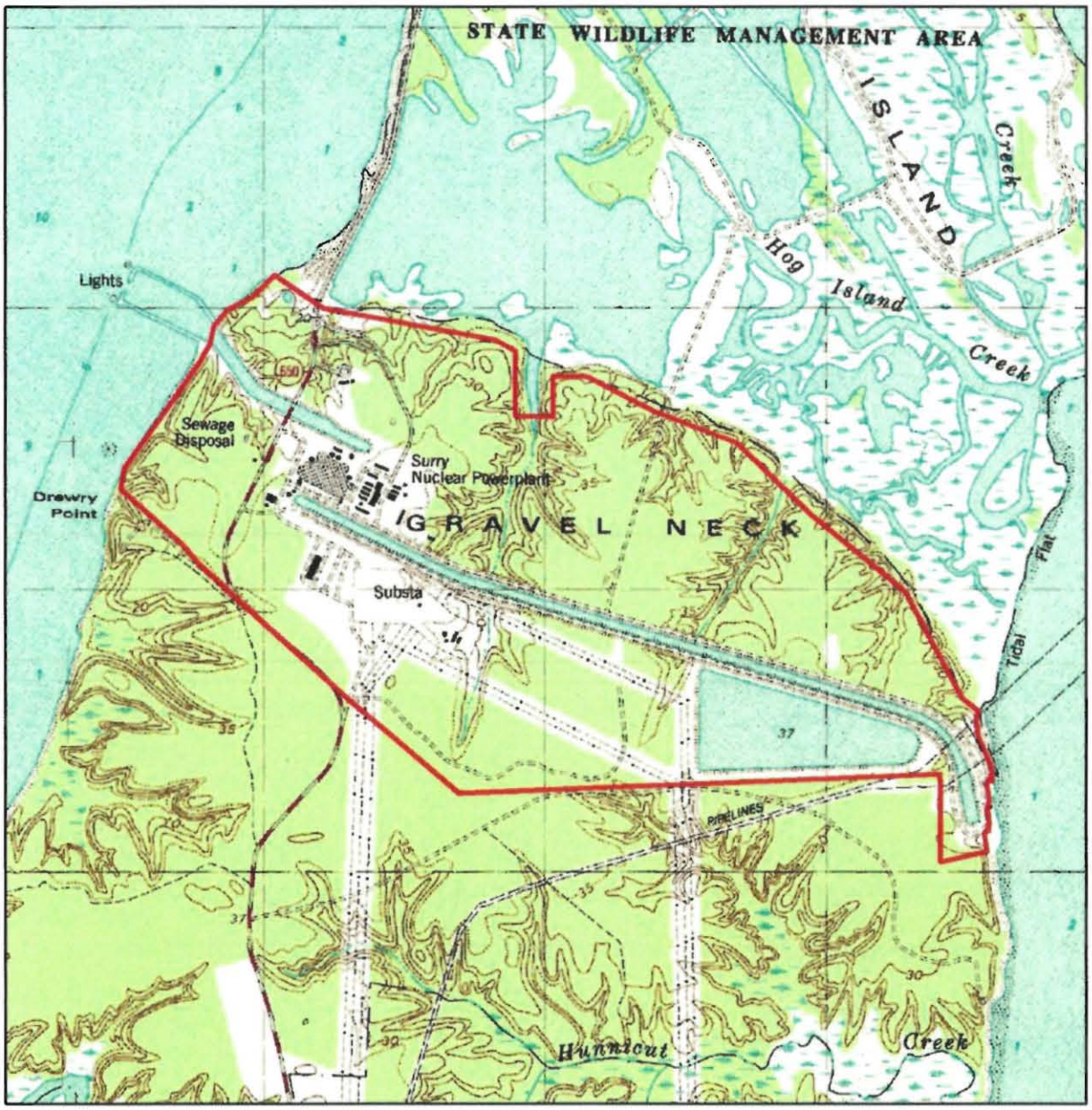


Figure 6-mile Vicinity

Dominion Energy Services, Inc
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

August 14, 2017

Ms. Renee Hypes
Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond, VA 23219

RE: Dominion - Surry Power Station

Dear Ms. Hypes:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential impact on species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA), important plant and animal habitats, including critical habitats as defined by the ESA, and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

In recognition of the fact that the environmental impacts of an existing facility were assessed during the original licensing process, and that license renewal is unlikely to have significant additional or different impacts, the regulations identify categories of topics that may be governed by a Generic Environmental Impact Statement (GEIS). The regulations also identify issues that require site-specific analysis in the ER for the renewal. The NRC has also issued guidance relating to the environmental analysis required as part of the renewal process, including development of the GEIS.

As part of the renewal process, the NRC may request a consultation with your agency regarding the license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process seeking input from you regarding the effects that extending the license term may have on listed species (or candidates proposed for listing) and important plant and animal habitats within the station's immediate environs. Figures depicting the station site and the vicinity within a 6-mile radius of the station and a table of listed species in the station's vicinity are enclosed, and a brief discussion of the station and its operations during the extended license term is provided below.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

The Hog Island Tract of the Hog Island Wilderness Management Area (HIWMA) is adjacent to the northern boundary of SPS at the tip of Gravel Neck Peninsula. The 2,900 acres of the Hog Island Tract are primarily tidal marshes and diked impoundments that are interspersed with pine forests. The Carlisle and Stewart Tracts of the HIWMA, approximately 1,000 acres in extent, are southeast of SPS. These parcels are primarily upland forested areas, but also contain tidal marshes along Lawnes Creek. All three tracts of the HIWMA are owned by the Virginia Department of Game and Inland Fisheries (VDGIF) and support a rich variety of wildlife. The tidal flats and marshes provide habitat for large numbers and numerous species of migratory shore birds, wading birds, and waterfowl.

Species potentially occurring near the SPS site, or within counties occurring in a 6-mile radius of the site (Surry, James City, York, and Isle of Wight Counties) that are currently federally or state listed (or proposed for listing) as threatened or endangered are included in the enclosed table.

During the license renewal term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment. The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to listed species and important species habitats within the

immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Manager, Generation Environmental Services

Attachments:

Table of Protected Species Potentially Occurring in the SPS Vicinity
Figure SPS Site
Figure 6-mile Vicinity

Table of Protected Species Potentially Occurring in the SPS Vicinity

Common Name	Scientific Name	Federal Legal Status	State Legal Status
AMPHIBIANS			
Barking Treefrog[ab]	*Hyla gratiosa*	None	LT
Eastern Tiger Salamander[d]	*Ambystoma tigrinum*	None	LE
Mabee's Salamander[b]	*Ambystoma mabeei*	None	LT
Birds			
Bachman's Sparrow[b]	*Peucaea aestivalis*	None	LT
Bald Eagle[c]	*Haliaeetus leucocephalus*	DL	None
Black Rail[b]	*Laterallus jamaicensis*	None	LE
Henslow's Sparrow[b]	*Ammodramus henslowii*	None	LT
Loggerhead Shrike[b]	*Lanius ludovicianus*	None	LT
Migrant Loggerhead Shrike[b]	*Lanius ludovicianus migrans*	None	LT
Peregrine Falcon[b]	*Falco peregrinus*	DL	LT
Piping Plover[d]	*Charadrius melodus*	LT	LT
Red Knot[b]	*Calidris canutus rufa*	LT	LT
Red-cockaded Woodpecker[b]	*Picoides borealis*	LE	LE
Roseate Tern[d]	*Sterna dougallii dougalli*	LE	LE
FISH			
Atlantic Sturgeon[ab]	*Acipenser oxyrinchus*	LE	LE
Blackbanded Sunfish[ab]	*Enneacanthus chaetodon*	None	LE
MAMMALS			
Little Brown Bat[b]	*Myotis lucifugus lucifugus*	None	LE
Northern Long-eared Bat[bc]	*Myotis septentrionalis*	LT	LT
Rafinesque's Eastern Big-eared Bat[b]	*Corynorhinus rafinesquii macrotis*	None	LE
Tri-colored Bat[b]	*Perimyotis subflavus*	None	LE
Reptiles			
Canebrake Rattlesnake[b]	*Crotalus horridus*	None	LT
Eastern Chicken Turtle[d]	Deirochelys reticularia reticularia	None	LE
Kemp's Ridley Sea Turtle[d]	*Lepidochelys kempii*	LE	LE
Leatherback Sea Turtle[d]	*Dermochelys coriacea*	LE	LE

Common Name	Scientific Name	Federal Legal Status	State Legal Status
Loggerhead Sea Turtle[d]	*Caretta caretta*	LT	LT
Northern Diamond-backed Terrapin[b]	*Malaclemys terrapin terrapin*	None	CC
Spotted Turtle[b]	*Clemmys guttata*	None	CC
VASCULAR PLANTS			
Sensitive Joint-vetch[ac]	*Aeschynomene virginica*	LT	LT
Small Whorled Pogonia[d]	*Isotria medeoloides*	LT	LE

[a] Listed by the Virginia Department of Conservation and Recreation Natural Heritage as occurring or likely to occur in Surry County, Virginia

[b] Listed by the VDGIF as occurring or likely to occur in Surry County, Virginia

[c] Listed by the USFWS as occurring or likely to occur in Surry County, Virginia

[d] Not listed as occurring in Surry County by the VDGIF or the USFWS

DL = Delisted LE = Listed Endangered LT = Listed Threatened CC = Collection Concern

Figure SPS Site

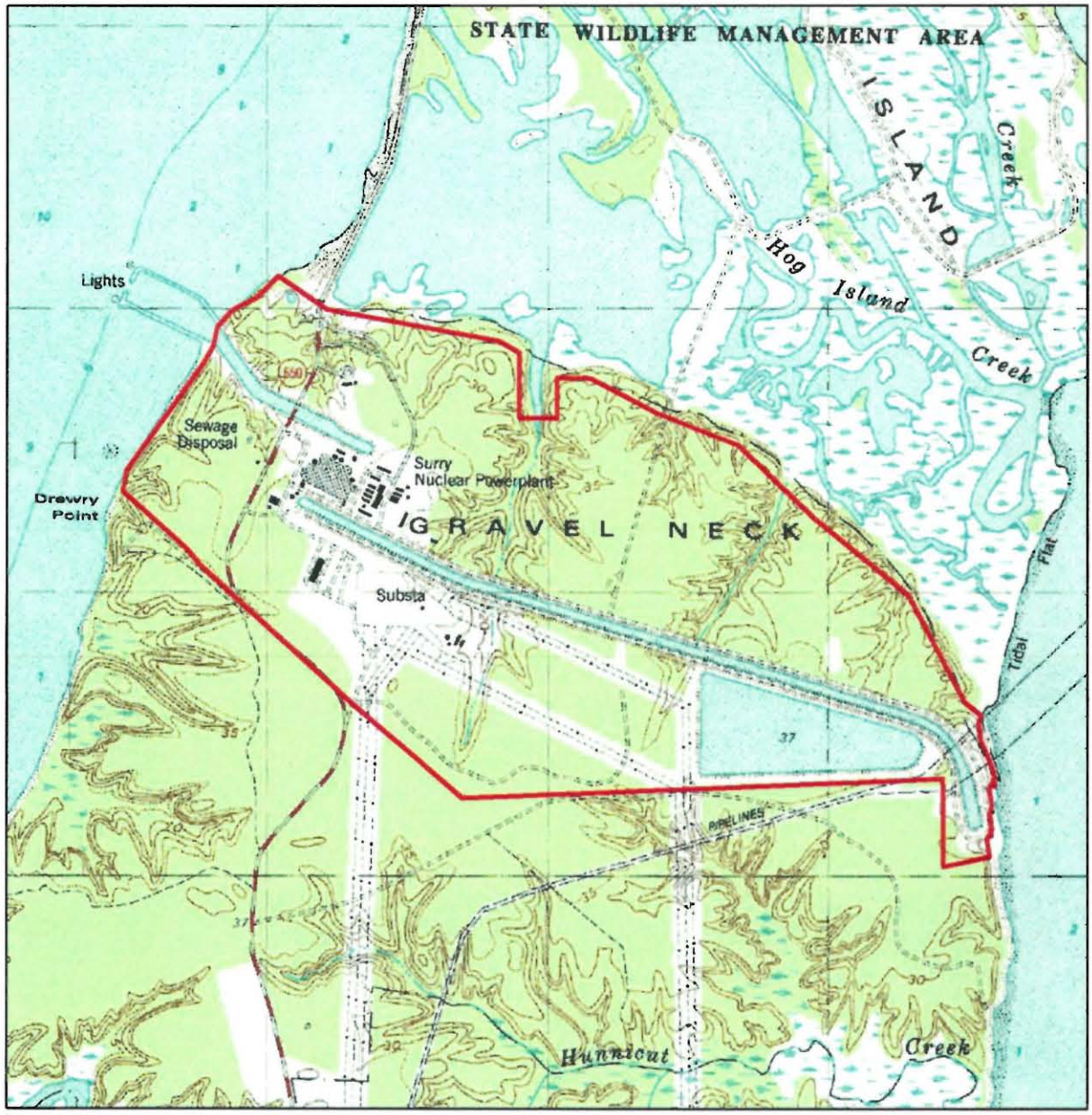
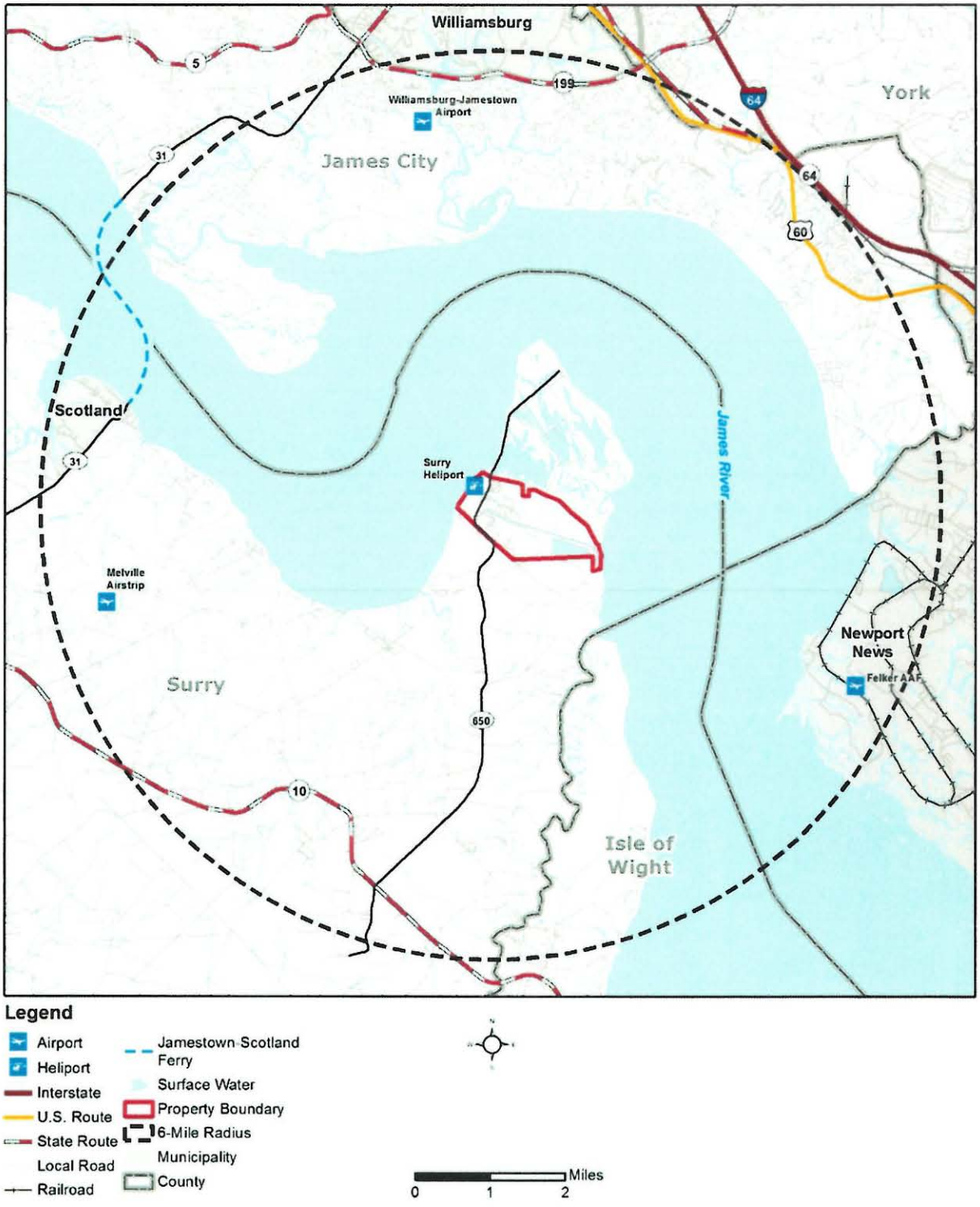


Figure 6-mile Vicinity



Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

August 3, 2017

Ms. Amy Ewing
Virginia Department of Game and Inland Fisheries
Environmental Services Section
P.O. Box 90778
Richmond, VA 23228

RE: Virginia Electric and Power Company - Surry Power Station Units 1 and 2 Subsequent License Renewal

Dear Ms. Ewing:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential impact on species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA), important plant and animal habitats, including critical habitats as defined by the ESA, and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

In recognition of the fact that the environmental impacts of an existing facility were assessed during the original licensing process, and that license renewal is unlikely to have significant additional or different impacts, the regulations identify categories of topics that may be governed by a Generic Environmental Impact Statement (GEIS). The regulations also identify issues that require site-specific analysis in the ER for the renewal. The NRC has also issued guidance relating to the environmental analysis required as part of the renewal process, including development of the GEIS.

As part of the renewal process, the NRC may request a consultation with the U.S. Fish & Wildlife Service (USFWS) regarding the license renewal. During the review for the current license term, the USFWS requested that your agency be contacted to provide input regarding the license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input regarding the effects that extending the license term may have on listed species (or candidates proposed for listing) and important plant and animal habitats within the station's immediate environs. Figures depicting the station site and the vicinity within a 6-mile radius of the station and a table of listed species in the station's vicinity are enclosed.

A brief discussion of the station and its operations during the extended license term is provided below.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

The Hog Island Tract of the Hog Island Wilderness Management Area (HIWMA) is adjacent to the northern boundary of SPS at the tip of Gravel Neck Peninsula. The 2,900 acres of the Hog Island Tract are primarily tidal marshes and diked impoundments that are interspersed with pine forests. The Carlisle and Stewart Tracts of the HIWMA, approximately 1,000 acres in extent, are southeast of SPS. These parcels are primarily upland forested areas, but also contain tidal marshes along Lawnes Creek. All three tracts of the HIWMA are owned by the Virginia Department of Game and Inland Fisheries (VDGIF) and support a rich variety of wildlife. The tidal flats and marshes provide habitat for large numbers and numerous species of migratory shore birds, wading birds, and waterfowl.

Species potentially occurring near the SPS site, or within counties occurring in a 6-mile radius of the site (Surry, James City, York, and Isle of Wight Counties) that are currently federally or state listed (or proposed for listing) as threatened or endangered are included in the enclosed table. No candidate species have been identified; the rusty patched bumble bee is not known in this locale and is therefore not included.

During the license renewal term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment, or sensitive species, plants or habitats. The Company also does not anticipate

any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to listed/candidate species and important species habitats within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Manager, Generation Environmental Services

Attachments:

Table of Protected Species Potentially Occurring in the SPS Vicinity
Figure SPS Site
Figure 6-mile Vicinity

Table of Protected Species Potentially Occurring in the SPS Vicinity

Common Name	Scientific Name	Federal Legal Status	State Legal Status
AMPHIBIANS			
Barking Treefrog[ab]	*Hyla gratiosa*	None	LT
Eastern Tiger Salamander[d]	*Ambystoma tigrinum*	None	LE
Mabee's Salamander[b]	*Ambystoma mabeei*	None	LT
Birds			
Bachman's Sparrow[b]	*Peucaea aestivalis*	None	LT
Bald Eagle[c]	*Haliaeetus leucocephalus*	DL	None
Black Rail[b]	*Laterallus jamaicensis*	None	LE
Henslow's Sparrow[b]	*Ammodramus henslowii*	None	LT
Loggerhead Shrike[b]	*Lanius ludovicianus*	None	LT
Migrant Loggerhead Shrike[b]	*Lanius ludovicianus migrans*	None	LT
Peregrine Falcon[b]	*Falco peregrinus*	DL	LT
Piping Plover[d]	*Charadrius melodus*	LT	LT
Red Knot[b]	*Calidris canutus rufa*	LT	LT
Red-cockaded Woodpecker[b]	*Picoides borealis*	LE	LE
Roseate Tern[d]	*Sterna dougallii dougalli*	LE	LE
FISH			
Atlantic Sturgeon[ab]	*Acipenser oxyrinchus*	LE	LE
Blackbanded Sunfish[ab]	*Enneacanthus chaetodon*	None	LE
MAMMALS			
Little Brown Bat[b]	*Myotis lucifugus lucifugus*	None	LE
Northern Long-eared Bat[bc]	*Myotis septentrionalis*	LT	LT
Rafinesque's Eastern Big-eared Bat[b]	*Corynorhinus rafinesquii macrotis*	None	LE
Tri-colored Bat[b]	*Perimyotis subflavus*	None	LE
Reptiles			
Canebrake Rattlesnake[b]	*Crotalus horridus*	None	LT
Eastern Chicken Turtle[d]	Deirochelys reticularia reticularia	None	LE
Kemp's Ridley Sea Turtle[d]	*Lepidochelys kempii*	LE	LE
Leatherback Sea Turtle[d]	*Dermochelys coriacea*	LE	LE

Common Name	Scientific Name	Federal Legal Status	State Legal Status
Loggerhead Sea Turtle[d]	*Caretta caretta*	LT	LT
Northern Diamond-backed Terrapin[b]	*Malaclemys terrapin terrapin*	None	CC
Spotted Turtle[b]	*Clemmys guttata*	None	CC
VASCULAR PLANTS			
Sensitive Joint-vetch[ac]	*Aeschynomene virginica*	LT	LT
Small Whorled Pogonia[d]	*Isotria medeoloides*	LT	LE

[a] Listed by the Virginia Department of Conservation and Recreation Natural Heritage as occurring or likely to occur in Surry County, Virginia

[b] Listed by the VDGIF as occurring or likely to occur in Surry County, Virginia

[c] Listed by the USFWS as occurring or likely to occur in Surry County, Virginia

[d] Not listed as occurring in Surry County by the VDGIF or the USFWS

DL = Delisted LE = Listed Endangered LT = Listed Threatened CC = Collection Concern

Figure SPS Site

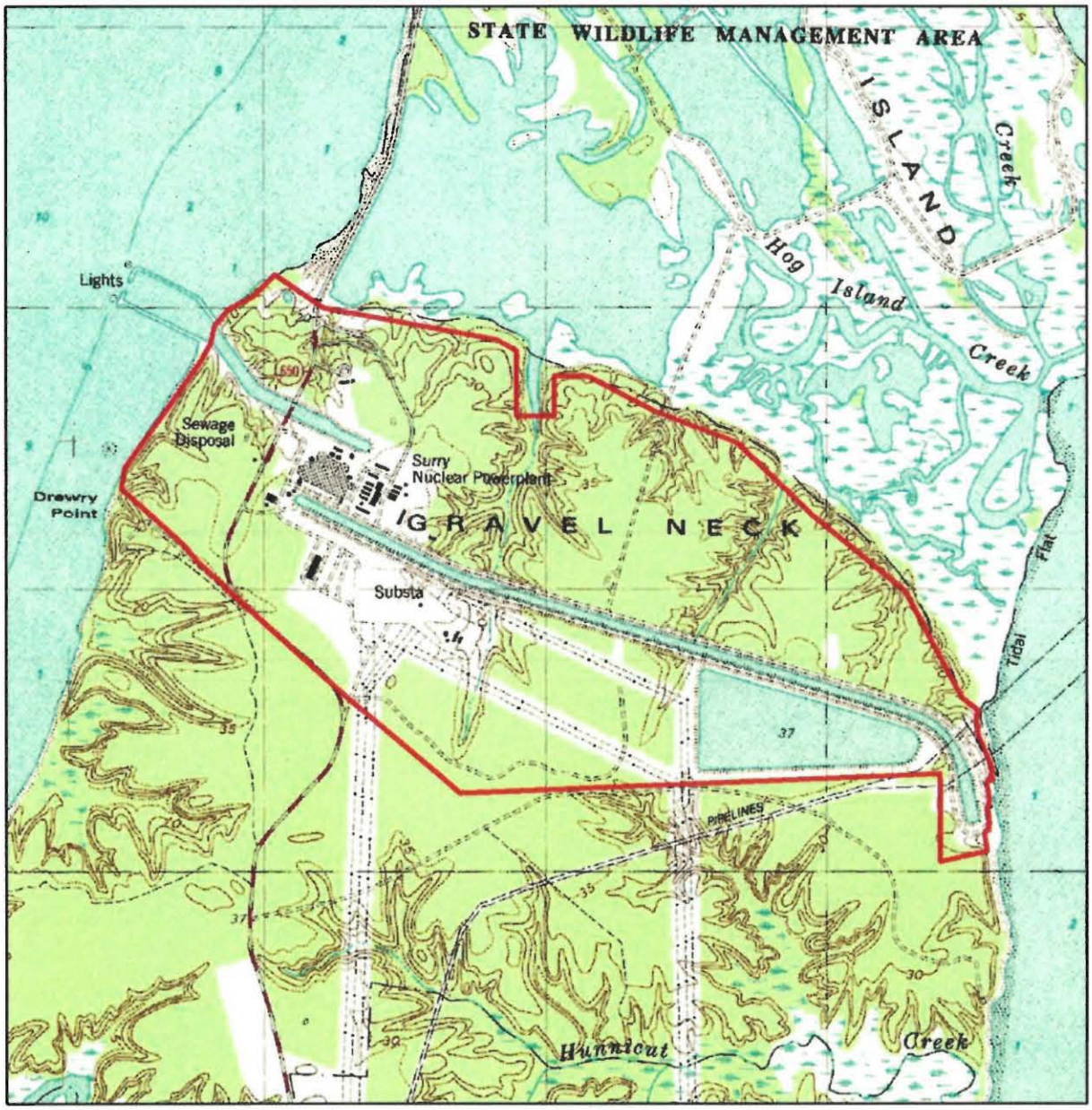
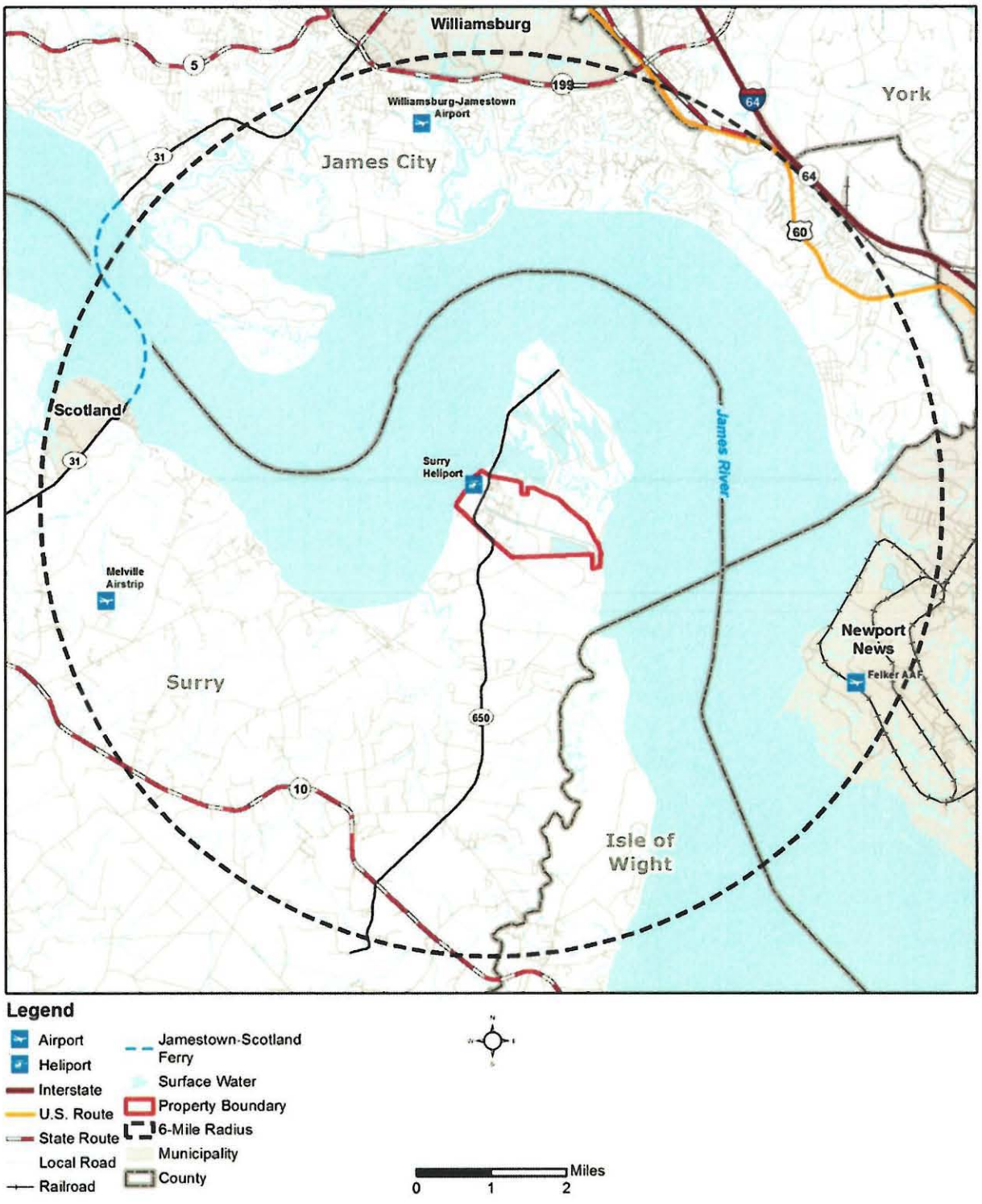


Figure 6-mile Vicinity



Dominion Energy Services, Inc
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

August 3, 2017

Mr. Tony Watkinson
Chief of Habitat Management
Virginia Marine Resource Commission (VMRC)
2600 Washington Avenue, 3rd Floor
Newport News, VA 23607

RE: Virginia Electric and Power Company - Surry Power Station Units 1 and 2 Subsequent License Renewal

Dear Mr. Watkinson:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential impact on species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA) and important plant and animal habitats, including critical habitats as defined by the ESA and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

In recognition of the fact that the environmental impacts of an existing facility were assessed during the original licensing process, and that license renewal is unlikely to have significant additional or different impacts, the regulations identify categories of topics that may be governed by a Generic Environmental Impact Statement (GEIS). The regulations also identify issues that require site-specific analysis in the ER for the renewal. The NRC has also issued guidance relating to the environmental analysis required as part of the renewal process, including development of the GEIS.

As part of the renewal process, the NRC may request a consultation with your agency regarding the license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input regarding the effects that extending the license term may have on listed species (or candidates proposed for listing) and important plant and animal habitats within the station's immediate environs. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed, and a brief discussion of the station, its operations during the extended license term, and listed and candidate species in the station's vicinity is provided below.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

The Hog Island Tract of the Hog Island Wilderness Management Area (HIWMA) is adjacent to the northern boundary of SPS at the tip of Gravel Neck Peninsula. The 2,900 acres of the Hog Island Tract are primarily tidal marshes and diked impoundments that are interspersed with pine forests. The Carlisle and Stewart Tracts of the HIWMA, approximately 1,000 acres in extent, are southeast of SPS. These parcels are primarily upland forested areas, but also contain tidal marshes along Lawnes Creek. All three tracts of the HIWMA are owned by the Virginia Department of Game and Inland Fisheries (VDGIF) and support a rich variety of wildlife. The tidal flats and marshes provide habitat for large numbers and numerous species of migratory shore birds, wading birds, and waterfowl.

Marine or anadromous species potentially occurring near the SPS site or within counties occurring in a 6-mile radius of the site (Surry, James City, York, and Isle of Wight Counties) that are currently federally or state listed as threatened or endangered are included in the table below.

Common Name	**Scientific Name**	**Federal Legal Status**	**State Legal Status**
Atlantic Sturgeon	*Acipenser oxyrinchus*	Endangered	Endangered
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Endangered
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened

During the license renewal term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the

independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or sensitive species, plants or habitats. The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to listed marine species and important aquatic habitats within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Manager, Generation Environmental Services

Attachments:

Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

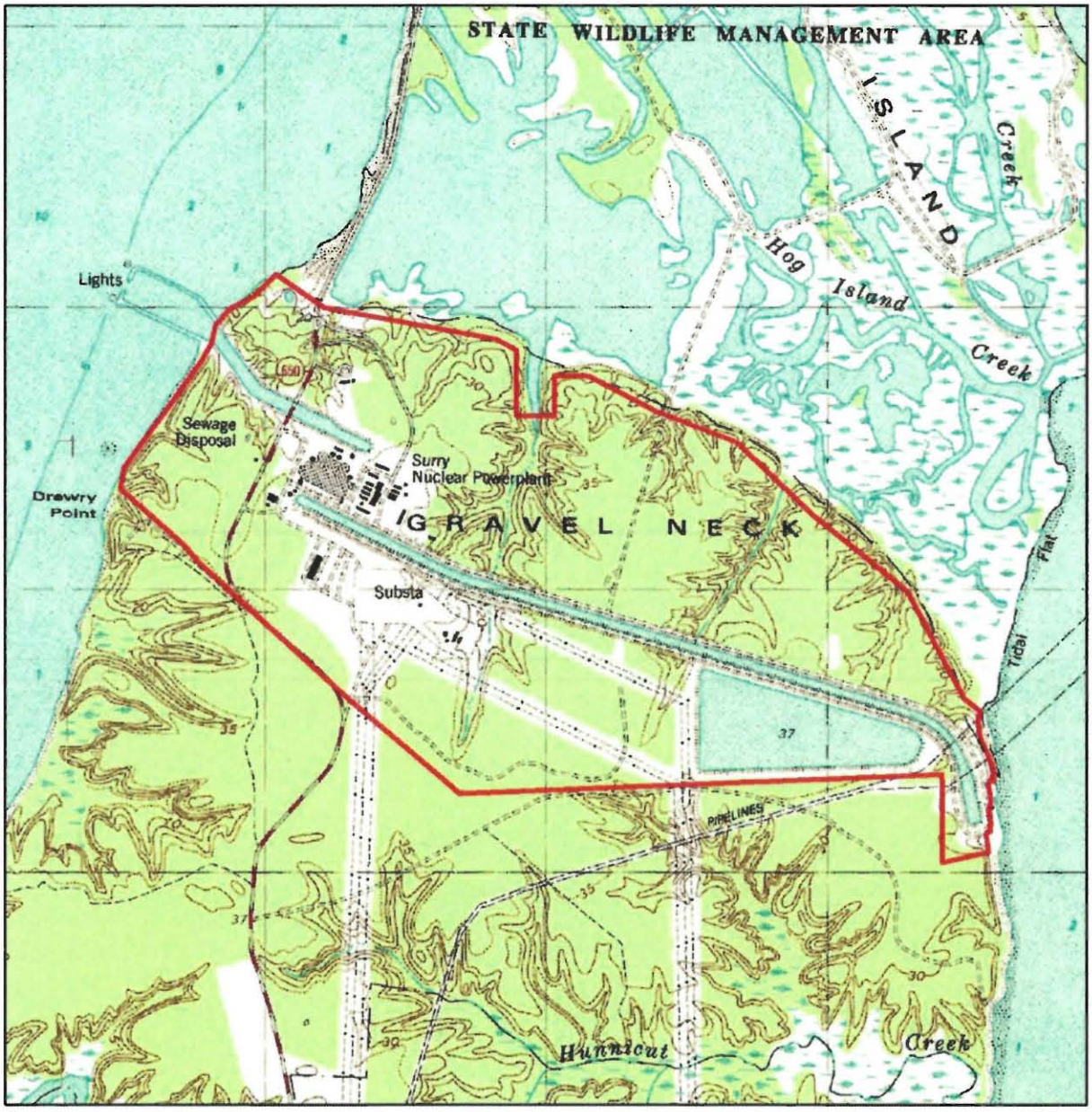


Figure 6-mile Vicinity

Intentionally Blank

Attachment D: Cultural Resource Consultation Letters

Intentionally Blank

Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief Walt "Red Hawk" Brown
Chereonhaka (Nottoway) Tribe
P.O. Box 397
27345 Aquia Path
Courtland, VA 23837

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Brown:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Chereonhaka (Nottoway) Tribe regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:
Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

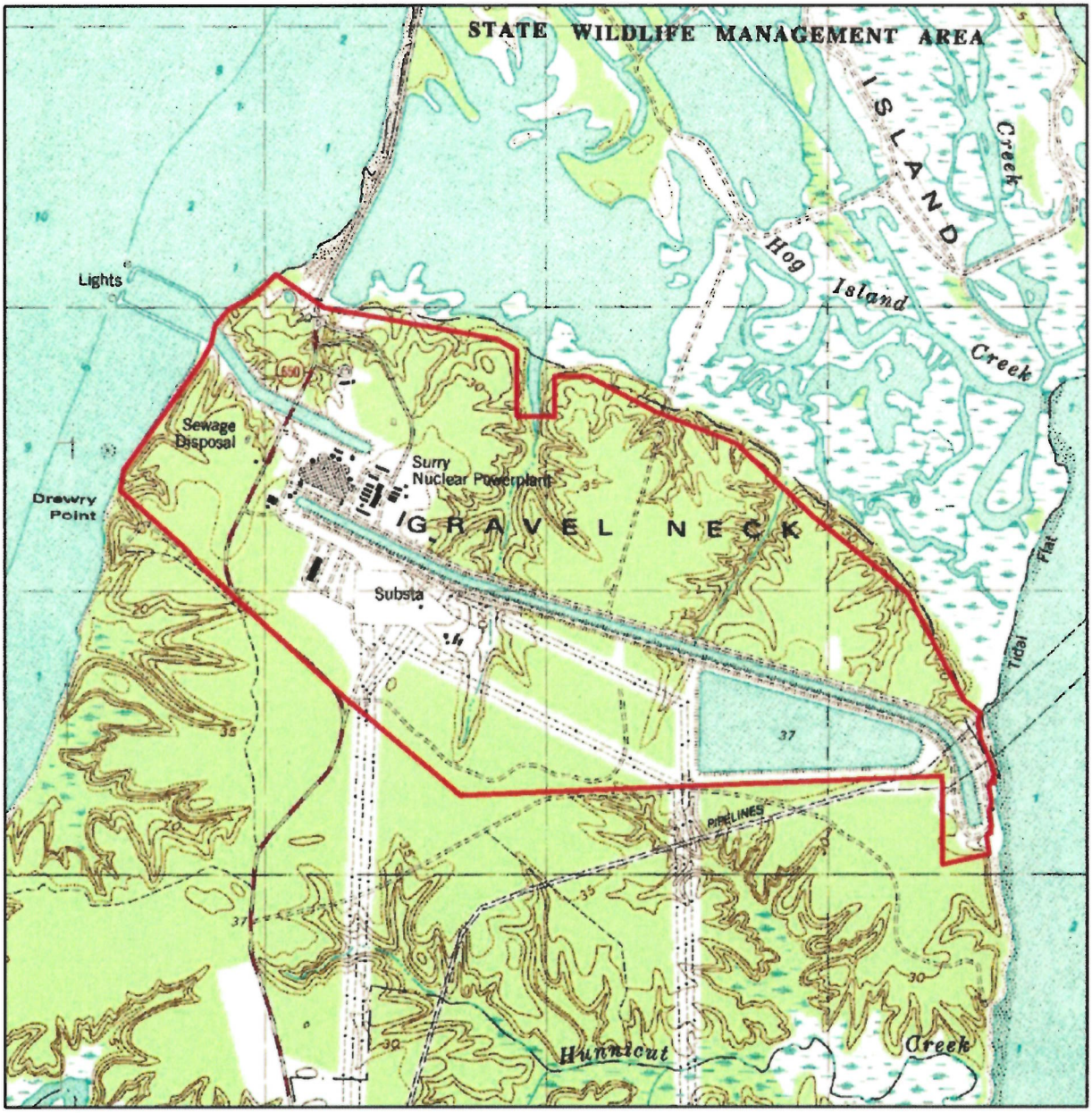
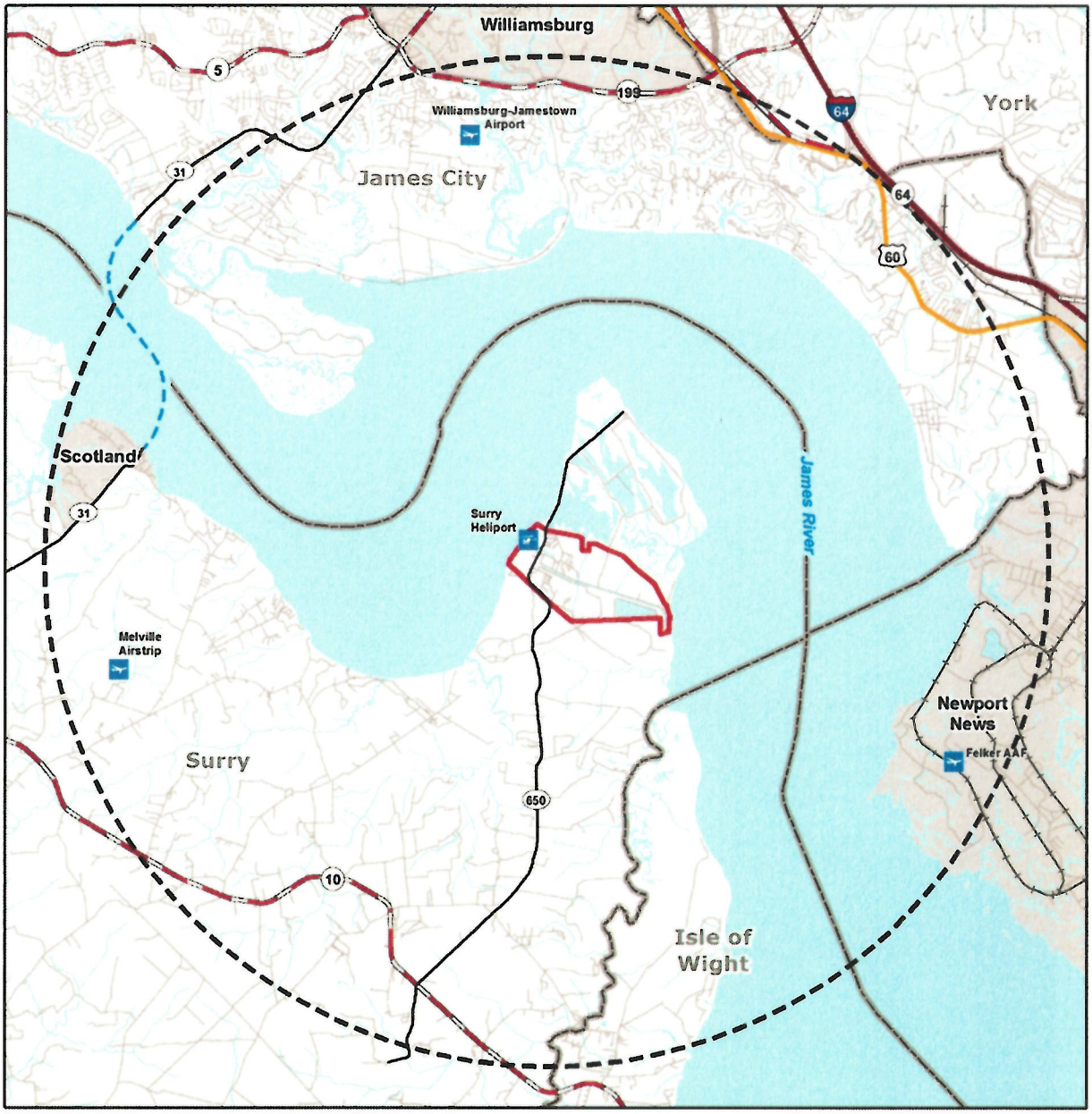


Figure 6-mile Vicinity



From:	wdbrowniii
To:	Tony Banks (Generation - 6)
Cc:	Water Blossom; Chief Walt Red Hawk Brown
Subject:	[External] Re: consultation regarding Surry Power Station Subsequent License Renewal
Date:	Saturday, July 14, 2018 10:30:37 AM

Mr Banks:
Thank you so very much for your response to our Tribal reply to be a consulting party germane to the Surry Power Station Subsequent License Renewal.

Please keep us informed throughout the project.

Thank You.
Chief Walt "Red Hawk" Brown
Cheroenhaka (Nottoway) Indian Tribe
27345 Aquia Path
P.O. Box 397
Courtland, VA 23837
www cheroenhaka-nottoway.org
wdbrowniii@aol.com
757 345 6839 cell

Sent from my Verizon, Samsung Galaxy smartphone

-------- Original message --------
From: Tony Banks <tony.banks@dominionenergy.com>
Date: 7/13/18 9:01 AM (GMT-05:00)
To: wdbrowniii@aol.com
Cc: Tony Banks <tony.banks@dominionenergy.com>
Subject: consultation regarding Surry Power Station Subsequent License Renewal

Chief Brown – thank you for your interest in the Surry Power Station (SPS) Subsequent License Renewal (SLR) project, and for continuing to serve regional and national interests with the Cheroenhaka (Nottoway) Indian Tribe.

As discussed earlier, and following our letter emailed of June 6, 2018, Dominion Energy will be working with the US Nuclear Regulatory Commission, the Commonwealth of Virginia, and Tribal organizations, as part of the 106 consultation process to support SPS SLR.

We understand the need to continue to respect Native American interests nationally, and especially in regions around our business facilities, including SPS. A part of that includes following processes to address historical and cultural resources should they be discovered from ground disturbance associated with continuing Units 1 & 2 operations.

We appreciate your acknowledgment that Dominion Energy will implement appropriate actions to address historical and cultural resources should that be necessary, and concurrence with Dominion Energy SPS SLR.

Please contact us again as needed. Thank you.

Tony Banks

Dominion Energy

804-273-2170

Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief Stephen Adkins
Chickahominy Tribe
8200 Lott Cary Road
Providence Forge, VA 23140

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Adkins:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Chickahominy Tribe regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:
Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

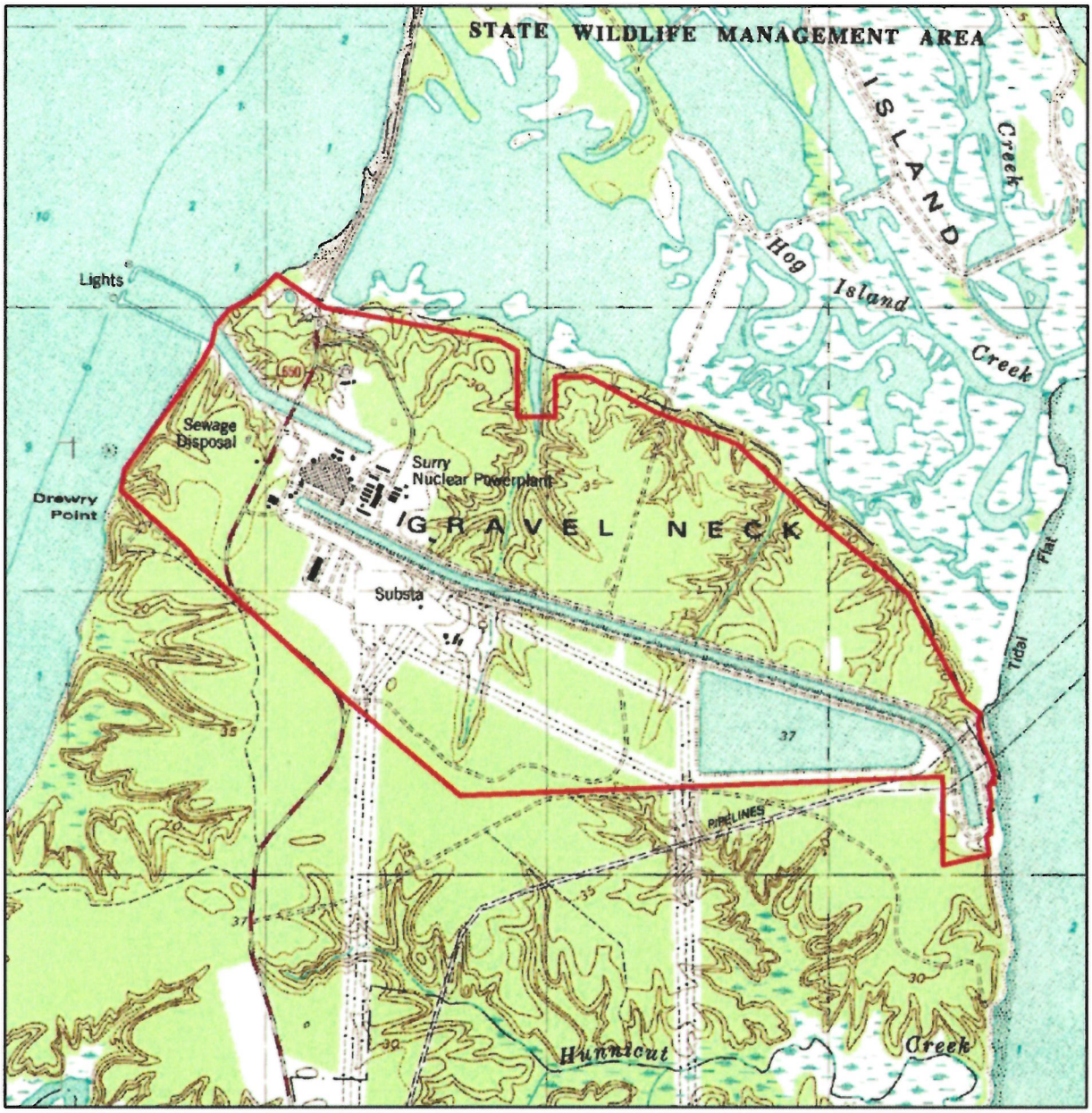


Figure 6-mile Vicinity

Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief Gene W. Adkins
Chickahominy Indians Eastern Division
3120 Mount Pleasant Road
Providence Forge, VA 23140

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Adkins:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Chickahominy Indians Eastern Division regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:
Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

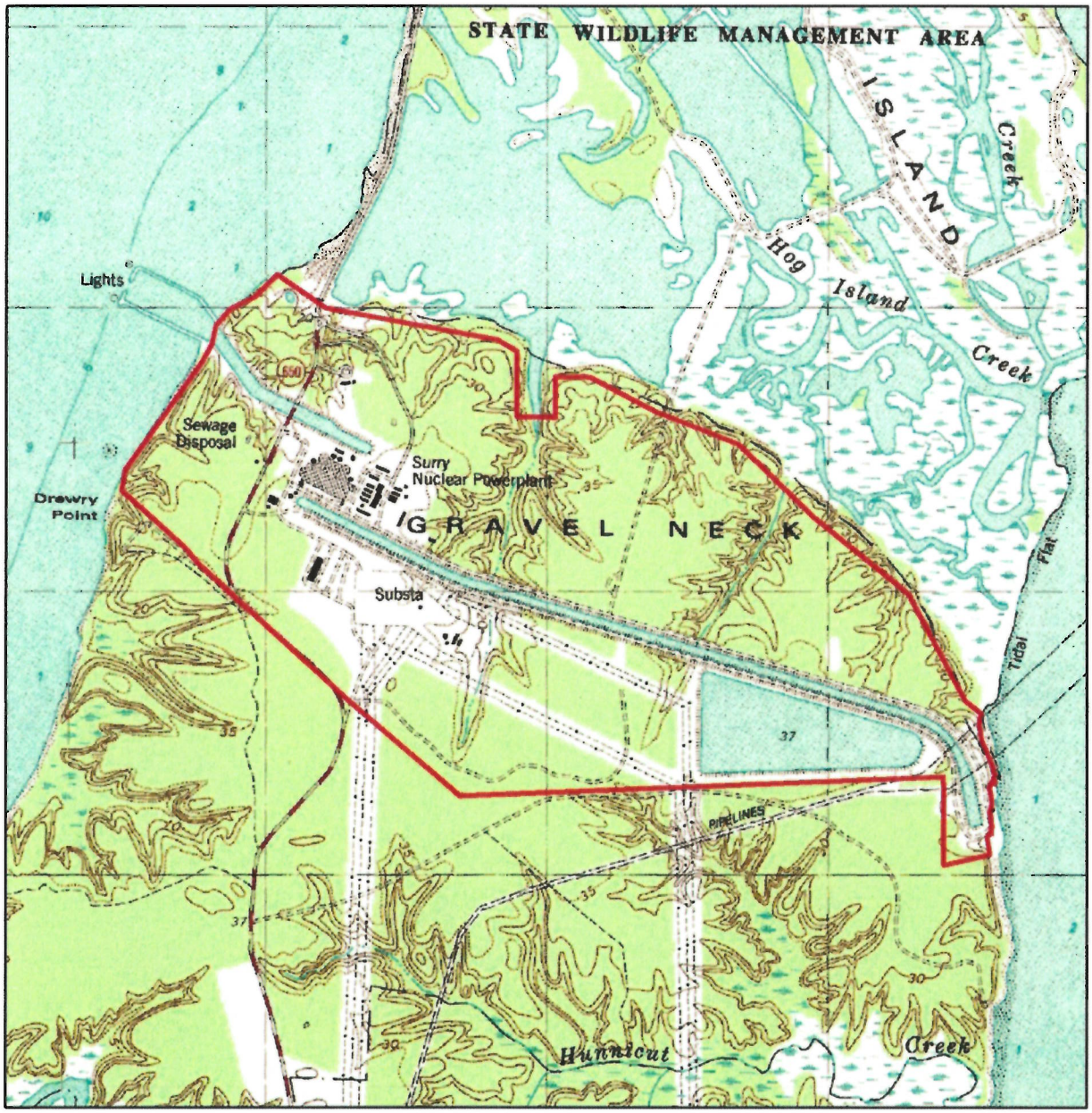
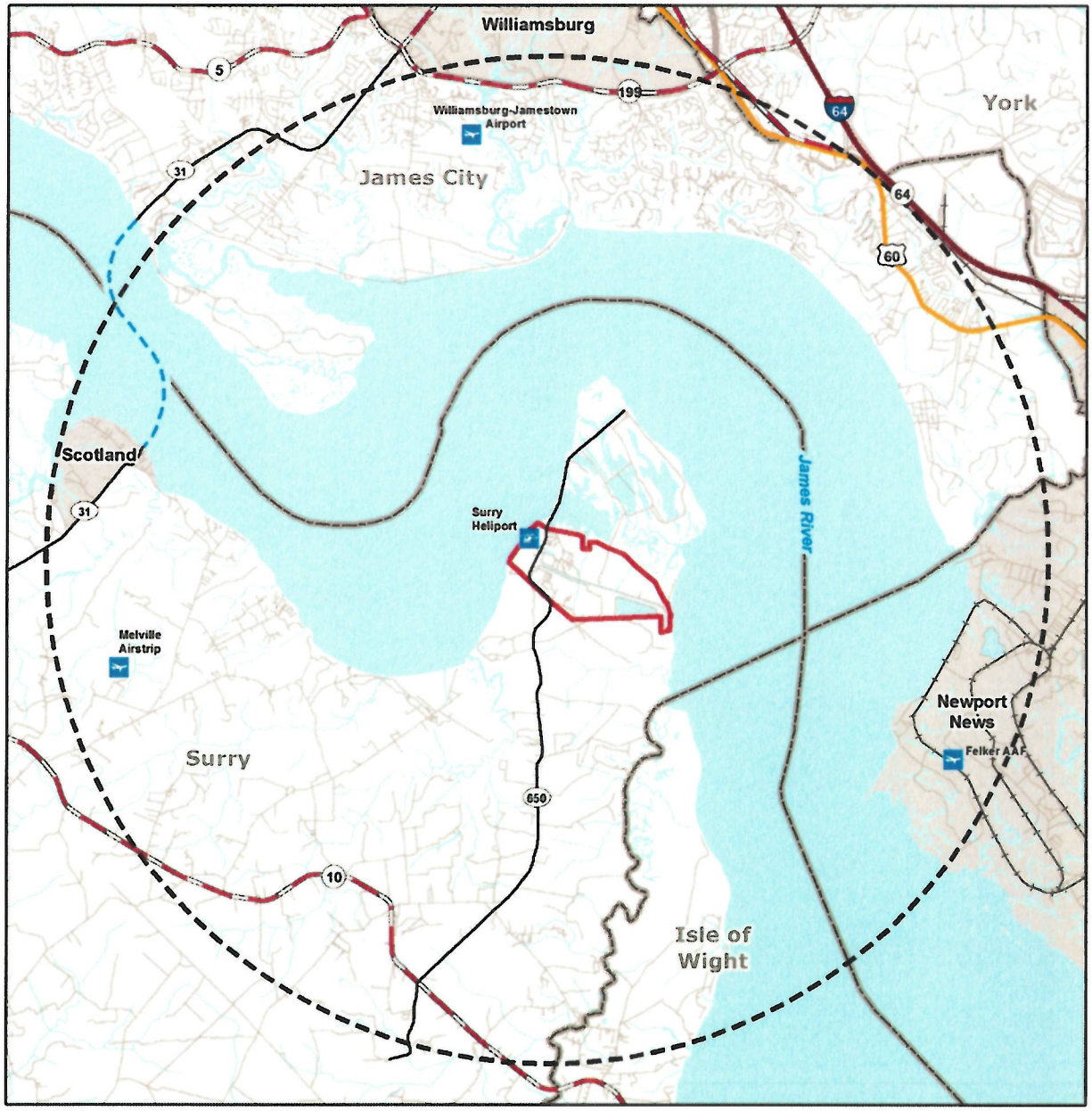


Figure 6-mile Vicinity



Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief Mark Custalow
Mattaponi Tribe
122 Nee A Ya Lane
West Point, VA 23181

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Custalow:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Mattaponi Tribe regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:
Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

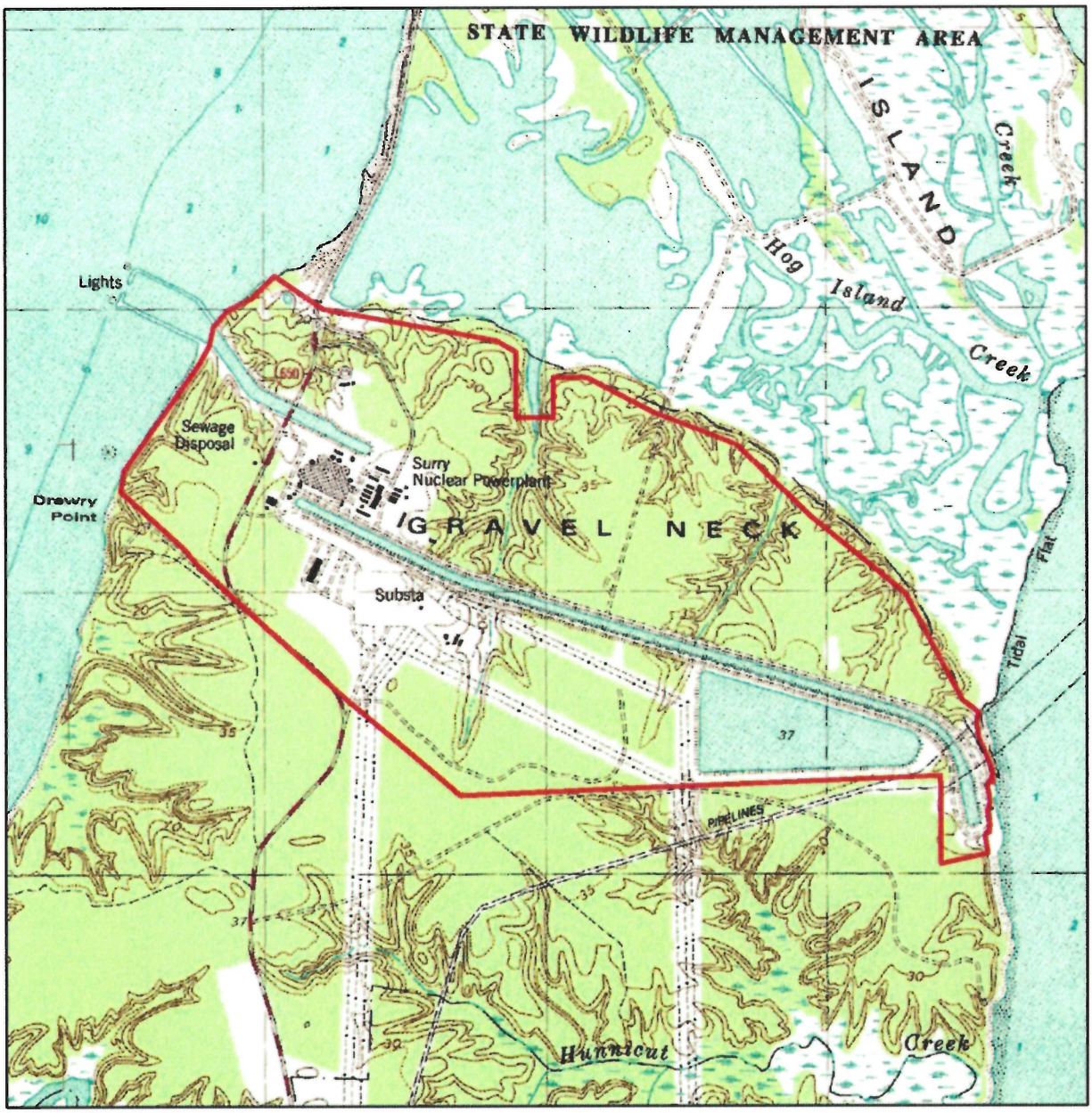
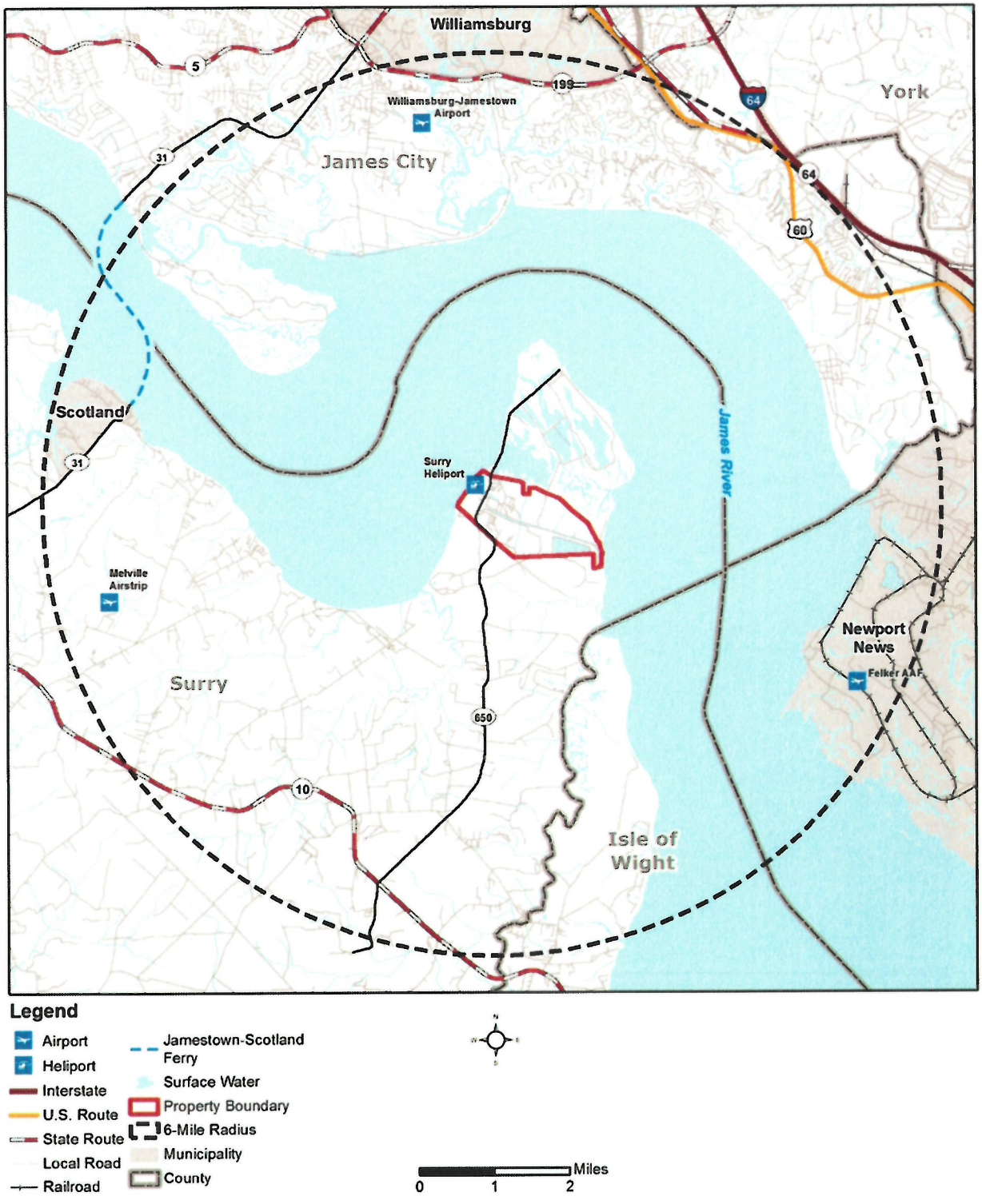


Figure 6-mile Vicinity



Dominion Energy Services, Inc
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief Lee Lockamy
Nansemond Indian Tribal Association
1001 Pembroke Lane
Suffolk, VA 23434

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Lockamy:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Nansemond Indian Tribal Association regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:
Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

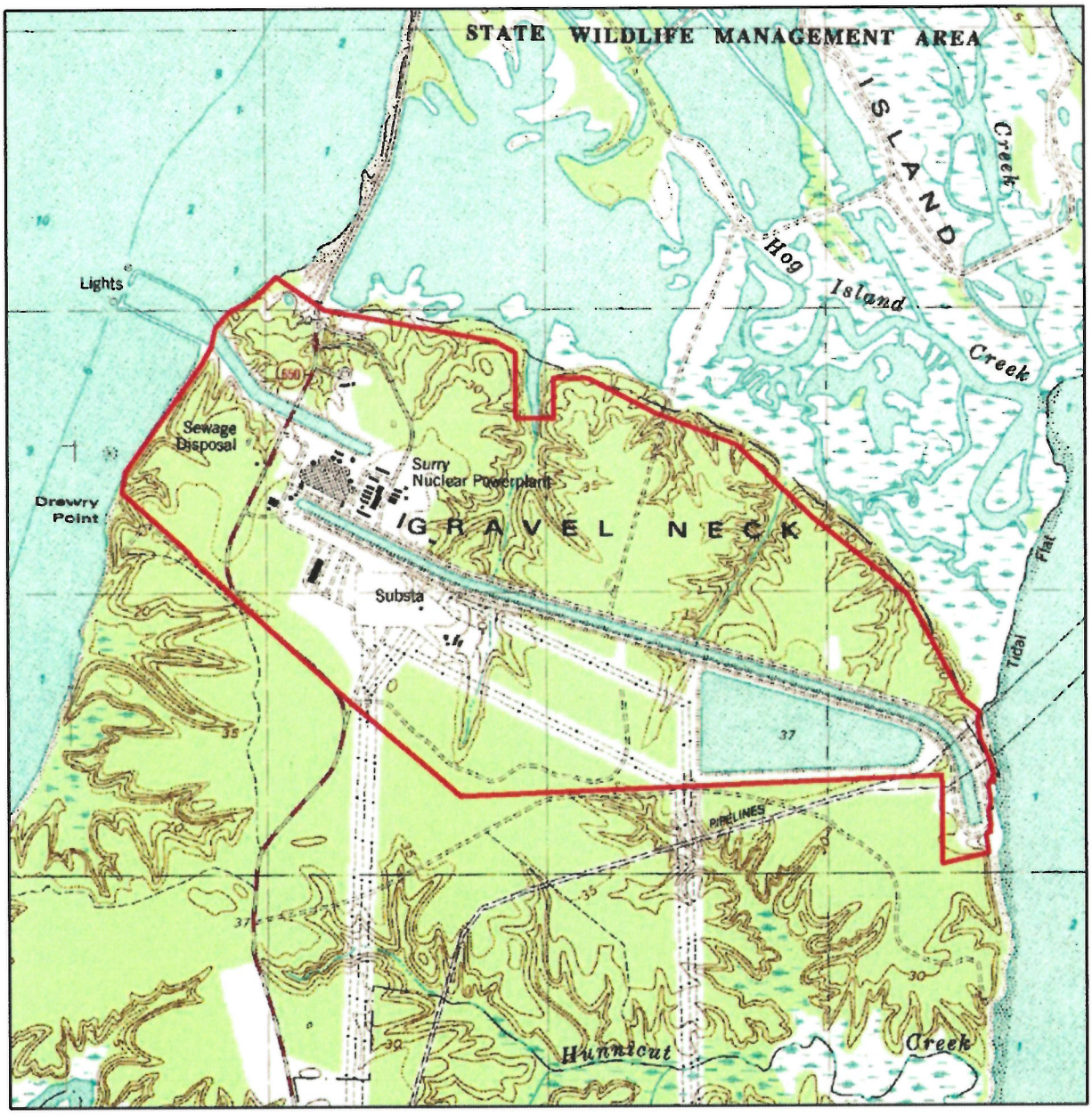
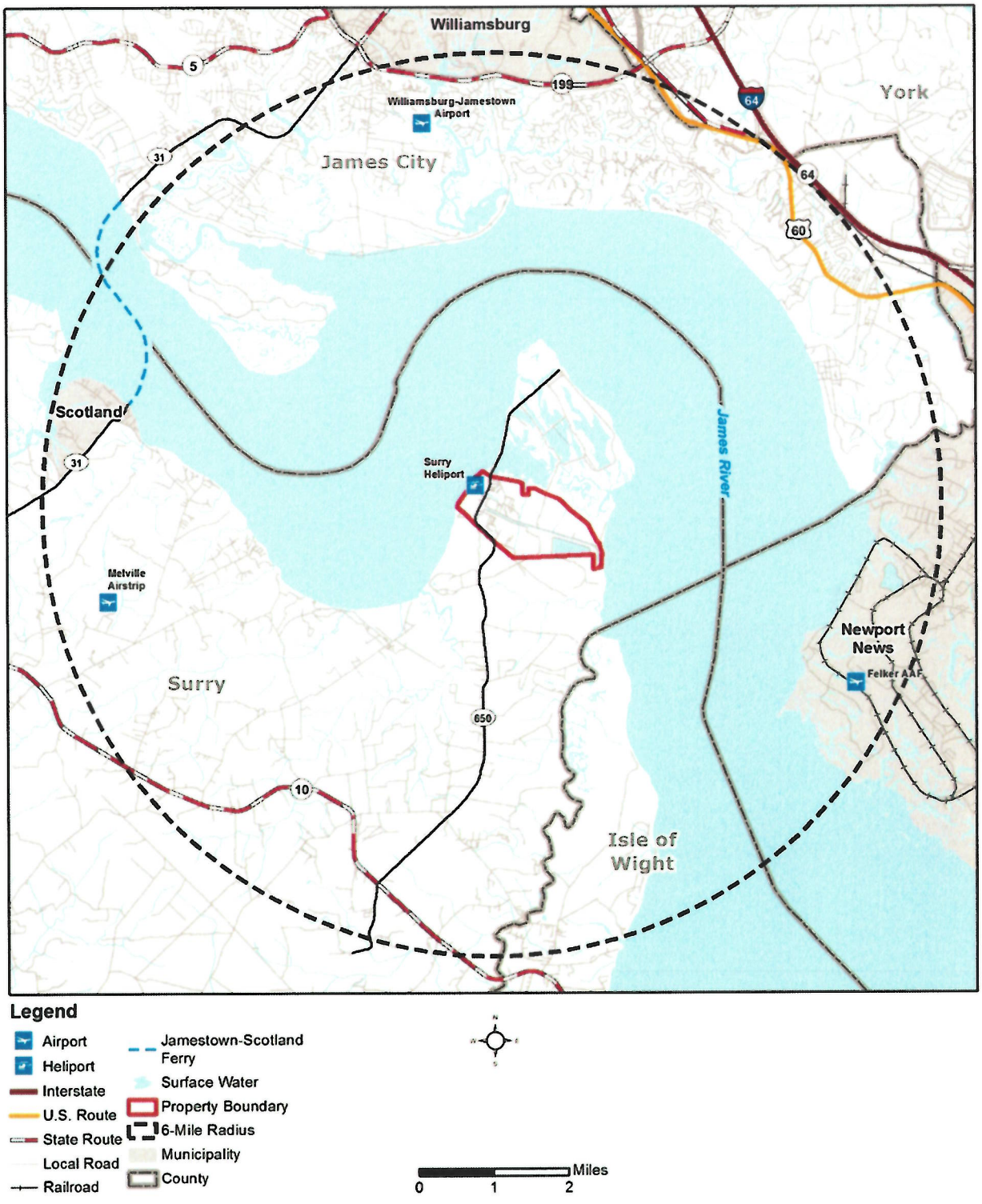


Figure 6-mile Vicinity



Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief Lynette Allston
Nottoway Tribe
25274 Barhams Hill Road
Drewryville, VA 23844

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Allston:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Nottoway Tribe regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:
Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

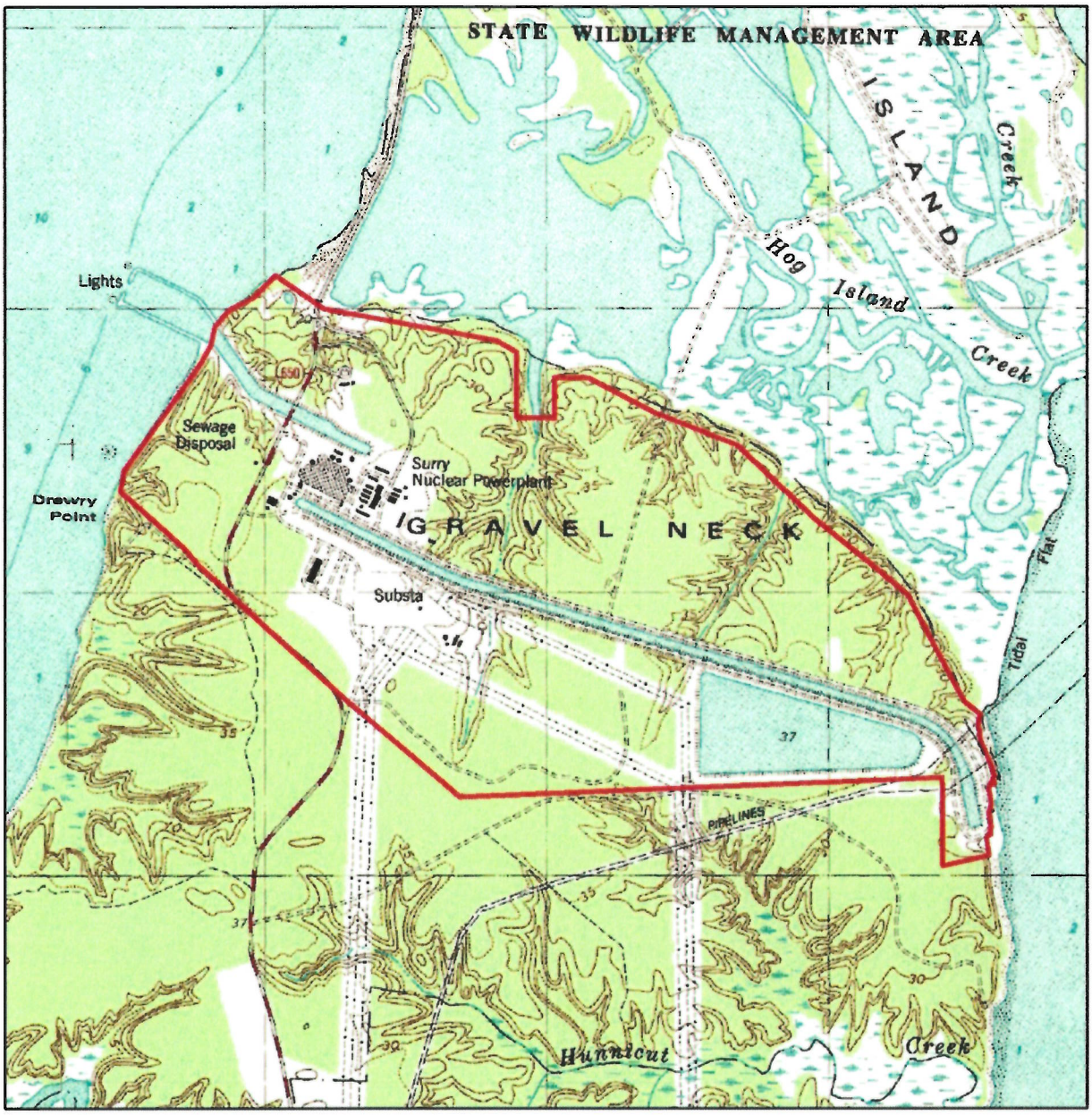


Figure 6-mile Vicinity

Dominion Energy Services, Inc
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief Robert Gray
Pamunkey Nation
191 Lay Landing Road
King William, VA 23086

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Gray:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Pamunkey Nation regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:

Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

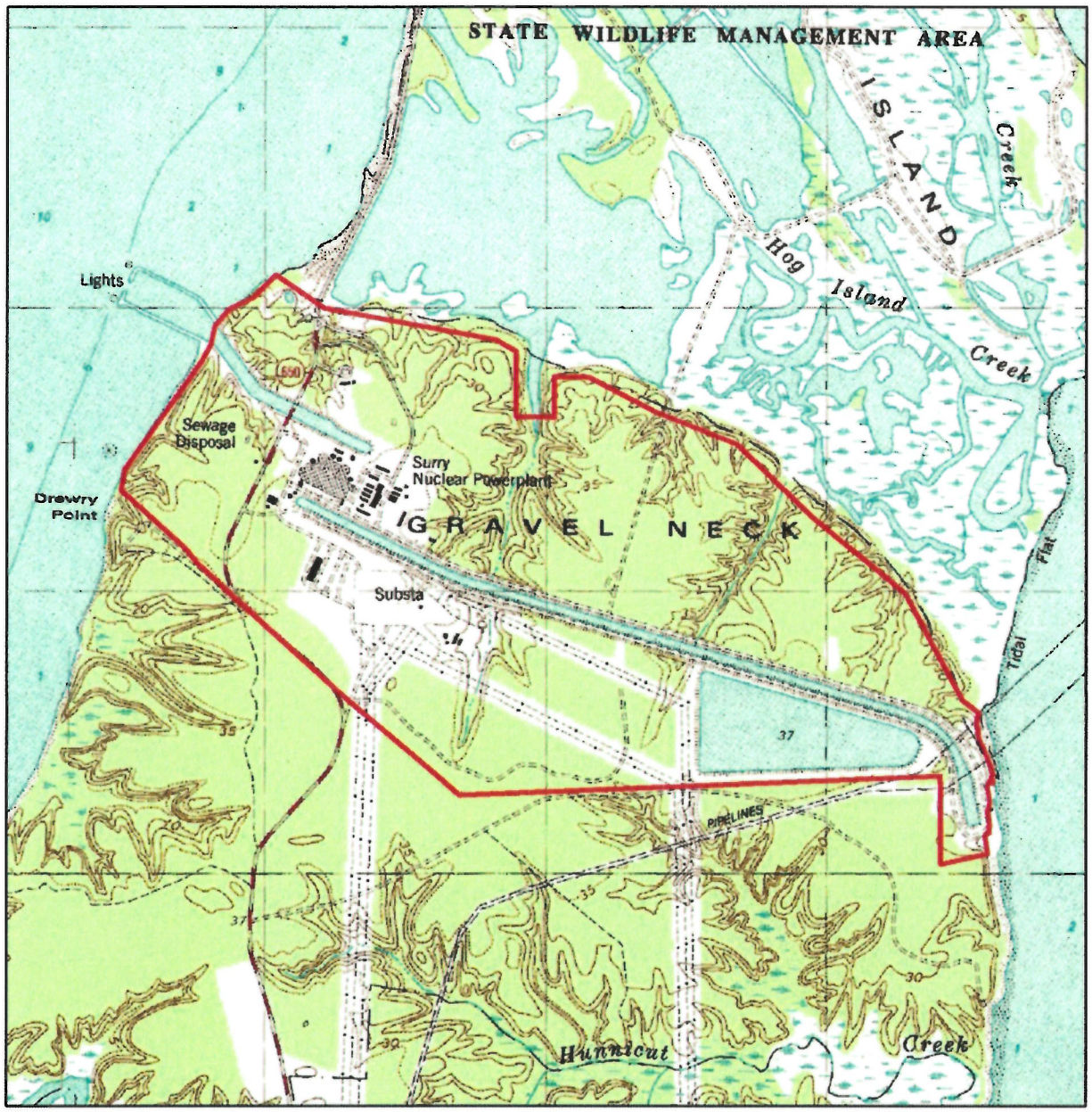


Figure 6-mile Vicinity

Dominion Energy Services, Inc
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief John R. Lightner
Patawomeck Tribe
1416 Brent Street
Fredericksburg, VA 22401

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Lightner:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Patawomeck Tribe regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:
Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

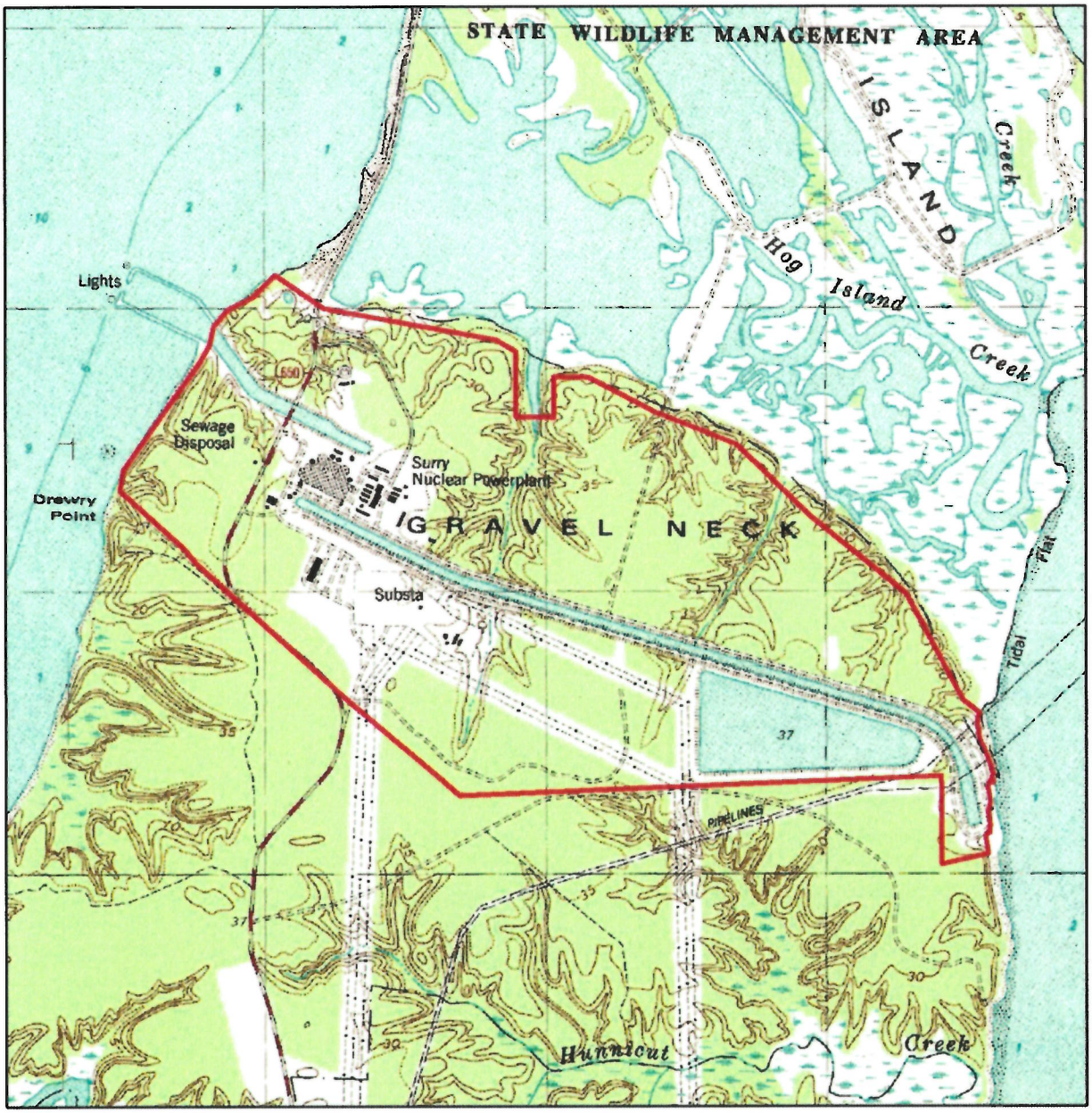
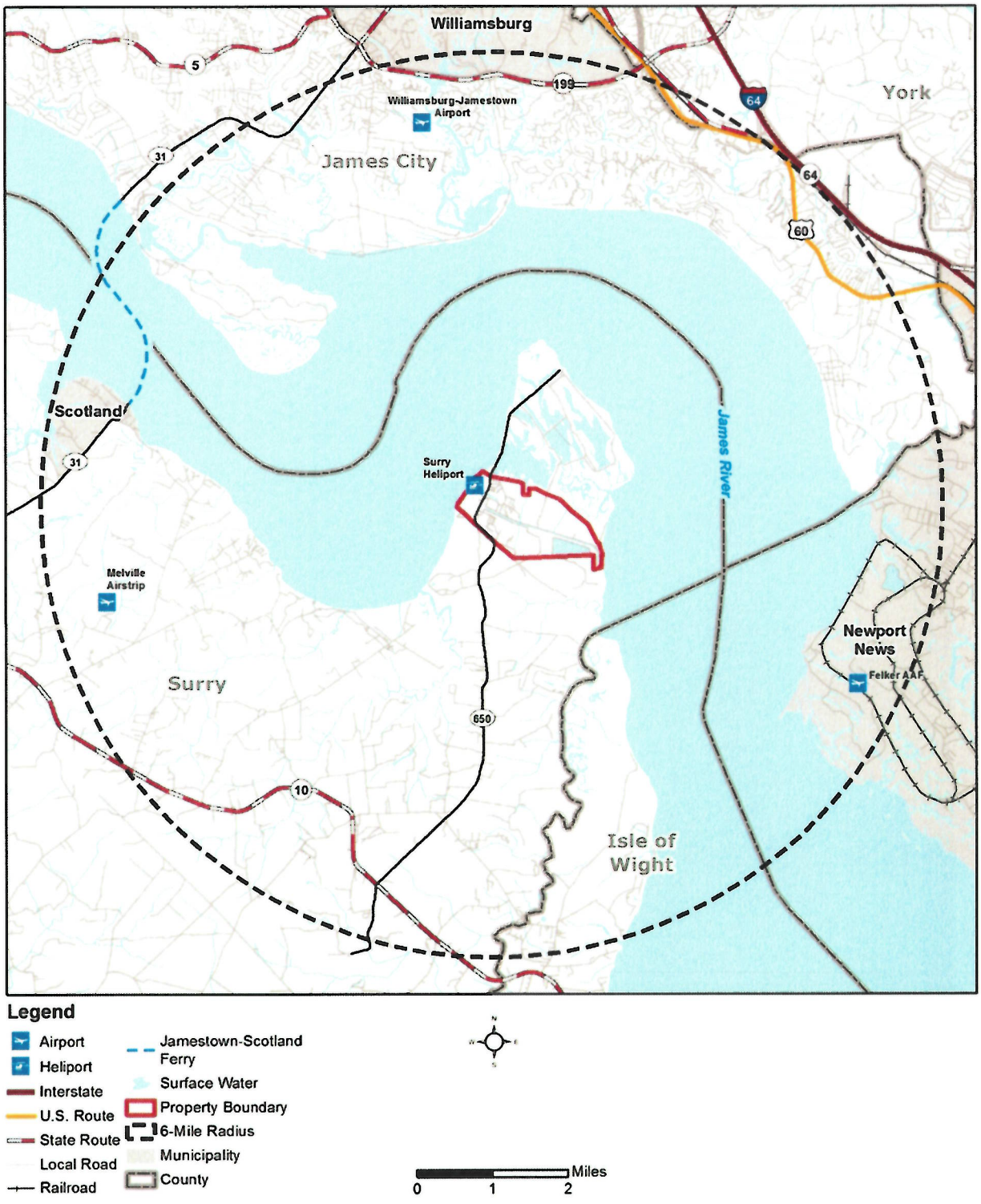


Figure 6-mile Vicinity



Dominion Energy Services, Inc
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief G. Anne Richardson
Rappahannock Tribe
5036 Indian Neck Road
Indian Neck, VA 23148

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Richardson:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Rappahannock Tribe regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:
Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

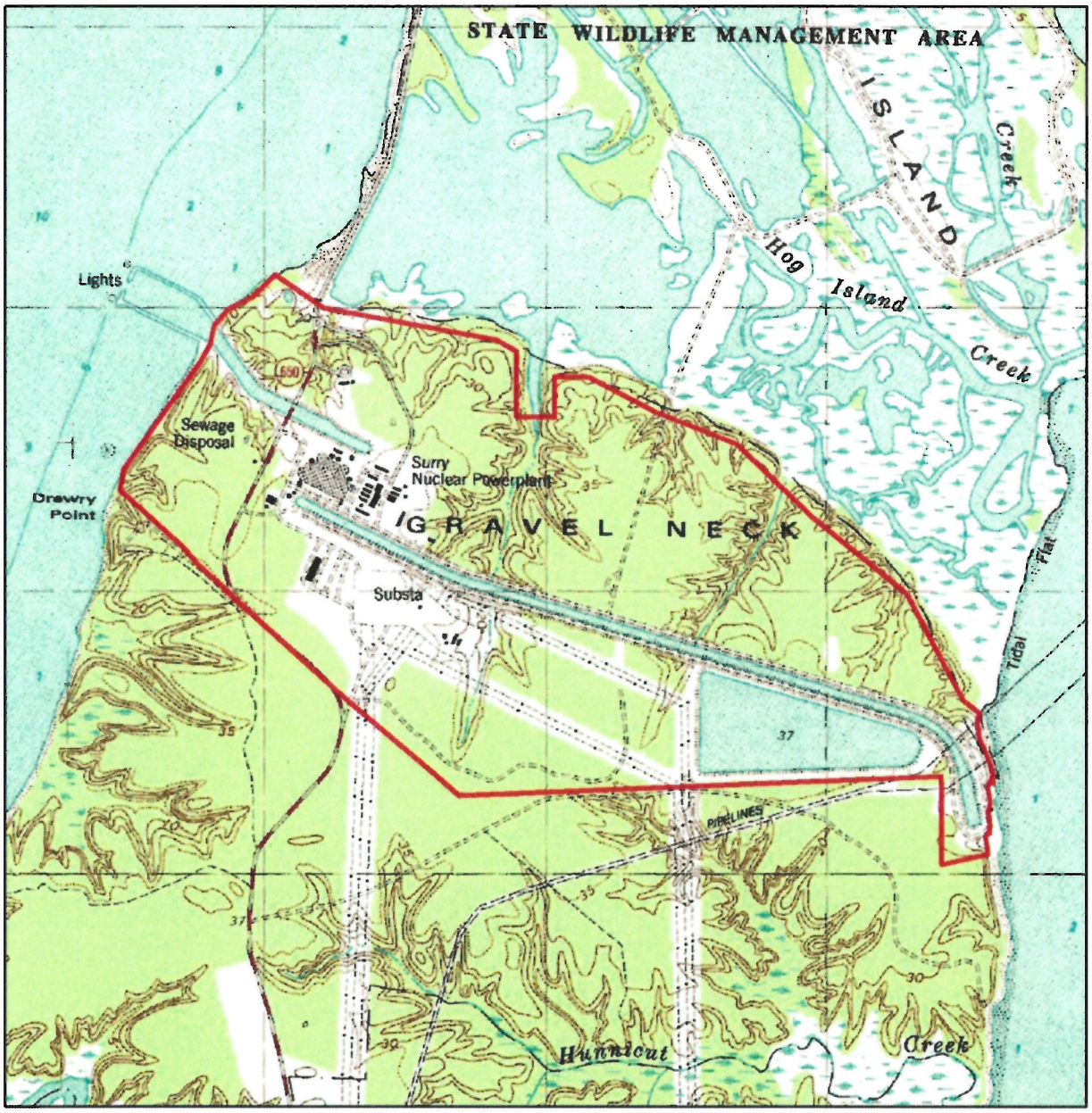
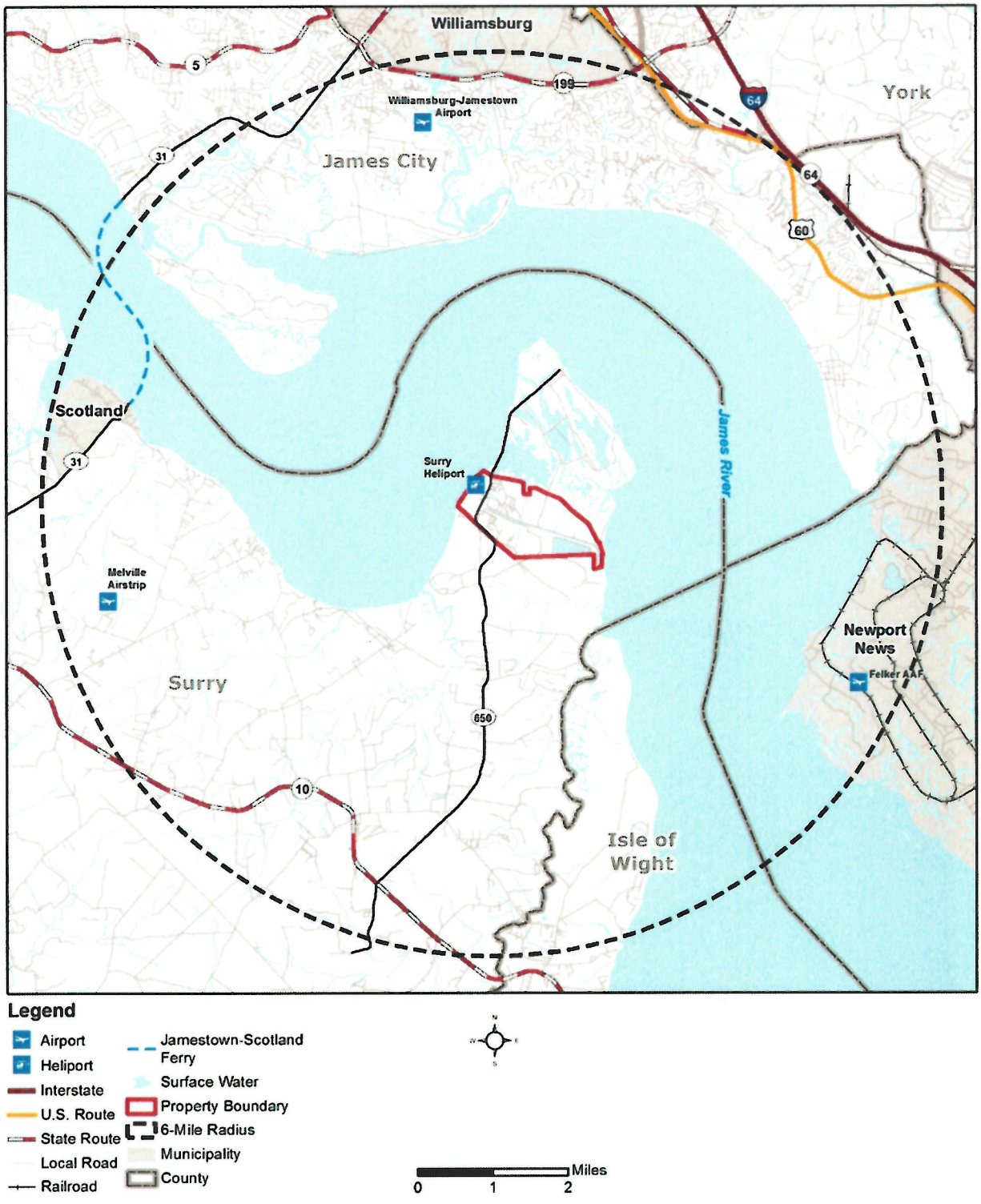


Figure 6-mile Vicinity



Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

May 17, 2018

Chief W. Frank Adams
Upper Mattaponi Tribe
5932 East River Road
King William, VA 23086

RE: Dominion Energy Virginia - Surry Power Station: Section 106 Review

Dear Chief Adams:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

While environmental impacts of an existing facility were assessed during original licensing, and license renewal is unlikely to have significant additional or different impacts, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Upper Mattaponi Tribe regarding license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources.

The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Cc: Molly Plautz

Enclosures:

Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

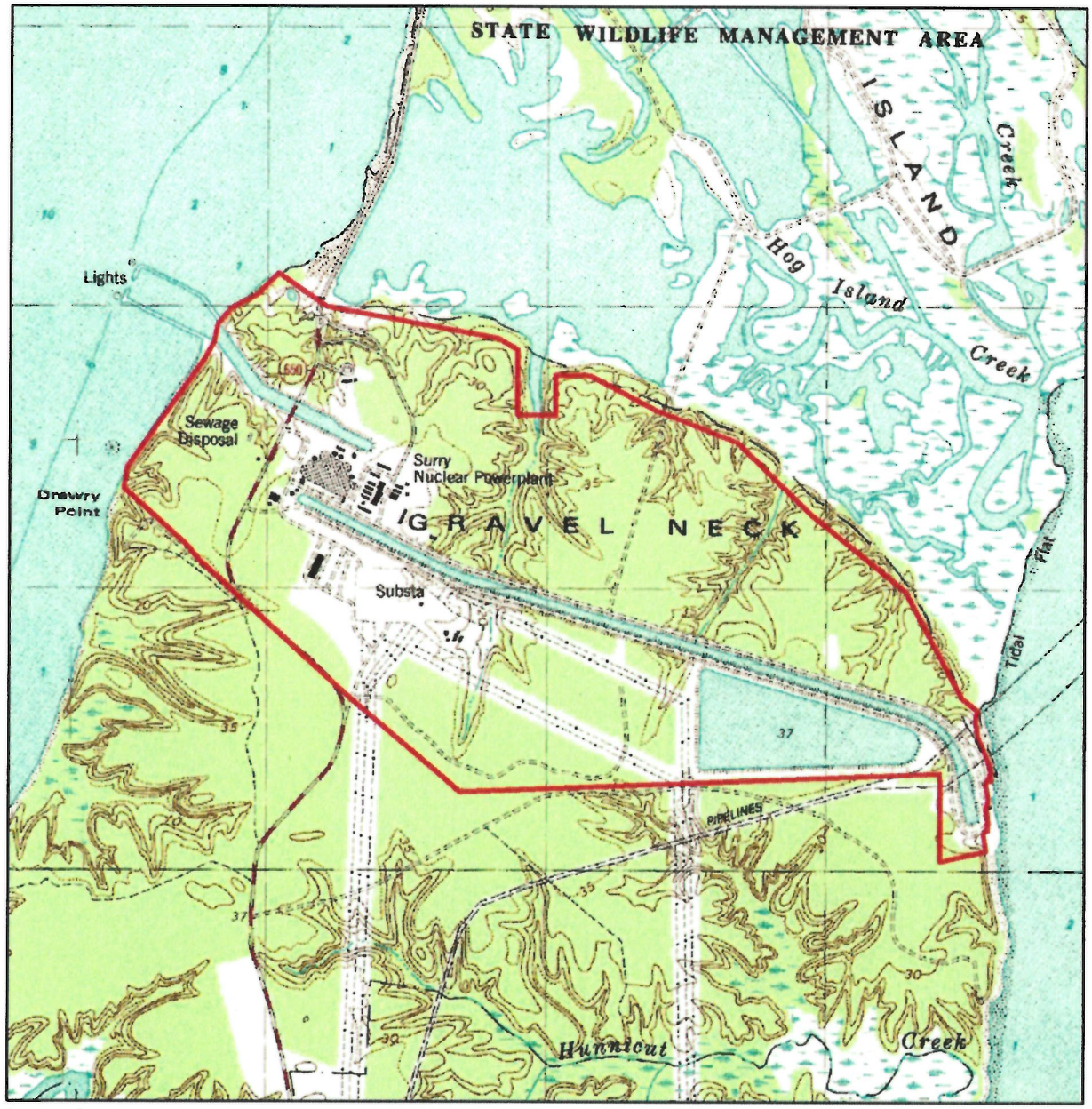


Figure 6-mile Vicinity

Pamela F Faggert
Chief Environmental Officer and Senior Vice President - Sustainability

5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

Dominion Energy

BY U.S. MAIL
RETURN RECEIPT REQUESTED

August 3, 2017

Ms. Nekole Alligood, Section 106 Manager
The Delaware Nation
P.O. Box 825
Anadarko, OK 73005

RE: Virginia Electric and Power Company - Surry Power Station Units 1 and 2 Subsequent License Renewal

Dear Ms. Alligood:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources including tribal cultural resources on or near the Surry site.

In recognition of the fact that the environmental impacts of an existing facility were assessed during the original licensing process, and that license renewal is unlikely to have significant additional or different impacts, the regulations identify categories of topics that may be governed by a Generic Environmental Impact Statement (GEIS). The regulations also identify issues that require site-specific analysis in the ER for the renewal action.

As part of the renewal process, the NRC may request a consultation with the Virginia State Historic Preservation Office (SHPO) and the Delaware Nation regarding the license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following the application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input from you regarding the effects that extending the license term may have on historic and cultural resources within the station's environs. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

During the extended license term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the independent spent fuel storage installation (ISFSI), if needed, is the only ground-disturbing activity anticipated at the SPS site during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources. The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources, including tribal cultural resources, within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in the preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Pamela F. Faggert

Attachments:

Figure SPS Site
Figure 6-mile Vicinity

Figure SPS Site

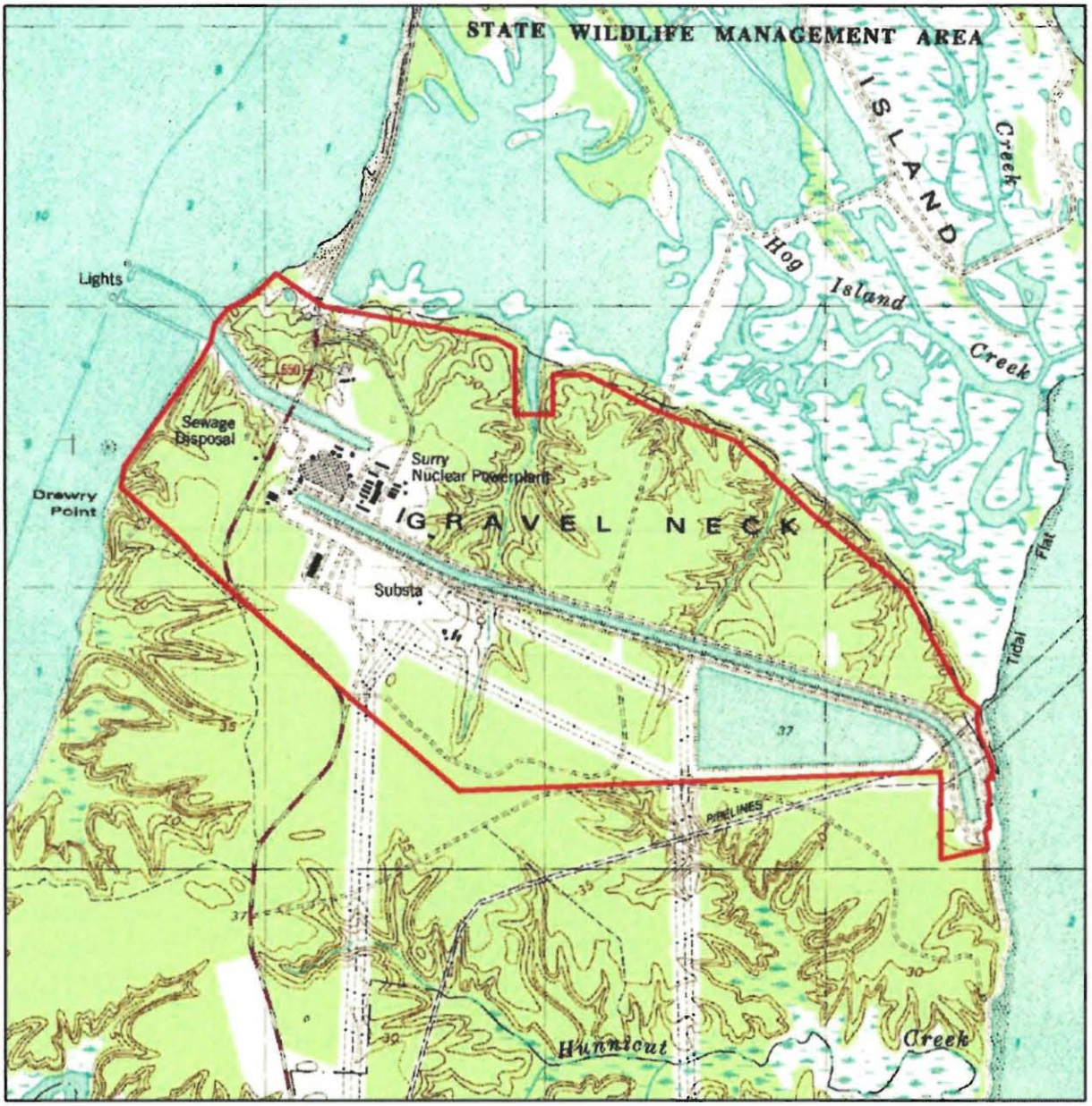


Figure 6-mile Vicinity

From:	Kimberly Penrod
To:	Oula K Shehab-Dandan (Services - 6)
Cc:	Kimberly Penrod
Subject:	[External] RE: Virginia Electric and Power Company/ Surrey Power Station, Units 1 and 2 Subsequent License Renewal/ Gravel Neck Peninsula, Surry County, Virginia
Date:	Thursday, August 24, 2017 11:16:49 AM

Oula,

The protection of our tribal cultural resources and tribal trust resources will take all of us working together.
We look forward to working with you and your agency.
With the information you have submitted we can concur at present with this proposed plan.
Our main concerns at the Delaware Nation on these projects are as follows:

1. Keeping a 50-100 ft (at least) area of protection around known sites.
2. Maintaining the buffer area and not allowing heavy equipment to impact these areas. Compression is an issue of concern for us.
3. Protection of indigenous plants and/or re-introduction of the indigenous plants to the area is important to the Delaware Nation. Many of these are considered Traditional Cultural Properties for our people.
4. And if something is found, halting all work, contacting us within 48 hours and when work resumes discussion of a monitor if needed.

As with any new project, we never know what may come to light until work begins.
The Delaware Nation asks that you keep us up to date on the progress of this project and if any discoveries arise please contact us immediately.

Our department is trying to go as paper free as possible. If it is at all feasible for your office to send email correspondence we would greatly appreciate.

Please update your files to reflect my contact information below.

If you need anything additional from me please do not hesitate to contact me.

Respectfully,

Kim Penrod
Delaware Nation
Director, Cultural Resources/106
Archives, Library and Museum
31064 State Highway 281
PO Box 825
Anadarko, OK 73005
(405)-247-2448 Ext. 1403 Office
(405)-924-9485 Cell

kpenrod@delawarenation.com

Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

August 3, 2017

Ms. Julie Langan, Director & State Historic Preservation Officer
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

RE: Virginia Electric and Power Company - Surry Power Station Units 1 and 2 Subsequent License Renewal

Dear Director Langan:

Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. The Company expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. Dominion Energy Virginia is contacting you for assistance in assessing the impacts from continued operation during this renewed license period.

The license renewal process is governed by 10 CFR Part 54, and requires development of an Environmental Report (ER) by the applicant that assesses the potential environmental impacts from continued operation of the facility for an additional 20 years. Among other things, the ER will address the potential to impact historic and cultural resources on or near the Surry site.

In recognition of the fact that the environmental impacts of an existing facility were assessed during the original licensing process, and that license renewal is unlikely to have significant additional or different impacts, the regulations identify categories of topics that may be governed by a Generic Environmental Impact Statement (GEIS). The regulations also identify issues that require site-specific analysis in the ER for the renewal.

As part of the renewal process, the NRC may request a consultation with your agency in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470), and the federal Advisory Council on Historic Preservation regulations (36 CFR 800) regarding the license renewal. Should the NRC consultation take place, a prospective time frame for its conduct is anticipated to be within a few months following application submittal.

To facilitate our assessment and the consultation process, we are contacting you early in the application process to seek input regarding the effects that extending the license term may have on historic and cultural resources within the station's environs. Figures depicting the station site and the vicinity within a 6-mile radius of the station are enclosed.

SPS is an 840-acre facility located on Gravel Neck Peninsula in Surry County, Virginia, on the south side of the James River, approximately 25 miles upstream of the point where the river enters the Chesapeake Bay. In accordance with NRC regulations, the transmission lines within the scope of the license renewal are those located within the SPS site boundary. An approximate 85-acre management area for material from maintenance dredging in the James River at SPS's water intakes, located approximately four miles from the SPS site, is presently being evaluated for permitted use.

A single cultural resource has been identified in the western portion of 840-acre Dominion Energy Virginia SPS property, the Lawnes Creek Church Site (44SY2). The National Register of Historic Places (NRHP) status of the site has not been determined. There are no additional NRHP-eligible cultural resources on the 840-acre SPS property. The proposed license renewal of SPS includes construction of a new 1-acre concrete storage pad at the existing Independent Spent Fuel Storage Installation (ISFSI). This action was previously reviewed by Virginia Department of Historical Resources (VDHR), and it was determined that no historic properties will be affected (DHR File No. 2016-0995).

Our research indicates that there are approximately 45 cultural resource sites within 6 miles of the SPS. Known archaeological sites and historic properties for SPS's six-mile vicinity excluding the SPS site are listed in the enclosed table. Many of these resources are listed or potentially eligible for listing to the NRHP due to their association with early colonization. This includes Hog Island, which is part of a Historic District the US Army Corps of Engineers determined as NRHP eligible.

During the extended license renewal term, Dominion Energy Virginia proposes to continue operating the units as currently operated. The construction of a new concrete storage pad (pad #5) at the ISFSI, if needed, is the only ground-disturbing activity anticipated during the extended license renewal period.

Dominion Energy Virginia does not anticipate the continued operation of SPS to adversely affect the environment or any cultural or historic resources. The Company also does not anticipate any refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process.

As stated above, this letter seeks your input to support the Company's preparation of an ER for the extended license term relating to historic and cultural resources within the immediate environs of the station. We appreciate your notifying us of your comments and sharing any information you believe Dominion Energy Virginia should consider in preparation of the ER. The Company plans to include this letter and any response you provide in the ER.

Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Manager, Generation Environmental Services

Attachments:

Table List of Known Archaeological Sites and Historic Properties
Figure SPS Site
Figure 6-mile Vicinity

Table List of Known Archaeological Sites and Historic Properties

Eligible or Potentially Eligible Archaeological Sites Within a 6-Mile Radius of SPS[(a)]

VDHR ID#	County	Quadrangle	NRHP Status
046-5415	Isle of Wight	Hog Island	Eligible
047-5307	James City	Hog Island	Potentially eligible
047-5333	James City	Yorktown	Eligible
047-5432	James City	Surry	Potentially eligible
090-0121	Surry	Hog Island	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046	Surry	Surry	Potentially eligible
090-5046-0001	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046-0002	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046-0003	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046-0004	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
090-5046-0008	Surry	Surry	Not individually eligible; contributing to Scotland Wharf Historic District
121-5068	Newport News City	Yorktown	Eligible
121-5070	Newport News City	Hog Island	Eligible
121-xxx	Newport News City	Yorktown	Eligible
-	Surry/James City	Hog Island/Surry	Eligible
90-26 (44SY2)	Surry	Hog Island	Undetermined
90-27 (44SY3)	Surry	Hog Island	Undetermined
90-52	Surry	Hog Island	Undetermined
90-121-1	Surry	Hog Island	Undetermined
90-121-2	Surry	Hog Island	Undetermined
90-121-3	Surry	Hog Island	Undetermined
90-121-4	Surry	Hog Island	Undetermined
90-121-5	Surry	Hog Island	Undetermined
90-121-6	Surry	Hog Island	Undetermined
90-121-7	Surry	Hog Island	Undetermined
Area 1	Surry	Hog Island	Undetermined
44SY114	Surry	Hog Island	Undetermined
44SY138	Surry	Hog Island	Undetermined
44SY159	Surry	Hog Island	Undetermined
44SY212	Surry	Hog Island	Undetermined
44SY213	Surry	Hog Island	Undetermined
44SY218	Surry	Hog Island	Undetermined

(LBGI 2001; LBGI 2013)

a. Due to the large number of sites (579) within 6 miles of SPS, only sites that are potentially eligible, determined eligible, or within the SPS site boundary or in very close proximity are included.

NRHP-Listed Properties Within a 6-Mile Radius of SPS

Resource Name	County	Quadrangle	NRHP Listed	Distance from SPS[a]
Fort Huger	Isle of Wight	Bacons Castle	2008	4.5
Carter's Grove	James City	Hog Island	1969	4.9
Jamestown National Historic Site Jamestown Island Jamestown Island Historic District	James City	Hog Island/Surry	1966	3.6
Kingsmill Plantation	James City	Hog Island	1972	4.3
Governor's Land Archaeological District	James City	Surry	1973	Address restricted[b]
Bacon's Castle	Surry	Bacons Castle	1966	4.0
Melville	Surry	Surry	1980	5.3
Pleasant Point (Crouches Creek Plantation)	Surry	Surry	1976	4.3
Rich Neck Farm	Surry	Surry	1980	4.0
Old Brick Church (Lower Southwark Church)	Surry	Bacons Castle	1986	4.5
Chippokes Plantation Historic District (Chippokes State Park)	Surry	Hog Island	1969	2.6
Matthew Jones House	Newport News City	Yorktown	1969	5.2
Fort Crafford	Newport News City	Yorktown	1974	5.1

(LBGI 2001; LBGI 2013)

a. Distances are approximate and based on the SPS center point and NRHP location data.

b. Distance not identified due to confidential nature of prehistoric site locations.

Figure SPS Site

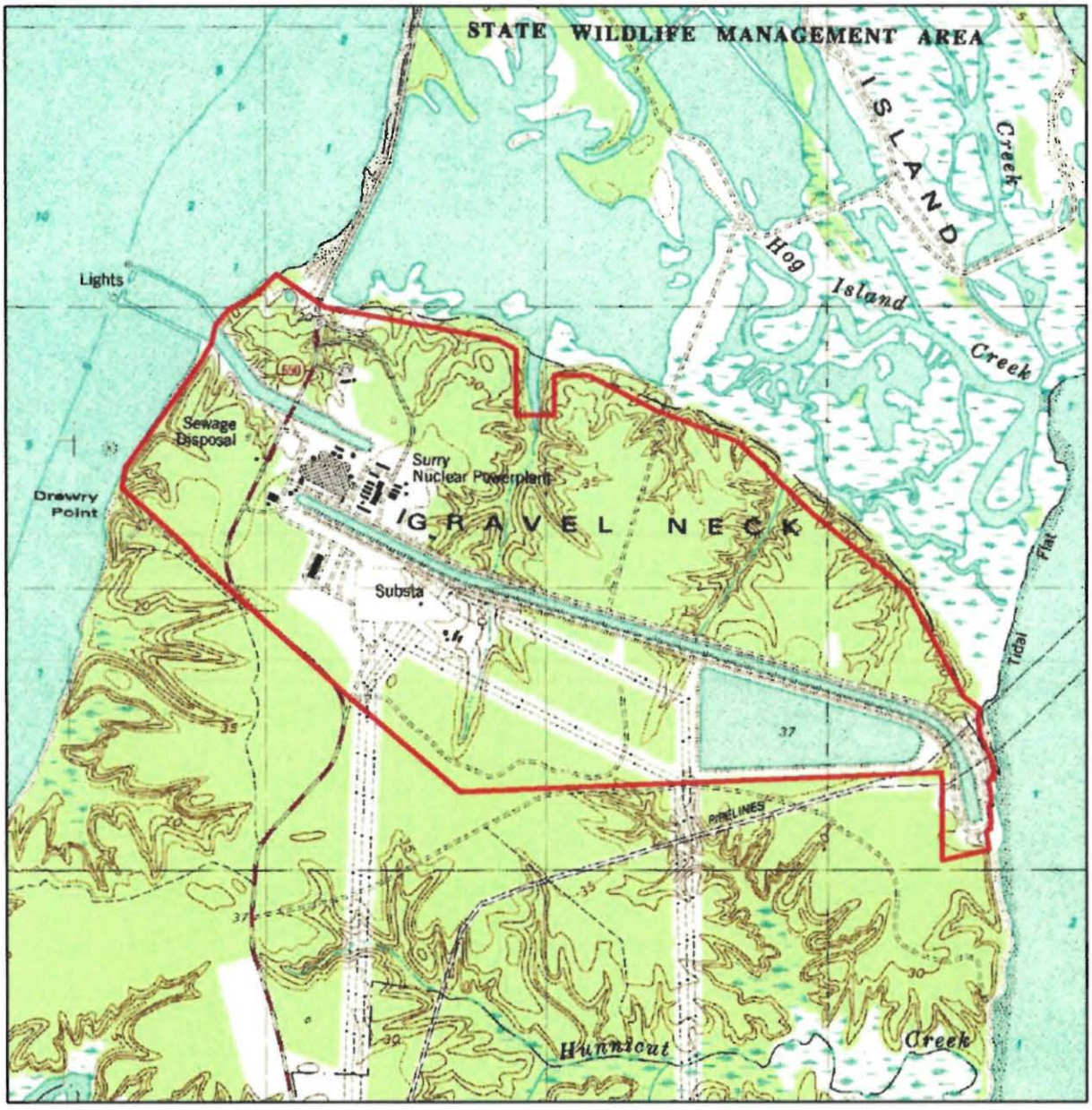


Figure 6-mile Vicinity

COMMONWEALTH of VIRGINIA

Molly Joseph Ward
Secretary of Natural Resources

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221

Julie V. Langan
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
www.dhr.virginia.gov

December 20, 2017

Mr. Tony Banks
Dominion Energy Services, Inc.
5000 Dominion Boulevard
Glen Allen VA 23060

RE: Surry Power Station – Units 1 and 2 License Renewal
Surry County, VA
DHR File No. 2017-0798

Dear Mr. Banks:

The Department of Historic Resources (DHR), which serves as the Virginia State Historic Preservation Office, has received notice of Dominion Energy's intention to pursue renewal of its licenses from the Nuclear Regulatory Commission (NRC) to operate Units 1 and 2 at the Surry Power Station (SPS). Our comments are provided as assistance to Dominion and the NRC in the preparation and review of these applications.

As you are aware, our records show one identified historic resource on the SPS property. Site 44SY0002 represents the archaeological remains of the Lawnes Creek Church. No comprehensive archaeological survey has been completed of the SPS property and other historic resources may remain undocumented. The stretch of river running along Hog Island has been designated part of the Jamestown Island-Hog Island-Captain John Smith Trail Historic District, which has been determined eligible for listing in the National Register of Historic Places. We do not object to the renewal of these licenses and find that the continued operation of the facility is unlikely to adversely affect historic properties; however, we offer the following for consideration by NRC:

1. Dominion should consult with DHR on all projects at the SPS that include ground-disturbing activities in areas not previously disturbed by similar activities; and
2. Dominion should update the unanticipated discoveries plans to ensure that contact information remains valid.

If you have any questions at this time, please contact me at roger.kirchen@dhr.virginia.gov.

Sincerely,

Roger W. Kirchen, Director
Review and Compliance Division

Western Region Office
962 Kime Lane
Salem, VA 24153
Tel: (540) 387-5443
Fax: (540) 387-5446

Northern Region Office
5357 Main Street
PO Box 519
Stephens City, VA 22655
Tel: (540) 868-7029
Fax: (540) 868-7033

Eastern Region Office
2801 Kensington Avenue
Richmond, VA 23221
Tel: (804) 367-2323
Fax: (804) 367-2391

Attachment E: Coastal Zone Management Act Certification

Intentionally Blank

Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

August 3, 2017

Ms. Laura McKay
CZM Program Manager
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 23219

RE: Virginia Electric and Power Company - Surry Power Station Units 1 and 2 Subsequent License Renewal

Dear Ms. McKay

The Virginia Electric and Power Company (Dominion Energy Virginia or the Company) is submitting this Coastal Zone Management Act (CZMA) Consistency Certification for the above-referenced project. The Company is preparing an application to renew the operating licenses issued by the U.S. Nuclear Regulatory Commission (NRC) for Surry Power Station Units 1 and 2 (SPS) for an additional 20 years. Dominion Energy Virginia expects to submit the renewal application in the first quarter of 2019. For SPS Unit 1, this requested renewal would extend the license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053.

To meet the requirements of the Federal Consistency Review, Dominion Energy Virginia has developed a CZMA Consistency Certification for this project, which is located within Virginia's designated Coastal Zone.

The CZMA Consistency Certification including the project description is attached. The certification demonstrates the project is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Zone Management Program and will be conducted in a manner consistent with the Program.

We request your concurrence with the certification. Should you or your staff have any questions or comments, please contact Ms. Oula Shehab-Dandan at (804) 273-2697 oula.k.shehab-dandan@dominionenergy.com or Mr. Tony Banks at (804) 273-2170 tony.banks@dominionenergy.com.

Sincerely,

Jason E. Williams
Manager, Generation Environmental Services

Attachment

Federal Consistency Certification
for Federal Permit and License Applicants

Table of Contents

COASTAL ZONE MANAGEMENT ACT CONSISTENCY CERTIFICATION

This document provides the Commonwealth of Virginia with the Virginia Electric and Power Company (Dominion Energy Virginia) consistency certification and necessary data and information under the Coastal Zone Management Act (CZMA) Section 307(c)(3)(A) and 15 CFR Part 930, subpart D, for the continued operation of Surry Power Station Units 1 and 2 (SPS) for an additional 20 years under a renewed U.S. Nuclear Regulatory Commission (NRC) operating license term. For SPS Unit 1, this requested subsequent license renewal would extend the current renewed NRC operating license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053. The proposed action for subsequent license renewal is for continued operation of SPS Units 1 and 2 until 2052 and 2053, respectively, in accordance with applicable regulatory requirements of the NRC, other federal agencies, the Commonwealth of Virginia, and local government bodies with jurisdiction.

CERTIFICATION

Dominion Energy Virginia certifies that the proposed activity complies with the enforceable policies of Virginia's Coastal Zone Management Program (VCP) and will be conducted in a manner consistent with the VCP.

NECESSARY DATA AND INFORMATION

Proposed Action

Dominion Energy Virginia is applying to the NRC for the renewal of the operating licenses for the two nuclear generating units of SPS for an additional 20 years. For SPS Unit 1, this requested renewal would extend the NRC operating license expiration date from May 25, 2032, to May 25, 2052. For SPS Unit 2, this requested renewal would extend the license expiration date from January 29, 2033, to January 29, 2053.

SPS was licensed in 1972 and 1973 for a period of 40 years, with the original operating license terms expiring in 2012 and 2013 for Units 1 and 2, respectively (NRC 2017). SPS Units 1 and 2 received renewed operating licenses from the NRC on March 20, 2003, extending the license terms to 2032 and 2033, respectively (NRC 2003). For the 2003 license renewal, Dominion Energy Virginia prepared a CZMA program consistency certification and received a letter of concurrence from the Virginia Department of Environmental Quality (VDEQ) on February 20, 2002, documenting that the renewal of the SPS operating licenses was consistent with the CZMA program (NRC 2002, Table E-1).

SPS is located on the James River in Surry County, Virginia. Figures E-1 and E-2 show the SPS 50-mile region and 6-mile vicinity, respectively. Figure E-3 presents the site location on a U.S. Geological Survey topographical map. The subsequent license renewal application (SLRA) being submitted to the NRC also considers the impacts from the in-scope transmission lines shown on Figure E-4, which connect the generating units to the transmission grid and

provide power to the plant during outages. These transmission lines are located wholly on the SPS site.

Two other facilities are co-located on the SPS site and also operated by Dominion Energy Virginia. The first of these is the Gravel Neck Combustion Turbines Station (GNCTS), an oil/natural gas-fired generating plant, which does not require a license from the NRC. GNCTS shares air, wastewater, and groundwater withdrawal permits with SPS Units 1 and 2. The second is an independent spent fuel storage installation (ISFSI), a dry storage facility for spent fuel removed from SPS Units 1 and 2 that is separately licensed by the NRC (License No. SNM-2501 and under a general license pursuant to NRC regulations). The SLRA requests renewal of the nuclear generating units' operating licenses only. While this consistency determination is for an extension of the operations of the nuclear units only, both GNCTS and the ISFSI are considered in the cumulative impacts of the Environmental Report (discussed below) supporting the SPS SLRA.

During the proposed subsequent license renewal period of extended operations, Dominion Energy Virginia would continue to operate SPS as described in the following paragraphs. In addition, Dominion Energy Virginia would continue to maintain compliance with its federal, state, and local environmental permits and authorizations. Table E-1 provides a summary of authorizations held by SPS for current plant operations. Authorizations in this context include any permits, licenses, approvals, or other entitlements that would continue to be in place, as appropriate, throughout the period of extended operation given their respective renewal schedules. Prior to initiating any activity associated with SPS requiring a permit(s) and/or approval(s) applicable to the VCP's enforceable policies, Dominion Energy Virginia will renew such permit(s) and/or approval(s) in a timely manner, and will adhere to the conditions contained therein.

SPS uses uranium dioxide fuel in two nuclear reactors to produce steam to drive turbines that generate 1,676 (summer output) to 1,750 (winter output) megawatts of electricity for consumer use. Cooling water is withdrawn from the James River through a channel dredged in the riverbed between the main river channel and the eastern shore of Gravel Neck Peninsula, a distance of approximately 5,700 feet. Dominion Energy Virginia dredges this channel every three-to-four years to maintain a depth of approximately 13 feet.

When SPS is operating at full power, circulating water pumps move 1,680,000 gallons per minute (gpm) from the James River to an intake channel. SPS discharges the heated effluent (11.9×10^9 British thermal units per hour) through a discharge canal to the river. The discharge canal extends about 1,200 feet into the James River. SPS maintains a Virginia Pollutant Discharge Elimination System (VPDES) permit (Permit No. VA0004090) for this discharge (VDEQ 2016). The VPDES program also addresses compliance with Clean Water Act (CWA) Section 316(b) concerning impingement and entrainment, and Dominion Energy Virginia is conducting required entrainment studies to allow VDEQ to determine the best technology available for reducing entrainment. Any modifications to the cooling system would be incorporated into a modified VPDES permit and implemented during the current license term.

SPS uses groundwater for domestic, process, and cooling purposes. Dominion Energy Virginia holds a VDEQ groundwater withdrawal permit (Permit GW0003901) authorizing groundwater withdrawals through wells which serve both SPS and GNCTS. The permit allows a maximum withdrawal of 154.7 million gallons of water per year (mgy) and a monthly maximum of about 15.89 million gallons (mg) (VDEQ 2013a).

Dominion Energy Virginia holds a joint Title V air permit for SPS air emission units, consisting of two auxiliary boilers and several diesel-powered engines, and GNCTS operation (Permit PRO50336). The SPS air emission sources include emergency equipment (e.g., generators) for safe plant operation in case of loss of other normal power supply. As such, the sources generally operate for minimal periods of time for testing purposes. While SPS and GNCTS are permitted jointly, they each have their own permitted emission sources, addressed by applicable regulations cited in the current and/or future revised Title V permit. Emissions reports submitted to VDEQ annually contain tabular summary information for each station's applicable permitted air emission units. Criteria pollutants and applicable hazardous air pollutants are also summed and reported in the annual update and emissions statement.

Dominion Energy Virginia employs approximately 940 workers at SPS and an additional 140 temporary supplemental staff in rotating shifts. About 60 percent of SPS employees live in Isle of Wight and Surry Counties. During the 18-month cycle staggered for Units 1 and 2 outages, 1,000 to 1,500 additional workers are onsite (Dominion 2017a).

Environmental Impacts

The NRC has prepared a generic environmental impact statement (GEIS) on impacts that nuclear power plant operations can have on the environment (NRC 2013) and has codified its findings (10 CFR 51, Subpart A, Appendix B, Table B-1). NRC regulations require review of environmental impacts when renewing an operating license. NRC regulation 10 CFR 51.53(c) requires an applicant for license renewal to submit with its application a separate document entitled Applicant's Environmental Report – Operating License Renewal Stage (ER). Even though an environmental analysis and a supplement to the GEIS were completed for the first renewal of SPS' operating licenses, a new analysis must be completed for subsequent license renewal. The purpose of the SLRA ER is to evaluate the impact on human and natural environments for an additional twenty years of operation. NRC's requirements for a SLRA ER require that the ER (1) identifies the environmental resources that may be affected; (2) assesses the potential environmental impacts of continued operations and refurbishment; and (3) identifies relevant actions to mitigate potential significant (beyond SMALL) adverse impacts and ensure federal, state, and local regulatory compliance. SMALL impacts are defined in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3 as:

> Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

The license renewal environmental evaluation focuses on 77 environmental issues which the NRC has categorized into Category 1 or Category 2. In addition to the 77 categorized issues, the GEIS and NRC regulations consider an uncategorized issue on chronic effects of electromagnetic fields that NRC has reviewed, but does not require license renewal applicants to consider in their renewal applications. Sixty (60) environmental issues are classified as Category 1 and were dispositioned generically by the NRC (10 CFR 51 Subpart A, Appendix B). Those issues do not need to be addressed individually in the ER, but the applicant is required to apply a process to look for potential new information and evaluate the significance of any new information on a plant-specific basis in the applicant's ER. Of the 60 Category 1 issues, 53 are applicable to SPS. Seventeen (17) issues, which could not be dispositioned generically, are classified as Category 2 impact issues. The potential impacts of these issues must be addressed on a plant-specific basis in the ER. Category 2 issues include such items as impacts on aquatic species from entrainment, impingement, and thermal effects; endangered species; groundwater use conflicts; and cumulative impacts on specified environmental and socioeconomic resources that interface with SPS. Of the 17 Category 2 issues, 12 are applicable to SPS.

NRC requirements for license renewal also include preparation of an integrated plant assessment (IPA) [10 CFR 54.21]. The IPA must identify systems, structures, and components (SSCs) subject to an aging management review. The purpose of the IPA is to demonstrate that the effects of aging will be adequately managed so that the intended functions will be maintained during the subsequent license renewal period. The SPS IPA that Dominion Energy Virginia conducted under 10 CFR Part 54 has identified no refurbishment or replacement actions needed to maintain the functionality of SSCs for the proposed subsequent license renewal action.

Regarding the applicable Category 1 issues, Dominion Energy Virginia conducted a new and significant information review and did not identify any new and significant information. Therefore, Dominion Energy Virginia has adopted by reference the NRC findings and GEIS analyses (NRC 2013) for all applicable Category 1 issues. The applicable Category 1 issues are presented in Table E-2 along with their NRC finding.

Regarding the applicable Category 2 issues, Table E-3 summarizes the site-specific assessment by each Category 2 issue. From the review of these individual Category 2 issues, Dominion Energy Virginia identified the following site-specific unavoidable adverse impacts associated with the proposed subsequent license renewal period:

- The majority of the land use at SPS would continue to be designated as industrial until the plant is shut down and decommissioned (decommissioning can take up to 60 years after permanent shutdown of SPS). Uranium mining associated with the nuclear fuel cycle and the management area for material from maintenance dredging in the James River at SPS's water intakes also has offsite land use implications.
- Aquatic organisms would continue to be impinged and entrained at the intake structure, but these impacts were determined to be SMALL.

- Normal plant operations result in industrial wastewater discharges containing small amounts of water treatment chemical additives to the James River at or below VDEQ approved concentrations. Compliance with the VPDES permit would ensure that impacts remain SMALL.
- Operation of SPS results in consumptive use of James River water as a result of plant operations. However, the water is considered low quality in the vicinity of SPS. SPS withdraws about three percent of the James River's tidal flow while one percent of that is lost to evaporation.
- Operation of SPS results in the generation of spent nuclear fuel and waste material, including low-level radioactive waste (LLRW), hazardous waste, and nonhazardous waste. However, specific plant design features in conjunction with a waste minimization program; employee safety training programs and work procedures; and strict adherence to applicable regulations for storage, treatment, transportation, and ultimate disposal of this waste ensure that the impact is SMALL.
- Operation of SPS results in a very small increase in radioactivity in the air. The incremental radiation dose to the local population resulting from SPS operations is typically less than the magnitude of the fluctuations that occur in natural background radiation. Doses to the members of the public from SPS's gaseous releases would be well within the allowable limits of 10 CFR Part 20 and 10 CFR Part 50, Appendix I. Operation of SPS also creates a very low probability of accidental radiation exposure to inhabitants of the area.

These adverse impacts associated with SPS license renewal are mitigated to SMALL by implementation of current SPS programs and permit compliance (i.e., VPDES permit; stormwater program; air permit; spill prevention, control, and countermeasure program; hazardous waste management program; cultural resource protection plan; and environmental review programs) and do not require the implementation of additional mitigation measures.

Findings Applicable to Enforceable Policies

Potential effects of the proposed subsequent license renewal on the coastal zone are described below. Items "a" through "i" address impacts related to the VCP's enforceable policies. The policy as included in the VCP is presented in italics, and Dominion Energy Virginia's finding of whether the policy is applicable to the proposed subsequent license renewal period follows. If the policy is applicable, the finding discussion presents how Dominion Energy Virginia complies with the policy, which in the case of most of the enforceable policies involves obtaining and complying with a federal or state permit.

a. Fisheries Management

Policy

The program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational fisheries to maximize food production and recreational opportunities. This program is administered by the Marine Resources Commission

(MRC) (Virginia Code §28.2-200 through §28.2-713) and the Department of Game and Inland Fisheries (DGIF) (Virginia Code §29.1-100 through §29.1-570).

The State Tributyltin (TBT) Regulatory Program has been added to the Fisheries Management program. The General Assembly amended the Virginia Pesticide Use and Application Act as it related to the possession, sale, or use of marine antifoulant paints containing TBT. The use of TBT in boat paint constitutes a serious threat to important marine animal species. The TBT program monitors boating activities and boat painting activities to ensure compliance with TBT regulations promulgated pursuant to the amendment. The MRC, DGIF, and Virginia Department of Agriculture and Consumer Services share enforcement responsibilities (Virginia Code §3.2-3904 and 3.2-3935 to §3.2-3937).

Finding

SPS maintains a VPDES permit for all its process and stormwater discharges, with the most recent renewal of its VPDES permit in 2016 (Permit No. VA0004090) (VDEQ 2016). Part I.C.16 of the SPS VPDES permit (VDEQ 2016) and an accompanying factsheet (VDEQ 2013b) present rationale for why the regulator considers the permit's thermal limitations adequate to assure the protection and propagation of a balanced indigenous community of shellfish, fish, and wildlife in the James River. This rationale is based on the results of the 316(a) thermal demonstration submitted in 1977. 2016 permit effluent limitations remain adequate. 9 VAC 25-260-90 of the Virginia Water Quality Standards states that a satisfactory showing made in conformance with 316(a) complies with the general standard and with the temperature requirements of the standards (Dominion 2016).

No notices of violation were received in 2012 – 2016 for the VPDES permit (Dominion 2017b). However, a warning letter regarding elevated biological oxygen demand (BOD) readings in the SPS discharge was received in October 2016. Corrective actions were implemented and follow-up sampling indicated the initial elevated BOD condition was temporary and has been addressed (Dominion 2016).

The VDPES program also addresses compliance with CWA Section 316(b), which is specific to impingement and entrainment impacts associated with cooling water intake structures. In response to new CWA 316(b) regulatory requirements, Dominion Energy Virginia is conducting entrainment studies to determine if the current operational methods to prevent entrainment are sufficient to meet the new requirements. SPS must comply with CWA 316(b) regulations. VDEQ will make the final determination of compliance and could require modifications of the intake structures and/or the cooling system. Any modifications would be designed to reduce entrainment and impingement impacts. Continued compliance with VPDES permit conditions during the proposed subsequent license renewal period (the permit is subject to renewal every five years) would ensure that SPS's direct and indirect impacts to aquatic ecological communities are minimized.

As discussed above, SPS operates in compliance with its VPDES permit which ensures water quality and is protective of aquatic communities, thus compatible with the promotion of commercial and recreational fisheries. There is little commercial fishing on the James River in

the vicinity of the SPS site, however, oyster beds, located in the river to the north and east of the Gravel Neck Peninsula are leased for private oyster harvest by the Virginia Marine Resources Commission. In addition, SPS is adjacent to the Hog Island Wildlife Management Area (HIWMA) which offers recreational fishing (VDGIF 2017). SPS operations have been conducted in harmony with the oyster beds and HIWMA for many years. Those operations will not change during the renewal period.

Dominion Energy Virginia owns boats for use at SPS. As a matter of policy, however, boats are trailered and are never water-bound, not even overnight. Dominion Energy Virginia adopted this practice so that no antifouling coatings of any type are required.

Dominion Energy Virginia finds that SPS operations are in compliance with this VCP enforceable policy and will continue to have programs and permits in place to ensure compliance during the proposed subsequent license renewal term.

b. Subaqueous Lands Management

Policy

The management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects on marine and fisheries resources, wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by the DEQ Water Division. The program is administered by the MRC (Virginia Code §28.2-1200 through §28.2-1213).

Finding

SPS (Dominion Energy Virginia) received a permit for encroachment in, on, or over state-owned subaqueous bottoms for the purpose of dredging the plant's intake channel. This permit, VMRC #2016-0710, was issued August 16, 2016, and expires July 26, 2021, and includes a limit of 150,000 cubic yards removal of accumulated sediments (VMRC 2016). SPS dredges the intake channel approximately every three-to-four years. SPS will continue to obtain the necessary subaqueous land permit prior to undertaking any dredging during the subsequent license renewal period and abide by the conditions of the permit. No other impacts to subaqueous lands are expected as a result of subsequent license renewal.

Dominion Energy Virginia finds that SPS operations are in compliance with this VCP enforceable policy and will continue to have programs and permits in place to ensure compliance during the proposed subsequent license renewal term.

c. Wetlands Management

Policy

The purpose of the wetlands management program is to preserve tidal wetlands, prevent their despoliation, and accommodate economic development in a manner consistent with wetlands preservation. (i) The tidal wetlands program is administered by the MRC (Virginia Code §28.2-1301 through §28.2-1320).

(ii) The Virginia Water Protection Permit program administered by the DEQ includes protection of wetlands --both tidal and non-tidal. This program is authorized by Virginia Code § 62.1-44.15:5 and the Water Quality Certification requirements of §401 of the Clean Water Act of 1972.

Finding

Dominion Energy Virginia will obtain, maintain and comply with the necessary permits to protect wetlands during the proposed subsequent license renewal period. The proposed subsequent license renewal does not include additional construction or land-disturbing activities involving encroachment on wetlands.

SPS (Dominion Energy Virginia) maintains VPDES Permit No. VA0004090, reissued February 29, 2016, for both its process and industrial stormwater discharges and implements a stormwater pollution prevention plan (SWPPP) to eliminate or reduce pollutants in stormwater discharges, which could potentially affect wetlands (VDEQ 2016). Dominion Energy Virginia will seek construction stormwater permits as needed during the proposed subsequent license period.

SPS (Dominion Energy Virginia) was issued a U.S. Army Corps of Engineers (USACE) verification, for removal of debris on the existing intake structure, 2012-NWP #3 NAO-2008-01451/05-V2428, pursuant to the Corps nationwide permit (NWP) 3. This NWP was unconditionally certified by VDEQ for the CWA Section 401 Water Quality Certification program (USACE 2013). USACE reissued NWP 3 in 2017. VDEQ conditionally certified the re-issued NWP 3 (VDEQ 2017a). SPS (Dominion Energy Virginia) is still authorized to remove debris under the 2012-NWP #3 until a new authorization can be obtained before March 18, 2018.

The Tidal Wetlands Act of 1972 gave the Virginia Marine Resources Commission the responsibility for issuing tidal wetlands permits under Chapters 12 and 13 of Title 28.2 of the Code of Virginia. SPS (Dominion Energy Virginia) received permit VMRC #2016-0710 for maintenance dredging (VMRC 2016) under Title 28.2 Chapter 12 of the Virginia code. For this same maintenance dredging activity, SPS (Dominion Energy Virginia) also received authorization from the USACE on June 20, 2016, under the USACE Norfolk District Regional Permit 02 (13-RP-02) and special conditions in response to application NAO-2008-1451/VMRC#16-V0710. The regional permit expires on August 14, 2018 (USACE 2016). The VDEQ issued a 401 Certification for RP-02.

Dominion Energy Virginia will seek an industrial stormwater general permit for the use of a dredge materials management area (DMMA) being constructed approximately four miles from the SPS site to support future maintenance dredging of the SPS intake channel (Dominion 2017d).

Dominion Energy Virginia finds that SPS operations are in compliance with this VCP enforceable policy and will continue to have programs and permits in place to ensure compliance during the proposed subsequent license renewal term.

d. Dunes Management

Policy

Dune protection is carried out pursuant to the Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission (Virginia Code §28.2-1400 through §28.2-1420).

Finding

This policy covers dunes in the geographic area of the Eastern Shore, the Atlantic beaches south of the Chesapeake Bay entrance, and the shoreline of the Chesapeake Bay proper (VMRC 1993, page 9). The policy is not applicable to SPS's location and features.

e. Non-point Source Pollution Control

Policy

(1) Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by DEQ (Virginia Code §62.1-44.15:51 et seq.).

(2) Coastal Lands Management is a state-local cooperative program administered by DEQ's Water Division and 84 localities in Tidewater (see i) Virginia (Virginia Code §62.1-44.15:67 – 62.1-44.15:79 and Virginia Administrative Code 9 VAC 25-830-10 et seq.).

Finding

Dominion Energy Virginia's proposed action for continued operation of SPS Units 1 and 2 does not include modifications to structures or other soil disturbing activities during the subsequent license renewal period. However, should routine infrastructure, renovation, and maintenance projects involve ground disturbance, Dominion Energy Virginia maintains and implements a stormwater pollution prevention plan (SWPPP) and identifies best management practices (BMPs) that will be used to prevent or reduce the pollutants in stormwater discharges. Regarding non-point sources of pollution, SPS (Dominion Energy Virginia) holds VDEQ construction stormwater general permit VAR106343 for the spoils yard (VDEQ 2014). Stormwater is primarily controlled as point sources with the VPDES permit including five stormwater outfalls (VDEQ 2016). Dominion Energy Virginia has submitted a notice of intent for a construction stormwater permit for construction and use of the DMMA during the current license term and will obtain other permits as needed prior to construction, including a land disturbance permit from Surry County and a dam operations permit from the Virginia Department of Conservation and Recreation. The DMMA will be in use during the proposed subsequent license renewal period and Dominion Energy Virginia will obtain an industrial stormwater general permit prior to its use and maintain appropriate permitting through its operating life (Dominion 2017d).

For non-point source pollution control during the proposed subsequent license renewal period, Dominion Energy Virginia will seek a VDEQ construction stormwater permit and a Surry County land disturbing permit [the local erosion and sedimentation control (ESC) permit] (Surry County 2017) as needed.

Dominion Energy Virginia finds that SPS operations are in compliance with this VCP enforceable policy and will continue to have programs and permits in place to ensure compliance during the proposed subsequent license renewal term.

Coastal lands management is discussed below under item i.

f. Point Source Pollution Control

Policy

The point source program is administered by the State Water Control Board (DEQ) pursuant to Virginia Code §62.1-44.15. Point source pollution control is accomplished through the implementation of:

(1) The National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to Section 402 of the federal Clean Water Act and administered in Virginia as the Virginia Pollutant Discharge Elimination System (VPDES) permit program.

(2) The Virginia Water Protection Permit (VWPP) program administered by DEQ (Virginia Code §62.1-44.15:5) and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

Finding

As discussed above under a. fisheries management, SPS maintains VPDES Permit No. VA0004090, reissued February 29, 2016 for both its process and industrial stormwater discharges. This permit addresses compliance with CWA 316(a) and (b) requirements addressing water intake and thermal discharges. The permit also includes limits for pH, chlorine, and monitoring requirements for total suspended solids, and thallium for its external outfall for process water as well as additional limits and monitoring requirements for various internal outfalls. There are additional limits for bacteriological organisms and monitoring for nutrient constituents at the SPS internal outfall for the onsite sewage treatment plant. The permit also establishes monitoring requirements for the stormwater outfalls and requires the development and implementation of a SWPPP (VDEQ 2016).

Dominion Energy Virginia will also seek an industrial stormwater general permit for the DMMA (Dominion 2017d).

Compliance with current and future VPDES regulatory requirements and permit conditions and implementation of the SWPPP will ensure protection of waters receiving point source discharges from SPS operations.

Dominion Energy Virginia finds that SPS operations are in compliance with this VCP enforceable policy and will continue to have programs and permits in place to ensure compliance during the proposed subsequent license renewal term.

g. Shoreline Sanitation

Policy

The purpose of this program is to regulate the installation of septic tanks, set standards concerning soil types suitable for septic tanks, and specify minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth. This program is administered by the Department of Health (Virginia Code §32.1-164 through §32.1-165).

Finding

SPS does not have septic tanks. The SPS site utilizes an onsite wastewater treatment plant permitted by VDEQ (Certificate to Operate 23074) (VDEQ 2007) and aboveground hauling tanks and a permanent pump and haul permit by the Virginia Department of Health (VDH 1997).

h. Air Pollution Control

Policy

The program implements the federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board (Virginia Code §10.1-1300 through 10.1-1320).

Finding

SPS applicable air emissions sources are permitted under Title V of the Federal Clean Air Act by VDEQ issued permit PRO50336 (VDEQ 2010). Dominion Energy Virginia submitted a timely application for renewal of the Title V permit for SPS and GNCTS on November 14, 2014 (Dominion 2014). Dominion Energy Virginia submitted an update of the renewal permit application on April 9, 2015 (Dominion 2015a). The 2010 permit has been administratively extended beyond its expiration date of May 17, 2015 and the stations are operating under the permit shield. Air emissions supporting SPS operations are minimal and stem from intermittent use and testing of auxiliary boilers and diesel generators. Best management practices, including fugitive dust controls and the imposition of permit conditions in VDEQ air emissions permits, ensure conformance with applicable state implementation plans. Dominion Energy Virginia will ensure compliance with permit conditions.

Dominion Energy Virginia finds that SPS operations are in compliance with this VCP enforceable policy and will continue to have programs and permits in place to ensure compliance during the proposed subsequent license renewal term.

i. Coastal Lands Management

Policy

Coastal Lands Management is a state-local cooperative program administered by DEQ's Water Division and 84 localities in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act (Virginia Code §62.1-44.15:67 – 62.1-44.15:79) and Chesapeake Bay Preservation Area Designation and Management Regulations (Virginia Administrative Code 9 VAC 25-830-10 et seq.).

Finding

The Chesapeake Bay Preservation Act and Chesapeake Bay Preservation Area Designation and Management Regulations were designed to enhance water quality, focusing on nonpoint pollution, and still allow reasonable development to continue. The Acts are implemented through local governments and required Surry County and other Tidewater communities to map resource protection areas (shoreline and near shoreline areas) and resource management areas (adjacent areas that which if improperly used or developed have a potential for causing significant water quality degradation or diminishing the functional value of the resource protection area) (VDEQ 2017).

Surry County implemented the Chesapeake Bay Preservation related regulations primarily through Section 3.1400 of its zoning ordinance (Surry County 2013).

The proposed subsequent license renewal does not include additional construction outside of the SPS site. SPS may require additional space for spent fuel storage during the period of extended operations. For the potential construction of an additional concrete pad at the existing ISFSI, Dominion Energy Virginia would seek the required state and local permit for stormwater and erosion and sediment control. For any other land disturbing activities during the proposed subsequent license renewal period, Dominion Energy Virginia would obtain the appropriate permits and authorizations prior to conducting the activity, and operate in compliance with such permits and authorizations.

Dominion Energy Virginia finds that SPS operations are in compliance with this VCP enforceable policy and will continue to have programs and permits in place to ensure compliance during the proposed subsequent license renewal term.

CONSIDERATION OF ADVISORY POLICIES

Of VCP's three advisory policies for geographic areas of particular concern, only the first category, Coastal Natural Resource Areas, concerns areas applicable to SPS's geographic location. This advisory policy is addressed below. VCP's advisory policies for shorefront access planning and protection address geographic areas on Virginia's coastal shorefront that are not applicable to SPS's geographic location.

Coastal Natural Resource Areas

These areas are vital to estuarine and marine ecosystems and/or are of great importance to areas immediately inland of the shoreline. Such areas receive special attention from the Commonwealth because of their conservation, recreational, ecological, and aesthetic values. These areas are worthy of special consideration in any planning or resources management process and include the following resources: wetlands, aquatic spawning, nursery, and feeding grounds; coastal primary sand dunes; barrier islands; significant wildlife habitat areas; public recreation areas; sand and gravel resources; underwater historic sites.

Wetlands

See protection measures discussed in wetlands above.

Aquatic Spawning, Nursery, and Feeding Grounds

Spawning and nursery grounds are not located in the vicinity of SPS. However, the vicinity does provide feeding opportunities for aquatic and avian species. The benthic community of the James River in the vicinity of SPS was assessed in 2007 and was found to be generally of the highest ranking of "meets goals" or indicating un-degraded conditions with some discrete sampling locations ranked as degraded and a few severely degraded. Also, within the SPS vicinity are two fish management areas, both of which are on the eastern side of the peninsula. (VCP 2017) In addition, the HIWMA provides feeding grounds for waterfowl (VDGIF 2017). These feeding grounds will not be affected any differently by SPS during the renewal period.

Plankton is subject to entrainment in the SPS once-through cooling water system. Dominion Energy Virginia is conducting entrainment studies to determine if the current operational methods to minimize entrainment are sufficient to meet CWA Section 316(b) requirements. VDEQ will make the final determination of compliance and could require modifications of the intake structures and/or the cooling system. Any modifications would be designed to reduce entrainment and impingement impacts.

Significant Wildlife Habitat Areas

The Hog Island tract of the HIWMA is adjacent to the northern boundary of SPS at the tip of Gravel Neck Peninsula. The Carlisle and Stewart tracts of the HIWMA are southeast of SPS. All three tracts of the HIWMA are owned and maintained by the Virginia Department of Game and Inland Fisheries and support a rich variety of wildlife. The tidal flats and marshes provide habitat for large numbers and numerous species of migratory shore birds, wading birds, and waterfowl (VDGIF 2017). SPS operations have been conducted in harmony with the HIWMA for many years. Those operations will not change during the renewal period.

The other areas of special consideration, coastal primary sand dunes, barrier islands, public recreation areas, sand and gravel resources, and underwater historic sites are not applicable to SPS's geographic location and/or features.

State Notification

By this certification that the continued operation of SPS Units 1 and 2 during a subsequent license renewal period is consistent with the Virginia Coastal Zone Management Program, Virginia is notified that it has six months from the receipt of this letter and accompanying information in which to concur with or object to Dominion Energy Virginia's certification. Pursuant to 15 CFR Section 930.62(b), if Virginia has not issued a decision within three months following commencement of state agency review, it shall notify Dominion Energy Virginia and the federal agency (NRC) of the status of the matter and the basis for further delay. The state's concurrence, objection, or notification of review status shall be sent to:

Chief of Environmental Section
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
One White Flint
11555 Rockville Pike
Rockville, MD 20555-2738

Pamela. F. Faggert
Chief Environmental Officer and Senior Vice President Sustainability
Dominion Energy Services, Inc.
5000 Dominion Boulevard
Glen Allen, Virginia 23060

REFERENCES

Dominion. 2014. Application for Renewal of the Title V permit for SPS and Gravel Neck Station. November 14, 2014

Dominion. 2015. Update to Application for Renewal of the Title V permit for SPS and Gravel Neck Station. April 9, 2015.

Dominion. 2016. Dominion-Surry Power Station and Gravel Neck-VPDES Permit No. VA0004090 Response to October 4, 2016 Warning Letter. October 20, 2016.

Dominion 2017a. Internal information for Subsequent License Renewal Application (SLRA) Environmental Report (ER) Section 2.5.

Dominion 2017b. Internal information for SLRA ER Section 9.3-001.

Dominion 2017c. Internal information for consistency certification CZM-001.

Dominion 2017d. Internal information for consistency certification CZM-002.

NRC (Nuclear Regulatory Commission). 2002. Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 6 Regarding Surry Power Station, Units 1 and 2. Final Report. NUREG-1437, Supplement 6. November 2002.

NRC. 2003. Issuance of Renewed Facility Operating License Nos. NPF-4 and NPF-7 for North Anna Power Station, Units Nos 1 and 2, and Renewed Facility Operating License Nos. DPR-32 and DPR-37 for Surry Power Station Unit Nos. 1 and 2. March 20, 2003.

NRC. 2013. Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants. NUREG-1437, Vols. 1 and 3, Revision 1. June 2013.

NRC. 2017. Surry Power Station, Unit 1 and Surry Power Station Unit 2. Retrieved from https://www.nrc.gov/reactors/operating/list-power-reactor-units.html. Accessed April 25, 2017.

Surry County 2013. Zoning Ordinance. Retrieved from http://www.surrycountyva.gov/uploads/docs/Zoning%20Ordinance%20(eff%203-4-13)%20part%20I.pdf and http://www.surrycountyva.gov/uploads/docs/Zoning%20Ordinance%20(eff%203-4-13)%20part%20II.pdf. Accessed April 4, 2017.

Surry County 2017. Land Disturbance Permit Application. Retrieved from http://www.surrycountyva.gov/departments/planning-and-community-development/. Accessed April 3, 2017.

USACE (U.S. Army Corps of Engineers). 2013. Permit, 2012-NWP #3 NAO-2008-01451/05-V2428, for removal of debris on the existing intake structure

USACE. 2016. Permit NAO-2008-1451/VMRC#16-V0710 for Maintenance Dredging Within the Existing Intake Channel. June 20, 2016.

VCP (Virginia Coastal Zone Management Program) 2017. Virginia Coastal Geospatial and Educational Mapping System (GEMS). Retrieved from <http://www.deq.virginia.gov/Programs/CoastalZoneManagement/CoastalGEMSGeospatialData.aspx> (accessed June 13, 2017).

VDH (Virginia Department of Health). Permanent Pump and Haul Agreement and General Permit. September 18, 1997.

VDEQ (Virginia Department of Environmental Quality). 2007. Surry Power Station WWTP Certificate to Operate 23074. August 23, 2007.

VDEQ. 2010. Title V of the Federal Clean Air Act and Virginia Control and Abatement of Air Pollution Permit for Dominion – Gravel Neck/Surry Power Stations. May 17, 2010.

VDEQ. 2013a. Ground Water Withdrawal Permit, Surry Nuclear Power Station, Surry Co. DEQ Permit #GW0003901. October 18, 2013.

VDEQ. 2013b. VA0004090 VPDES Permit Fact Sheet, Surry Power Station and Gravel Neck. March 25, 2013.

VDEQ. 2014. Construction Stormwater General Permit for Spoils Yard, VAR106343. August 22, 2014.

VDEQ. 2016. Virginia Pollutant Discharge Elimination System (VPDES) Permit Number VA0004090, Surry Power Station and Gravel Neck Reissuance. February 29, 2016.

VDEQ 2017a. Section 401 Water Quality Certification of the 2017 Nationwide Permits. April 7, 2017.

VDEQ 2017b. Programs/Water/Wetlands & Streams/Regulations. Retrieved from http://www.deq.virginia.gov/Programs/Water/WetlandsStreams/Regulations. Accessed June 12, 2017.

VDEQ. 2017c. Chesapeake Bay Preservation Act. Retrieved from http://www.deq.virginia.gov/Programs/Water/ChesapeakeBay/ChesapeakeBayPreservationAct.aspx. Accessed April 4, 2017.

VDGIF (Virginia Department of Game and Inland Fisheries). 2017. Hog Island. Retrieved from https://www.dgif.virginia.gov/wma/hog-island/. Accessed April 26, 2017.

VMRC (Virginia Marine Resources Commission). 1993. Coastal Primary Sand Dune/Beaches Guidelines. Retrieved from http://www.mrc.virginia.gov/regulations/dune_guidelines.pdf. Accessed March 24, 2017.

VMRC. 2016. Commonwealth of Virginia Marine Resources Commission Permit issued to Virginia Power and Electric Company, VMRC #2016-0710. August 16, 2016.

Table E-1. Permits and Authorizations for Current SPS Operations

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
CILLRWC	Omnibus Low-Level Radioactive Waste Interstate Compact Consent Act (1980; amended in 1985)	Authorization to export waste	None	Updated annually	Export of LLRW outside the region.
NRC	Atomic Energy Act 10 CFR 50	SPS license to operate Unit 1	DPR-32	5/25/2032	Operation of SPS Unit 1.
NRC	Atomic Energy Act 10 CFR 50	SPS license to operate Unit 2	DPR-37	1/29/2033	Operation of SPS Unit 2.
NRC	10 CFR Part 72	ISFSI	Site-specific license SNM-2501 and NRC general license	July 31, 2046	Operation of a dry storage ISFSI.
USACE	Federal Clean Water Act, Section 404 (33 USC 1344)	Authorization to use Regional Permit 2 (§401 Certification (8/9/2013)	2013-RP-02 NAO-2008-1451/VMRC#16-0710	8/14/2018	Periodic maintenance dredging of the intake channel in the James River.
USACE	Federal Clean Water Act, Section 404 (33 USC 1344)	Authorization to use nationwide permit	2012-NWP #3 NAO-2008-01451/05-V2428	3/18/2018	Maintenance of intake structure debris removal.
USFWS	MBTA 50 CFR Part 13 50CFR 21.41	Depredation permit	MB705136-0	9/30/2016	Authorization for selective take of migratory birds.
VDEQ	CAA, 9 VAC 5-80-10, 9 VAC 5-80-50 through 9 VAC 5-80-300 and 9 VAC 5-140-10 through 9 VAC 5-140-900	Title V permit	Registration number: 50336	Operating under a permit shield	NSR and acid rain permit incorporated into Title V permit. Title V permit is the federal operating permit for various emission units at SPS including two oil-fired boilers, nine stationary diesel generators, two stationary propane generators, four stationary diesel water pumps, and four stationary diesel air

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
					compressors.
VDEQ	CWA, Section 402; 9 VAC 25-31 *et seq.;* 9VAC25-790	Permit	VA0004090	2/28/2021	Once-through cooling, process water, sewage treatment plant, and stormwater discharges.
VDEQ	9VAC25-260	Permit	GW0003901	11/1/2023	Groundwater withdrawal for use as potable, process, and cooling water.
VDEQ	CWA, Section 402; 9VAC25-880	Authorization to use construction stormwater general permit	VAR106343	6/30/2019	Land disturbance activity, spoils yard.
VDEQ	18VAC160-20	Authorization to operate a wastewater treatment plant	23074	N/A	Wastewater treatment plant operating permit.
VDEQ	CZMA. Section 307(c)(3)(A) and 15 CFR Part 930, subpart D	Consistency Certification	N/A	N/A	Effects on any land or water use or natural resource of the coastal zone are consistent with the enforceable policies of Virginia's coastal management program.
VDH	Section 3.14, Waterworks Regulations of the Virginia Department of Health	Waterworks operation permit	3181802	N/A	Authorization to operate a non-transient non-community waterworks.
VMRC	CoV Title 28.2, Chapters 12 and 13	Permit	VMRC16-0710	7/26/2021	Periodic maintenance dredging of the intake channel in the James River.
USDOT	40 CFR 107 Subpart G	Registration	531000020241	None	Hazardous materials shipments.

CFR: Code of Federal Regulations
CILLRWC: Central Interstate Low-Level Radioactive Waste Commission
NRC: U.S. Nuclear Regulatory Commission
USACE: U.S. Army Corps of Engineers
U.S. DOT: U.S. Department of Transportation
USFWS: U. S. Fish and Wildlife Service
VAC: Virginia Administrative Code
VDEQ: Virginia Department of Environmental Quality
VDH: Virginia Department of Health
VMRC: Virginia Marine Resources Commission

Table E-2. Category 1 Issues Applicable to SPS

Issue	NRC Finding from 10CFR51, Subpart A, Appendix B, Table B-1
Onsite land uses	SMALL. Changes in onsite land use from continued operations and refurbishment associated with license renewal would be a small fraction of the nuclear power plant site and would involve only land that is controlled by the licensee.
Offsite land uses	SMALL. Offsite land use would not be affected by continued operations and refurbishment associated with license renewal.
Aesthetic impacts	SMALL. No important changes to the visual appearance of plant structures or transmission lines are expected from continued operations and refurbishment associated with license renewal.
Air quality impacts (all plants)	SMALL. Air quality impacts from continued operations and refurbishment associated with license renewal are expected to be small at all plants. Emissions resulting from refurbishment activities at locations in or near air quality nonattainment or maintenance areas would be short-lived and would cease after these refurbishment activities are completed. Operating experience has shown that the scale of refurbishment activities has not resulted in exceedance of the *de minimis* thresholds for criteria pollutants, and best management practices including fugitive dust controls and the imposition of permit conditions in State and local air emissions permits would ensure conformance with applicable State or Tribal Implementation Plans. Emissions from emergency diesel generators and fire pumps and routine operations of boilers used for space heating would not be a concern, even for plants located in or adjacent to nonattainment areas. Impacts from cooling tower particulate emissions even under the worst-case situations have been small.
Air quality effects of transmission lines	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.
Noise impacts	SMALL. Noise levels would remain below regulatory guidelines for offsite receptors during continued operations and refurbishment associated with license renewal.
Geology and soils	SMALL. The effect of geologic and soil conditions on plant operations and the impact of continued operations and refurbishment activities on geology and soils would be small for all nuclear power plants and would not change appreciably during the license renewal term.
Surface water use and quality (non-cooling system impacts)	SMALL. Impacts are expected to be small if best management practices are employed to control soil erosion and spills. Surface water use associated with continued operations and refurbishment associated with license renewal would not increase significantly or would be reduced if refurbishment occurs during a plant outage.
Altered current patterns at intake and discharge structures	SMALL. Altered current patterns would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been small at operating nuclear power plants.
Altered salinity gradients	SMALL. Effects on salinity gradients would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been small at operating nuclear power plants.
Scouring caused by discharged cooling water	SMALL. Scouring effects would be limited to the area in the vicinity of the intake and discharge structures. These impacts have been small at operating nuclear power plants.
Discharge of metals	SMALL. Discharges of metals have not been found to be a problem at

Issue	NRC Finding from 10CFR51, Subpart A, Appendix B, Table B-1
in cooling system effluent	operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. Discharges are monitored and controlled as part of the National Pollutant Discharge Elimination System (NPDES) permit process.
Discharge of biocides, sanitary wastes, and minor chemical spills	SMALL. The effects of these discharges are regulated by Federal and State environmental agencies. Discharges are monitored and controlled as part of the NPDES permit process. These impacts have been small at operating nuclear power plants.
Surface water use conflicts (plants with once-through cooling systems)	SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.
Effects of dredging on surface water quality	SMALL. Dredging to remove accumulated sediments in the vicinity of intake and discharge structures and to maintain barge shipping has not been found to be a problem for surface water quality. Dredging is performed under permit from the U.S. Army Corps of Engineers, and possibly, from other State or local agencies.
Temperature effects on sediment transport capacity	SMALL. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem.
Groundwater contamination and use (non-cooling system impacts)	SMALL. Extensive dewatering is not anticipated from continued operations and refurbishment associated with license renewal. Industrial practices involving the use of solvents, hydrocarbons, heavy metals, or other chemicals, and/or the use of wastewater ponds or lagoons have the potential to contaminate site groundwater, soil, and subsoil. Contamination is subject to State or Environmental Protection Agency regulated cleanup and monitoring programs. The application of best management practices for handling any materials produced or used during these activities would reduce impacts.
Groundwater quality degradation resulting from water withdrawals	SMALL. Groundwater withdrawals at operating nuclear power plants would not contribute significantly to groundwater quality degradation.
Exposure of terrestrial organisms to radionuclides	SMALL. Doses to terrestrial organisms from continued operations and refurbishment associated with license renewal are expected to be well below exposure guidelines developed to protect these organisms.
Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	SMALL. No adverse effects to terrestrial plants or animals have been reported as a result of increased water temperatures, fogging, humidity, or reduced habitat quality. Due to the low concentrations of contaminants in cooling system effluents, uptake and accumulation of contaminants in the tissues of wildlife exposed to the contaminated water or aquatic food sources are not expected to be significant issues.
Bird collisions with plant structures and transmission lines	SMALL. Bird collisions with cooling towers and other plant structures and transmission lines occur at rates that are unlikely to affect local or migratory populations and the rates are not expected to change.
Transmission line right-of-way (ROW) management impacts on terrestrial resources	SMALL. Continued ROW management during the license renewal term is expected to keep terrestrial communities in their current condition. Application of best management practices would reduce the potential for impacts.

Issue	NRC Finding from 10CFR51, Subpart A, Appendix B, Table B-1
Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	SMALL. No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.
Entrainment of phytoplankton and zooplankton (all plants)	SMALL. Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Infrequently reported thermal impacts (all plants)	SMALL. Continued operations during the license renewal term are expected to have small thermal impacts with respect to the following: Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem. Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem. Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms. Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem. Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem.
Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	SMALL. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been mitigated. Low dissolved oxygen was a concern at one nuclear power plant with a once-through cooling system but has been mitigated. Eutrophication (nutrient loading) and resulting effects on chemical and biological oxygen demands have not been found to be a problem at operating nuclear power plants.
Effects of non-radiological contaminants on aquatic organisms	SMALL. Best management practices and discharge limitations of NPDES permits are expected to minimize the potential for impacts to aquatic resources during continued operations and refurbishment associated with license renewal. Accumulation of metal contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal.
Exposure of aquatic organisms to radionuclides	SMALL. Doses to aquatic organisms are expected to be well below exposure guidelines developed to protect these aquatic organisms.
Effects of dredging on aquatic organisms	SMALL. Dredging at nuclear power plants is expected to occur infrequently, would be of relatively short duration, and would affect relatively small areas. Dredging is performed under permit from the U.S. Army Corps of Engineers, and possibly, from other State or local agencies.
Effects on aquatic resources (non-	SMALL. Licensee application of appropriate mitigation measures is expected to result in no more than small changes to aquatic communities from their

Issue	NRC Finding from 10CFR51, Subpart A, Appendix B, Table B-1
cooling system impacts)	current condition.
Impacts of transmission line right-of-way (ROW) management on aquatic resources	SMALL. Licensee application of best management practices to ROW maintenance is expected to result in no more than small impacts to aquatic resources.
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	SMALL. These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Employment and income, recreation and tourism	SMALL. Although most nuclear plants have large numbers of employees with higher than average wages and salaries, employment, income, recreation, and tourism impacts from continued operations and refurbishment associated with license renewal are expected to be small.
Tax revenues	SMALL. Nuclear plants provide tax revenue to local jurisdictions in the form of property tax payments, payments in lieu of tax (PILOT), or tax payments on energy production. The amount of tax revenue paid during the license renewal term as a result of continued operations and refurbishment associated with license renewal is not expected to change.
Community services and education	SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to local community and educational services would be small. With little or no change in employment at the licensee's plant, value of the power plant, payments on energy production, and PILOT payments expected during the license renewal term, community and educational services would not be affected by continued power plant operations.
Population and housing	SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to regional population and housing availability and value would be small. With little or no change in employment at the licensee's plant expected during the license renewal term, population and housing availability and values would not be affected by continued power plant operations.
Transportation	SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to traffic volumes would be small.
Radiation exposures to the public	SMALL. Radiation doses to the public from continued operations and refurbishment associated with license renewal are expected to continue at current levels, and would be well below regulatory limits.
Radiation exposures to plant workers	SMALL. Occupational doses from continued operations and refurbishment associated with license renewal are expected to be within the range of doses experienced during the current license term, and would continue to be well below regulatory limits.
Human health impact from chemicals	SMALL. Chemical hazards to plant workers resulting from continued operations and refurbishment associated with license renewal are expected to be minimized by the licensee implementing good industrial hygiene practices as required by permits and Federal and State regulations. Chemical releases to the environment and the potential for impacts to the public are expected to be minimized by adherence to discharge limitations of NPDES and other

Issue	NRC Finding from 10CFR51, Subpart A, Appendix B, Table B-1
	permits.
Microbiological hazards to plant workers	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures as required by permits and Federal and State regulations.
Physical occupational hazards	SMALL. Occupational safety and health hazards are generic to all types of electrical generating stations, including nuclear power plants, and are of small significance if the workers adhere to safety standards and use protective equipment as required by Federal and State regulations.
Design-basis accidents	SMALL. The NRC staff has concluded that the environmental impacts of design-basis accidents are of small significance for all plants.
Low-level waste storage and disposal	SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment would remain small during the license renewal term.
Onsite storage of spent nuclear fuel	During the license renewal term, SMALL. The expected increase in the volume of spent nuclear fuel from an additional 20 years of operation can be safely accommodated onsite during the license renewal term with small environmental impacts through dry or pool storage at all plants. For the period after the licensed life for reactor operations, the impacts of onsite storage of spent nuclear fuel during the continued storage period are discussed in NUREG–2157 and as stated in § 51.23(b), shall be deemed incorporated into this issue.
Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	For the high-level waste and spent-fuel disposal component of the fuel cycle, the EPA established a dose limit of 0.15 mSv (15 millirem) per year for the first 10,000 years and 1.0 mSv (100 millirem) per year between 10,000 years and 1 million years for offsite releases of radionuclides at the proposed repository at Yucca Mountain, Nevada. The Commission concludes that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high level waste disposal, this issue is considered Category 1.
Mixed-waste storage and disposal	SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal would not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small.
Nonradioactive waste storage and disposal	SMALL. No changes to systems that generate nonradioactive waste are anticipated during the license renewal term. Facilities and procedures are in place to ensure continued proper handling, storage, and disposal, as well as negligible exposure to toxic materials for the public and the environment at all plants.
Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste	SMALL. The impacts to the public from radiological exposures have been considered by the Commission in Table S–3 of this part. Based on information in the GEIS, impacts to individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99, would remain at or below the NRC's regulatory limits.

Issue	NRC Finding from 10CFR51, Subpart A, Appendix B, Table B-1
Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste	There are no regulatory limits applicable to collective doses to the general public from fuel-cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The Commission concludes that the collective impacts are acceptable. The Commission concludes that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective impacts of the uranium fuel cycle, this issue is considered Category 1.
Non-radiological impacts of the uranium fuel cycle	SMALL. The non-radiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant would be small.
Transportation	SMALL. The impacts of transporting materials to and from uranium-fuel-cycle facilities on workers, the public, and the environment are expected to be small.
Termination of plant operations and decommissioning	SMALL. License renewal is expected to have a negligible effect on the impacts of terminating operations and decommissioning on all resources.

Table E-3. Impacts of Proposed SPS Subsequent License Renewal by Category 2 Environmental Issue

Resource Issue	ER Section	Environmental Impact
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.1	No impact. Issue is not applicable because SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute [gpm]) [10 CFR 51.53(c)(3)(ii)(C)]	4.5.3	SMALL impact. SPS and GNCTS are permitted to withdraw a total of 154.7 mgy with a monthly maximum of about 15.89 mg (367.8 gpm) of groundwater for domestic, process, and cooling water. SPS and GNCTS currently withdraw 80 percent of the permitted monthly amount. Groundwater use is not expected to increase above permitted levels during the subsequent license renewal period.
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.2	No impact. Issue is not applicable because SPS utilizes a once-through cooling system with cooling water supplied by the James River.
Groundwater quality degradation (plants with cooling ponds at inland sites) [10 CFR 51.53(c)(3)(ii)(D)]	4.5.4	No impact. Issue is not applicable because SPS uses a once through cooling system and does not utilize cooling ponds.
Radionuclides released to groundwater [10 CFR 51.53(c)(3)(ii)(P)]	4.5.5	SMALL impact. Tritium has been measured in the groundwater monitoring wells at SPS, but no plant-related gamma isotopes or hard-to-detect radionuclides have been detected since the groundwater program was initiated in 2006.
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts) [10 CFR 51.53(c)(3)(ii)(E)]	4.6.5	SMALL impact. No refurbishment or other license renewal-related construction activities have been identified; adequate management programs and regulatory controls in place to protect onsite important terrestrial ecosystems.
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.4	No impact. Issue is not applicable because SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	4.6.1	SMALL impact. Based on past and current impingement studies, no impacts have been identified. VADEQ issued an interim BTA determination (2016) while SPS is completing the

Resource Issue	ER Section	Environmental Impact
[10 CFR 51.53(c)(3)(ii)(B)]		studies required by CWA Section 316(b).
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.2	SMALL impact. VDEQ considers the permit's thermal limitations adequate to assure the protection and propagation of a balanced indigenous community of shellfish, fish, and wildlife in the James River. This rational is based on the results of the 316(a) thermal demonstration submitted in 1977. 2016 permit effluent limitations remain adequate. 9 VAC 25-260-90 of the Virginia Water Quality Standards state that a satisfactory showing made in conformance with 316(a) are in compliance with the general standard and with the temperature requirements of the standards (Dominion 2016). VDEQ has approved the continuation of the 316(a) variance (2016). Because there are no planned operational changes during the license renewal term that would increase the temperature of SPS's existing thermal discharge, impacts are anticipated to be SMALL and mitigation measures are not warranted.
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.3	No impact. Issue is not applicable because SPS utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat [10 CFR 51.53(c)(3)(ii)(E)]	4.6.6	No effect. No refurbishment or other license renewal-related construction activities have been identified. The continued operation of the site would have no adverse effects on any federally or state-listed species. Subsequent license renewal would have no effect on threatened, endangered, and protected species in the vicinity of SPS.
Historic and Cultural Resources		
Historic and cultural resources [10 CFR 51.53(c)(3)(ii)(K)]	4.7	No adverse effects on historic properties. No refurbishment or other license renewal-related construction activities have been identified; administrative procedure ensures protection of these types of resources in the event of excavation activities.
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river) [10 CFR 51.53(c)(3)(ii)(G)]	4.9.1	SMALL impact. The size of the river, the saline and tidal influence of the estuary, the documented reduction in water temperatures surrounding the effluent discharge point, and regulatory restrictions placed on public access to the waters adjacent to the discharge structures,

Resource Issue	ER Section	Environmental Impact
		reduces the human health impact from microbiologic hazards.
Electric shock hazards [10 CFR 51.53(c)(3)(ii)(H)]	4.9.2	SMALL impact. The NRC determined electric shock potential for the transmission lines distributing Units 1 and 2 generation to the grid was small and did not warrant mitigation measures (NRC 2002, Section 4.2.1, page 4-20). All in-scope transmission lines are located completely within SPS exclusion area property and are National Electric Safety Code compliant.
Postulated Accidents		
Severe accidents [10 CFR 51.53(c)(3)(ii)(L)]	4.15.1	SMALL impact. No new cost-beneficial SAMAs have been identified as a result of Dominion's new and significant analysis, in accordance with drafted NEI 17-04.
Environmental Justice		
Minority and low-income populations [10 CFR 51.53(c)(3)(ii)(N)]	4.10.1	No disproportionately high and adverse impacts or effects on minority and low-income populations identified.
Cumulative Impacts		
Cumulative Impacts [10 CFR 51.53(c)(3)(ii)(O)]	4.12	SMALL to no cumulative impacts are expected for the continued operation of SPS. SMALL for air quality and noise, geology and soils, socioeconomics, human health, and waste management, surface water and groundwater resources, aquatic and terrestrial resources due to climate change; and no effect on historic and cultural resources.

Figure E-1. SPS 50-Mile Region

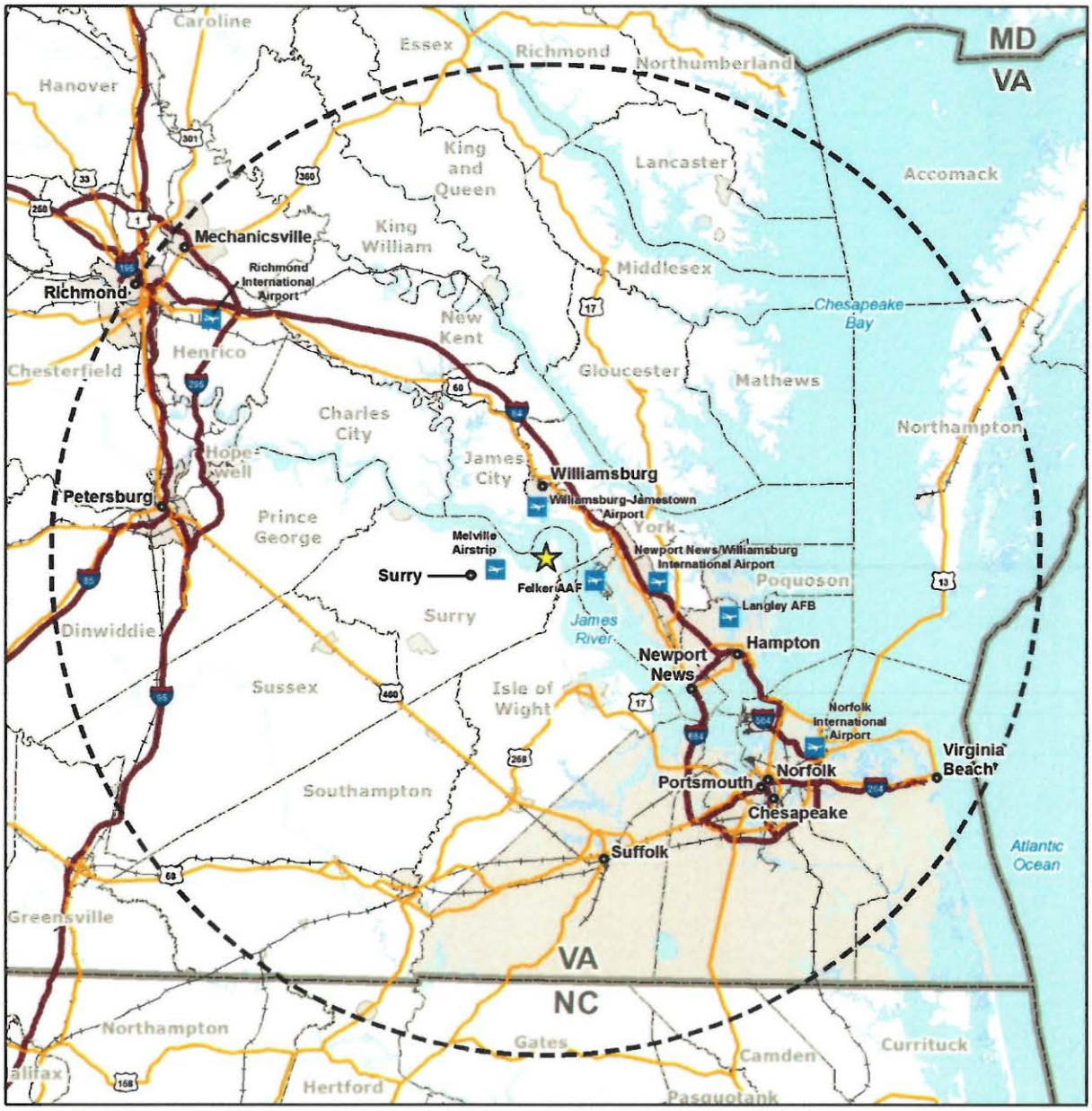


Figure E-2. SPS 6-Mile Vicinity

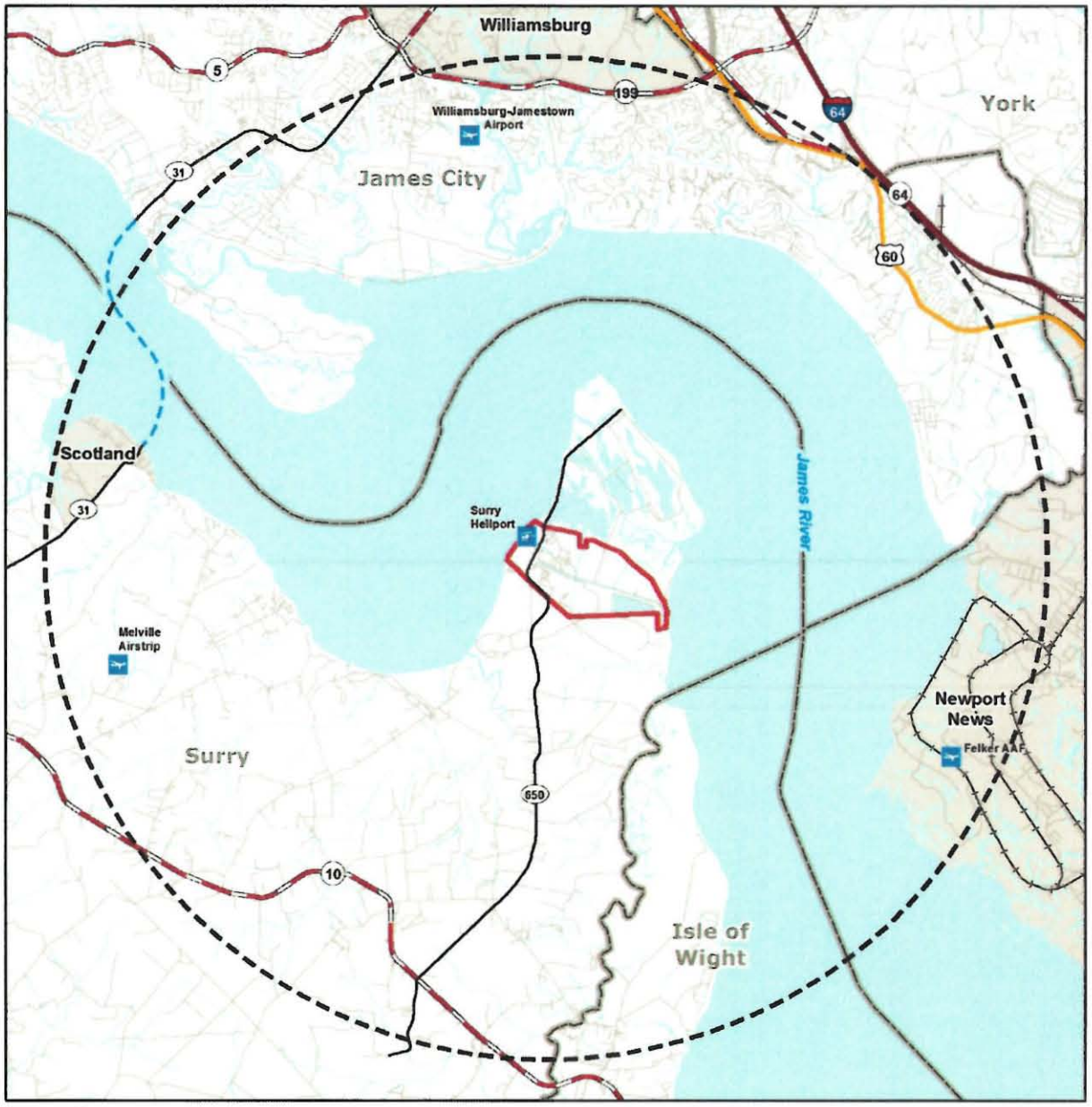


Figure E-3. SPS Site Topography

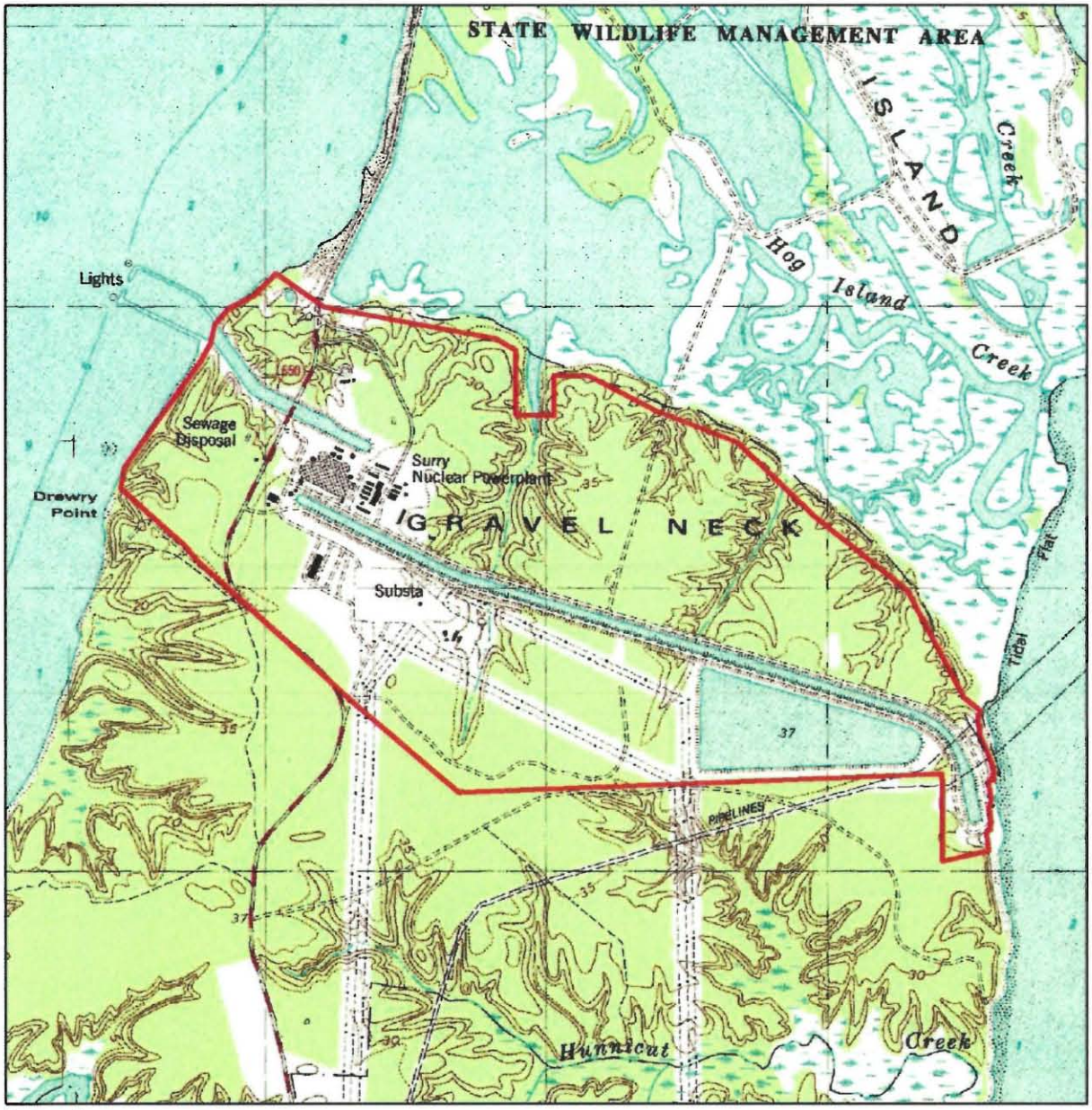
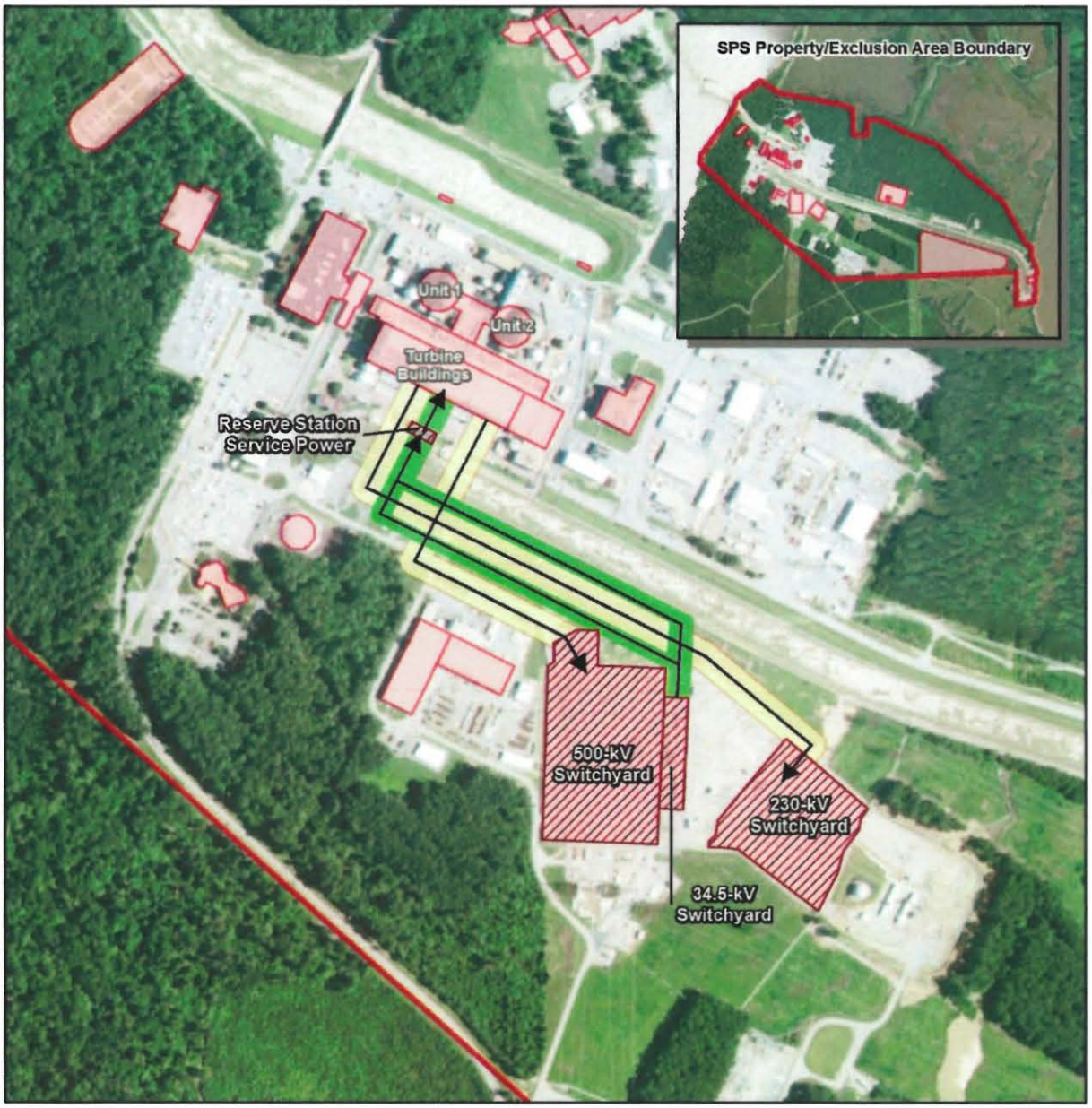


Figure E-4. SPS Site Layout and In-Scope Transmission Lines



Legend

- Electrical Current Flow
- Switchyard/Reserve Station Service
- Surry Building/Structure
- Transmission Lines from Units 1 & 2
- Distribution Lines to Units 1 & 2
- Property Boundary/Exclusion Area Boundary

0 300 600 Feet