DRAFT STATEMENT OF FINDINGS FOR EXECUTIVE ORDER 11990, "PROTECTION OF WETLANDS" AND EXECUTIVE ORDER 11988, "FLOODPLAIN MANAGEMENT"

SUSQUEHANNA TO ROSELAND 500KV TRANSMISSION LINE RIGHT-OF-WAY AND SPECIAL USE PERMIT ENVIRONMENTAL IMPACT STATEMENT

APPALACHIAN NATIONAL SCENIC TRAIL DELAWARE WATER GAP NATIONAL RECREATION AREA MIDDLE DELAWARE NATIONAL SCENIC AND RECREATIONAL RIVER

PENNSYLVANIA AND NEW JERSEY

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ATTACHMENTS

TABLES

ACRONYMS AND ABBREVIATIONS

APPA	Appalachian National Scenic Trail
B-K Line	Bushkill to Kittatinny Line
BMP	Best Management Practice
DEWA	Delaware Water Gap National Recreation Area
DBH	Diameter at Breast Height
DO	Dissolved Oxygen
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
kV	Kilovolt
MDSR	Middle Delaware National Scenic and Recreational River
NE	New England
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NPS	National Park Service
NWI	National Wetlands Inventory
PEM	Palustrine Emergent Wetlands
PEMB	Saturated Palustrine Emergent Wetlands
PEMY	Palustrine Emergent Saturated/Semi-permanent/Seasonal Wetland
PFO	Palustrine Forested Wetlands
PFO4/1E	Palustrine, Forested, Needle-Leaved Evergreen/Broad-Leaved Deciduous Seasonally Flooded/Saturated Wetland
PJM	PJM Interconnection
PPL	Pennsylvania Power and Light Electric Utilities Corporation
PSE&G	Public Service Electric and Gas Company
PSS	Palustrine Scrub Shrub Wetlands
PSS1E	Palustrine, Scrub Shrub, Broad- Leaved Deciduous, Seasonally Flooded/Saturated Wetland
ROW	Right-of-Way
RT&E	Rare, Threatened, or Endangered
SOF	Statement of Findings
S-R Line	Transmission Line Upgrade and Expansion from Susquehanna, Pennsylvania, to Roseland, New Jersey
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WUS	Waters of the United States

1.0 INTRODUCTION

This Wetlands and Floodplains Statement of Findings (SOF) describes the alternatives that were evaluated in the EIS, characterizes the wetland and floodplain resources that may be adversely impacted within National Park Service managed lands as a result of implementing the preferred alternative, describes adverse impacts that the project would likely have on these resources, and documents the steps that would be taken to avoid, minimize, and offset these impacts. All figures discussed in this document are included in attachment a.

1.1 WETLANDS

Executive Order 11990, "Protection of Wetlands", issued 24 May 1977, directs all federal agencies to avoid to the maximum extent possible the long- and short-term adverse impacts associated with the occupancy, destruction, or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. In the absence of such alternatives, parks must modify actions to preserve and enhance wetland values and minimize degradation.

To comply with Executive Order 11990 within the context of the agency's mission, the National Park Service (NPS) has developed a set of policies and procedures found in Director's Order 77-1: *Wetland Protection* (NPS 2012a) and *Procedural Manual #77-1: Wetland Protection* (NPS 2012a). These policies and procedures emphasize: 1) exploring all practical alternatives to building on, or otherwise adversely affecting, wetlands; 2) reducing impacts to wetlands whenever possible; and 3) providing direct compensation for any unavoidable wetland impacts by restoring degraded or destroyed wetlands on other NPS properties. If a preferred alternative would have adverse impacts on wetlands, a Statement of Findings (SOF) must be prepared that documents the above steps and presents the rationale for choosing an alternative that would have adverse impacts on wetlands. This SOF includes wetlands within park boundaries that would be affected by the proposed project.

1.2 FLOODPLAINS

Pursuant to Executive Order 11988, "Floodplain Management", and the NPS *Procedural Manual 77-2: Floodplain Management* (NPS 2002), the NPS has evaluated flooding hazards related to the proposed project. This SOF describes the preferred alternative, project site, floodplain determination, use of floodplain, investigation of alternatives, flood risks, and mitigation for the continued use of facilities within the floodplain.

2.0 ALTERNATIVES

A consortium of utilities, consisting of PPL Electric Utilities Corporation (PPL) and Public Service Electric and Gas Company (PSE&G), jointly known as the applicant, propose to construct a 500,000-volt (500-kilovolt [kV]) transmission line from the Susquehanna Substation (Berwick, Pennsylvania) to the Roseland Substation (Roseland, New Jersey) (the S-R Line), which would require crossing of Delaware Water Gap National Recreation Area (DEWA), Middle Delaware National Scenic and Recreational River (MDSR), and Appalachian National Scenic Trail (APPA) in Pennsylvania and New Jersey (figure 1). The purpose of the proposed action is to respond to the applicant's expressed request to construct a double-500kV power line across three units of the national park system, in light of the purposes and resources of the affected units of the national park system, as expressed in statutes, regulations, and policies.

The applicant's purpose for the proposed S-R Line is to strengthen the reliability of the grid at the direction of the regional transmission operator, PJM. PJM oversees the overall movement of wholesale electricity between many electric utilities in all or parts of 13 states and the District of Columbia. The

PJM 2007 load forecast model identified 23 projected grid reliability criteria violations starting in 2012. PJM advised that an upgrade to this line would aid in resolving several violations and issues related to reliability and congestion. The need for the proposed S-R Line has been expressed several times by PJM in planning documents. PJM's Regional Transmission Expansion Plans from 2007 to 2010 have identified the proposed S-R Line as an important project on what was termed by PJM as a "backbone" line. The North American Electric Reliability Corporation also identified the proposed S-R Line as a "backbone," while the applicant has repeatedly noted the need for and importance of increased electrical transmission capacity between Berwick, Pennsylvania and Roseland, New Jersey. If constructed, the new S-R Line would make the current transmission line corridor an even more important link in the regional grid than it is now. The two new lines proposed would require a much higher level of access roads and activity to monitor and maintain.

2.1 ALTERNATIVE 1 (NO ACTION)

The existing B-K Line traverses approximately 4.3 miles of DEWA. There are 22 transmission towers located within DEWA boundaries for the existing B-K Line, and there are no existing access roads to the ROW within the parks, except public roads open to general circulation. This alternative assumes that the existing line within the parks would remain in place without expansion or replacement. In essence, it assumes that current conditions on the ground would continue indefinitely into the future.

Subject to the foregoing qualification, however, the no-action alternative assumes the following:

- No additional ROW would be granted to the applicant.
- No additional transmission lines or increased voltage would be added.
- No new construction activity would take place; therefore, activities would only include operation and maintenance of the existing line.
- The existing towers would remain in place.

This action would have no effect on the existing transmission line outside NPS property. Though future construction could potentially occur within the existing ROW, for the purposes of the analysis, this alternative assumes that current conditions continue into the future and that no further construction occurs beyond the existing transmission line.

2.2 ALTERNATIVE 2 (NPS PREFERRED ALTERNATIVE)

Alternative 2, the applicant's proposed alternative, has been identified as the NPS preferred alternative. The preferred alternative 2 would include the replacement of the existing 230-kV transmission line that runs from Bushkill to Kittatinny (the B-K Line) with a new line, initially energized at 230 kV but built to carry 500 kV, co-located with a new double-circuit 500-kV line connecting the Susquehanna and Roseland substations (PPL and PSE&G 2008). Alternative 2 would follow the B-K Line corridor as it traverses approximately 4.3 miles of DEWA. The old B-K Line structures would be removed and replaced with the new 500kv structures. Within DEWA boundaries, the route also crosses MDSR and APPA (figure 2). In order to accommodate the S-R Line, the existing ROW would be widened and would require clearing of vegetation (both upland and wetland vegetation) for an additional 50 to 200 feet under alternative 2.

Alternative 2 would require removal of existing structures in the B-K Line ROW between the Bushkill Substation and the eastern boundary of DEWA. Foundations would remain in place below ground level to avoid additional ground disturbance. Above ground level, foundations would be mechanically chipped

and removed and the area would be backfilled, allowing the applicant to revegetate the area. These actions would be required for all action alternatives.

All preferred alternative access roads through wetlands (including two stream crossings) are identified in figures 3 and 4 and their impacts to wetlands are evaluated in this document. Alternative 2 would require new, permanent access roads that would affect some wetland and floodplain areas. There are no existing access roads within the park. The proposed permanent access roads would be located on old trails and overgrown roadbeds where possible. Generally, access roads would fall within the transmission line ROW, but in some instances, it would be necessary for access roads to extend outside the ROW. A total of 5.3 miles of access roads would be constructed, with 1.9 miles occurring outside the ROW. The access roads would be built within a 20-foot-wide limit of construction, to accommodate large construction vehicles. There would be no disturbance or activity outside of the boundaries of the 20-foot-wide limits. Following construction, the access roads would be narrowed to 15 feet wide. Any disturbed area outside the edges of the 15-foot-wide road base footprint would be restored and replanted. These approved roads would be maintained to be clear of vegetation and would be used to gain access to the ROW for maintenance of the transmission lines and for vegetation management.

There is one stream (riverine wetland) crossing on an existing road within the park (Van Campen Brook), but there are no plans to widen the bridge and there are no associated wetlands beyond the stream channel. If it is determined that the bridge needs to be widened and/or improved, construction would be done with no impacts to the riverine wetlands through construction of a bridge or other structure that would completely span the channel (i.e., no pilings, fill, or other support structures within the ordinary high water mark of the stream or in any adjacent wetlands). New spur roads may be required for pulling and splicing sites along the ROW but would not be placed in any wetland or floodplain areas. With the exception of permanent access roads, no equipment would be driven through wetland areas under alternative 2.

2.3 ALTERNATIVE 2B

The alignment for the applicant's alternate proposal, alternative 2b, would follow the same route as described for alternative 2 (figure 2). The difference between alternative 2 and alternative 2b is that the former would require widening the existing ROW, while the latter would be constructed within the existing ROW. The towers for alternative 2b would be the same height as those described for alternative 2, but alternative 2b would require two additional towers within NPS lands. These towers would be constructed within the existing 100-foot-wide portion of the alignment. In order for 2b to be a practicable alternative, the applicant would have to be given the right to clear danger trees on NPS property outside any deeded ROW (PPL 2010a). It is assumed that larger individual trees outside the ROW, in wetlands or uplands, would be removed periodically.

Access roads for alternative 2b are the same as those described for alternative 2. Alternative 2b would require a total of 5.3 miles of access roads, of which 2.6 miles would occur outside the ROW. Roads would be used and maintained as described for alternative 2. The applicant would need additional access roads beyond the ROW for construction. Locations of these roads outside the ROW would require NPS approval. With the exception of permanent access roads, no equipment would be driven through wetland areas under alternative 2b.

2.4 ALTERNATIVE 3

The alternative 3 alignment would pass through DEWA along the ROW of existing transmission and distribution lines (figure 2). The existing transmission and distribution lines would be removed prior to construction of the S-R Line. The existing transmission line ROW is 100 feet wide, and this alternative

would require clearing of vegetation for an additional 50 to 200 feet of ROW. The structures of the transmission and distribution lines would be constructed so that these lines and the S-R Line would run parallel to one another within the expanded ROW. That is, two separate sets of structures would be constructed, one set for the proposed S-R Line and one set for the existing transmission and distribution lines along the alternative 3 alignment. Alternative 3 would cross a total of 5.4 miles within the DEWA boundary. The route would cross approximately 1.7 miles of the northern end of Worthington State Forest, which is located outside DEWA's boundaries. The alignment for this alternative also crosses MDSR within DEWA, and APPA within Worthington State Forest.

Alternative 3 would require new permanent access roads and temporary spur roads. Generally, access roads would fall within the transmission line ROW, but in some instances, it would be necessary for access roads to extend outside the ROW. Alternative 3 would require approximately 3.5 miles of access roads, of which 0.9 mile would occur outside the ROW. Permanent access roads would be used and maintained as described for alternative 2. Temporary spur roads would not be located in wetland or floodplain areas.

Alternative 3 would include the removal of the B-K Line as a mitigation measure required by the NPS. If this alternative were chosen, the NPS would be granting construction and ROW permits to the applicant. Because the NPS would not allow two crossings for the applicant's transmission lines, the NPS would require that the applicant surrender the rights to the existing ROW between the Bushkill Substation and the eastern boundary of DEWA. The NPS would permit the relocation of the B-K Line to a replacement setting co-located with the S-R Line within areas under NPS jurisdiction. After removal of the B-K Line infrastructure, above-ground portions of the foundations would be mechanically chipped and removed and the area would be backfilled, allowing the applicant to revegetate the area.

2.5 ALTERNATIVE 4

Alternative 4 would have a north–south orientation and would cross approximately 1.5 miles of NPS lands (figure 2) along an existing ROW. The alternative would travel along the southwestern boundary of DEWA, crossing APPA, and would include a secondary crossing of NPS lands west of the Bushkill substation along the B-K Line. Outside the study area, alternative 4 would also cross through portions of Cherry Valley National Wildlife Refuge and the Lower Delaware River.

The existing ROW ranges from 100 to 200 feet wide and alternative 4 would require permanent clearing of vegetation for an additional 100 to 200 feet of ROW width (beyond the existing ROW). Alternative 4 would require a total of approximately 2.5 miles of access roads, with approximately 1.6 miles within NPS boundaries. Alternative 4 would use 0.9 mile of existing roads as access roads and would therefore require construction of 1.6 miles of new access roads, of which 0.5 mile would occur outside the ROW. Roads would be created, used, and maintained as described for alternative 2. The access roads for alternative 4 would not enter Cherry Valley National Wildlife Refuge. The applicant would need additional access roads outside the transmission line ROW.

For alternative 4, the structures of the distribution line that currently exist on this route would be replaced so that this line and the double-circuited S-R Line would run parallel to one another within the expanded ROW. The existing structures would be removed to allow the applicant to safely site and construct new lines in the expanded ROW. Existing lines removed prior to construction would be replaced with new lines during construction of the proposed S-R Line. Replacement power lines would be placed on new structures separate from but parallel to the new structures for the S-R Line within the expanded ROW along the alternative alignments.

Under alternative 4, the removal of the B-K Line would be required as mitigation. The removal of the B-K Line is described for alternative 3 and would be the same for alternative 4.

2.6 ALTERNATIVE 5

Alternative 5 would follow a similar alignment as alternative 4 (described above); however, beyond the study area, alternatives 4 and 5 would split. Thus, under alternative 4, the applicant would have the option of a secondary crossing of NPS land west of Bushkill, while under alternative 5 it would not. This is the only difference between 4 and 5 over which the NPS exercises any discretion or control. Alternative 5 would require construction of approximately 0.9 mile of new access roads, of which 0.16 mile would occur outside the ROW.

3.0 PROJECT SITE

The preferred alternative, alternative 2, crosses three units of the national park system in Pennsylvania and New Jersey: DEWA, MDSR, and APPA (figure 2). DEWA is a 67,210-acre park along the shores of the Delaware River in New Jersey and Pennsylvania that offers a variety of outdoor recreational opportunities. The diverse ecosystems and landscape features provide unique scenery and experiences for visitors and crucial habitat for plants and animals. The most popular geologic feature is the Delaware Water Gap, which is approximately 1,200 feet deep from the tops of the mountains to the surface of the Delaware River. The Gap is a mile wide from New Jersey's Mount Tammany to Pennsylvania's Mount Minsi. MDSR, which occurs completely within DEWA, cuts through the Gap. MDSR comprises 40 miles of the Delaware River, the longest undammed river in the eastern United States and one of the cleanest rivers in the nation due to years of work to protect and restore it (NPS 2010a; Delaware River Keeper n.d.). DEWA also contains approximately 27 miles of APPA, which is enjoyed by an estimated 4 million people each year. Within DEWA, APPA is situated atop the Kittatinny Ridge. The Ridge, also known as Blue Mountain, is a 185-mile ridge that winds through eastern and central Pennsylvania south to the Maryland state line.

The NPS cannot require the applicant to follow a certain route or avoid wetland impacts outside the boundaries of park lands; therefore, the portion of the route outside of park-managed lands is not discussed in detail in this SOF.

4.0 DESCRIPTION OF WETLANDS AND FLOODPLAINS WITHIN PROJECT AREA

4.1 WETLANDS

For the NPS, any area that is classified as a *wetland* according to the U.S. Fish and Wildlife Service's (USFWS) "Classification of Wetlands and Deepwater Habitats of the United States" (Report FWS/OBS-79/31) (Cowardin et al. 1979) is subject to NPS Director's Order 77-1: *Wetland Protection* (NPS 2012a). (*Deepwater habitats* are not subject to Director's Order 77-1.) Under the Cowardin definition, a wetland must have one or more of the following three attributes:

1. At least periodically, the land supports predominantly hydrophytes (wetland vegetation);
2. The substrate is predominantly undrained hydric soil; or
3. The substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

The Cowardin wetland definition encompasses more aquatic habitat types than the definition and delineation manual used by the Corps of Engineers for identifying wetlands subject to Section 404 of the Clean Water Act. The 1987 *Corps of Engineers Wetlands Delineation Manual* requires that *all three* of the parameters listed above (hydrophytic vegetation, hydric soil, wetland hydrology) be present in order for an area to be considered a wetland. The Cowardin wetland definition includes such wetlands, but also adds some areas that, though lacking vegetation and/or soils *due to natural physical or chemical factors* such as wave action or high salinity, are still saturated or shallow inundated environments that support aquatic life (e.g., unvegetated stream shallows, mudflats, rocky shores). The National Wetlands Inventory (NWI) of the USFWS produces information on the characteristics, extent, and status of the nation's wetlands and deepwater habitats. The wetlands on the maps are based upon the Cowardin wetland definition and classification system (Cowardin 1979), so (subject to ground truthing) they are considered wetlands by the NPS.

4.1.1 Wetland Assessment Methodology

Characterization of wetlands along the alternative alignments within the parks came from several sources, including field surveys conducted during the summer of 2010, NWI maps, environmental reports, previous wetland delineations, and aerial photography. The following reports were used: *Field Survey Report: Susquehanna to Roseland Transmission Line Proposal and Right-Of-Way Request Environmental Impact Statement* (NPS 2011b) and the *Susquehanna-Roseland 500 kV Transmission Line Project PPL Electric Utilities: Wetlands and Other Waters of the United States Findings Report Delaware Water Gap National Recreation Area Pike and Monroe Counties, Pennsylvania* (Berger 2010). Areas that appeared to be wetlands or were areas of known wetlands along each alternative were visited in the field. Within park boundaries, all vegetated wetlands were delineated using the Corps of Engineers Wetland Delineation Manual. The extent of the riverine wetland at the stream crossing was delineated using the ordinary high water marks on the banks of the stream. These wetland systems are described generally below and in more detail in the paragraphs that follow.

4.1.2 Wetlands along Alternatives 1, 2, and 2b

In Pennsylvania, a site investigation for the presence of jurisdictional waters of the United States, including wetlands, was conducted along the alignment for alternative 1, 2, and 2b between September 2008 and May 2009. In New Jersey, a site investigation for the presence of wetlands and jurisdictional waters was conducted along the alignment for alternative 2 in September, October, and November 2007. Both the Pennsylvania and New Jersey wetland delineations were conducted prior to the addition of regional supplements by the USACE and therefore lacked pertinent information regarding distribution of plant species within the wetland areas. In order to fill in the data gaps of the wetland delineations previously conducted, additional vegetation data was collected in April 2012 using the USACE regional supplement titled *Northcentral and Northeast Region*. Also in April 2012, the wetland functions/values were recorded in more detail and all wetland areas were ground-truthed and verified along alternatives 1, 2, and 2b. There are three wetlands (AA, wetland NWI-1, and wetland 49) located along alternative 2 but outside of park boundaries that are not discussed further in this SOF. The paragraphs that follow describe the wetlands that exist along alternative 1, 2, and 2b within park boundaries. Wetlands along alternatives 1, 2, and 2b are presented in figures 3, 4, 5, and 6.

Arnott Fen: Arnott Fen is a calcareous wetland characterized as a PEM/PSS (palustrine emergent/ palustrine scrub shrub) wetland along alternative 2. This fen occupies approximately 5.3 acres of the larger wetland complex in which it is found. Within the ROW, 80 percent of Arnott Fen is considered PEM while 20 percent is considered PSS. Calcareous fens arise out of the unique geological conditions that foster a unique biological community and form in areas with limestone bedrock. Calcareous

groundwater is discharged at Arnott Fen as a result of the calcareous geologic formations, which support calciphytic vegetation. A calcareous fen like Arnott Fen can only be found on areas of highly calcareous rock, which is necessary to provide the calcium needed to support calciphytic vegetation (Mellon 2010a, 11). The portion of the wetland along alternative 2 is dominated by tussock sedge (*Carex stricta*) and cattail (*Typha latifolia*) in the emergent areas (NPS 2012b). The scrub shrub vegetation is located along the outer fringe of the wetland and is dominated by red maple (*Acer rubrum*), smooth alder (*Alnus serrulata*) and swamp rose (*Rosa palustris*) (NPS 2012b). Other scrub shrub plant species include arrow wood (*Viburnum dentatum*), silky dogwood (*Cornus amomum*), red twig dogwood (*Cornus sericea*), buttonbush (*Cephalanthus occidentalis*), and winterberry (*Ilex verticillata*) (NPS 2012b). This community type exists in areas with base-rich water, often with a pH ranging from 7.0 to 8.1, and usually contains a rich organic layer (Fike 1999, 42). This plant community is considered globally imperiled, ranked as G1G2, and is the only community of its kind in Pennsylvania (NPS 2009, 4).

Rare plant communities support rare wildlife species that depend on the hydrologic conditions found at Arnott Fen and the surrounding wetland complex. The fen with surrounding wetlands and forest compose a unique ecosystem that supports diverse breeding bird, reptile, and amphibian populations, including species of conservation concern. Arnott Fen provides RT&E habitat and supports a known population of RT&Es (Mellon 2009). Arnott Fen also has known populations of at least six plant species of special Concern. Hydrology for the fen is provided by underground springs and seeps; pockets of open water and small stream channels exist throughout the fen. The primary hydrologic function of this wetland is groundwater recharge/discharge and the primary habitat value of this wetland is uniqueness/ heritage and endangered species habitat. Other functions and values of Arnott fen are included in table 1.

The larger wetland that encompasses Arnott Fen has been altered by beaver and human activity. Since the initial discovery of special-status species in the fen, beaver activity has altered water levels, flooding much of the area for several years. Remnant dams are still present and functioning in some parts of the wetland complex. In other areas, woody species are encroaching and succession has become a concern. Historical impacts on the wetland from beaver and humans have not been documented, nor have the changes been compared over time. The threat of encroachment of shrubby species and saplings may affect the wetland and fen (TNC 2000, 1).

Hogback Ridge: Hogback Ridge is considered an outstanding natural feature significant to the diversity of the area (NPS 1987; PATNC 1991, 14–25). Hogback Ridge contains woodlands as well as a wetland characterized as a PEM/PSS1E (palustrine emergent/palustrine, scrub shrub, broad- leaved deciduous, seasonally flooded/saturated wetland). This wetland is approximately 1.92 acres in size. Within the ROW, 60 percent of Hogback Ridge is considered PEM while 40 percent is considered PSS 1E. This wetland is considered a rare and unique community as well as an *Exceptional Value Wetland* by the Commonwealth of Pennsylvania because it supports endangered species habitat. Like Arnott Fen, the unique qualities of Hogback Ridge are a result of the limestone bedrock that forms the ridge. This wetland contains open water with standing/dead wood as well as emergent vegetation and scrub shrub vegetation in the higher elevations and along the fringe of the wetland (NPS 2012b). The wetland contains deciduous scrub shrub wetland vegetation and special-status wetland plant species that are not found anywhere else in the study area. The emergent portion of the wetland is dominated by upright sedge (*Carex stricta*), sphagnum moss (*Sphagnaceae* family), and Japanese stiltgrass (*Eulalia viminea*) along the outer edges (NPS 2012b). The scrub shrub portion of the wetland is dominated by smooth alder, winterberry, and highbush blueberry (*Vaccinium corymbosum*) (NPS 2012b). The canopy of the wetland is open although some mature red maple trees also exist as well as dead, standing wood. Hydrology for this wetland is provided by underground springs and seeps. The primary hydrologic function of this wetland is groundwater recharge/discharge and the primary habitat value of this wetland is uniqueness/heritage as well as endangered species habitat. Other functions and values of Hogback Ridge are included in table 1.

Wetland BB: Wetland BB is located within Pike County, Pennsylvania and lies within the floodplain of Bushkill Creek. This wetland contains separate PEM and PFO (palustrine forested wetland) portions, but the total size of this wetland is approximately 6.24 acres. The emergent wetland is dominated by skunk cabbage (*Symplocarpos foetidus*) and tussock sedge and is located along an open water stream and small oxbow lake that is likely an old channel of the Bushkill Creek. A small stream also exists within the forested portion of the wetland that is dominated by red maple, but also supports tulip poplar (*Liriodendron tulipifera*) and sourgum (*Nyssa sylvatica*). Wetland BB contains both temporary and saturated water regimes; the hydrology for the wetland is provided by the nearby Bushkill Creek and associated tributaries. Wetland BB is located just north of Bushkill Creek, which is characterized as a wild trout stream, stocked trout stream, and wetland greater than 10 acres in size. Therefore, wetland BB is considered an *Exceptional Value Wetland* because it located in the floodplain of waters listed as Exceptional Value under Chapter 93 (relating to water quality) in Pennsylvania State Code (§ 105.17 *Wetlands*). In addition, wetland BB supports endangered species habitat, which also characterizes this wetland as an *Exceptional Value Wetland*. The primary hydrologic functions of this wetland are groundwater recharge/discharge and flood flow alteration due to its proximity to Bushkill Creek and the oxbow lake; the primary habitat value of this wetland is uniqueness/heritage and endangered species habitat. Other functions and values of wetland BB are included in table 1.

Wetland CC: Wetland CC is a small PEM/PSS wetland located near the northern portion of the alignment within Pike County, Pennsylvania. This wetland is approximately 0.22 acre in size. Within the ROW, 70 percent of wetland CC is considered PEM while 30 percent is considered PSS. The emergent vegetation in Wetland CC is dominated by sphagnum moss, Japanese stiltgrass, and steeplebush (*Spirea tomentosa*) (NPS 2012b). The scrub shrub vegetation is dominated by smooth alder, highbush blueberry, and winterberry. Hydrology for this wetland is provided primarily by underground seeps and springs that turn into a headwater stream. The primary hydrologic function of this wetland is groundwater recharge/discharge, and wildlife habitat is another dominant function. Other functions and values of wetland CC are included in table 1.

Van Campen Wetland: Van Campen wetland is characterized as a PEM/PSS wetland located within Warren County, New Jersey. The wetland contains emergent and deciduous scrub shrub wetland vegetation and is a rare and unique community as well as an *Exceptional Value Wetland* because this wetland supports a special-status (state endangered) plant species. This wetland is approximately 10.33 acres in size. Within the ROW, 40 percent of the Van Campen wetland is considered PEM while 60 percent is considered PSS. The emergent portion of the wetland is dominated by upright sedge, steeplebush, and Japanese stiltgrass. The scrub shrub portion of the wetland is dominated by smooth alder and maleberry (*Lyonia ligustrina*). It was observed that the majority of the alder was removed in April 2012. Hydrology for this wetland is likely provided by underground springs and seeps; a small free flowing stream approximately 1 foot wide and some open water pockets were observed throughout the wetland. The primary hydrologic function of this wetland is groundwater recharge/discharge and the primary value of this wetland is uniqueness/heritage and endangered species habitat because this wetland is considered an *Exceptional Value Wetland*, a rare and unique community, and supports an endangered plant species. Other functions and values of Van Campen wetland are included in table 1.

Wetland 42: Wetland 42 has both PEM/PSS and PFO wetland portions and is partially located in the proposed ROW. This wetland is approximately 1.14 acres in size. There are two small free-flowing intermittent stream features approximately 1 ft wide within the PEM/PSS portion of wetland 42 that are fed by underground seeps and springs. Within the ROW in the PEM/PSS portion of the wetland, 40 percent of the wetland 42 is considered PEM while 60 percent is considered PSS The emergent vegetation is dominated by cattail, sensitive fern (*Onoclea sensibilis*) and Japanese stiltgrass (NPS 2012b). The scrub shrub vegetation is dominated by silky willow (*Salix sericea*), smooth alder, multiflora rose (*Rosa multiflora*), and highbush blueberry (NPS 2012b). The forested portion of wetland 42 is dominated by

tulip poplar. The forested portion also supports yellow birch (*Betula alleghaniensis*) and American beech (*Fagus grandifolia*). The understory of the forested wetland is dominated by sphagnum moss and Japanese stiltgrass but also supports cinnamon fern (*Osmunda cinnamomea).* Hydrology for this wetland is provided by underground seeps and springs which provide overland flow across this forested wetland (NPS 2012b). The primary hydrologic function of this wetland is groundwater recharge/discharge, and the primary habitat value of this wetland is wildlife habitat. Other functions and values of wetland 42 are included in table 1.

Wetland 45: Wetland 45 is a PEM/PSS wetland in the ROW and is approximately 1.1 acres in size. This wetland is located within the ROW, 20 percent of wetland 45 is considered PEM while 80 percent is considered PSS. The emergent vegetation in this wetland is dominated by cinnamon fern and Japanese stiltgrass but also supports soft rush (*Juncus effusus*), sedge species (*Carex spp*. not flowering at time of survey), false hellebore (*Veratrum viride*), sensitive fern, and sphagnum moss (NPS 2012b). The scrub shrub portion of the wetland is dominated by multiflora rose, Japanese barberry (*Berberis thunbergii*), highbush blueberry, and silky willow; additional shrub species included spicebush (*Lindera benzoin*) (NPS 2012b). Invasive species, including Japanese barberry and multiflora rose, are both dominant (total approximately 40 percent) in the shrub layer but are not very dense and do not appear to affect the functionality of this wetland. The hydrology of the wetland included narrow corridors of seeps, saturated soils (likely year round) and rivulets from 2 to 3 inches deep as well as a free-flowing stream 8 inches wide (NPS 2012b). The primary hydrologic function of this wetland is groundwater recharge/discharge. Other functions and values of wetland 45 are included in table 1.

Wetland 46: Wetland 46 is a PEM/PSS wetland that exists adjacent to a bermed, isolated, man-made open water pond located entirely within the maintained ROW. This wetland is approximately 0.24 acre in size. Within the ROW, 30 percent of wetland 46 is considered PEM while 70 percent is considered PSS. The vegetation in the sapling/shrub stratum is dominated by sheep laurel (*Kalmia latifolia*), smooth alder, and maleberry (NPS 2012b). The vegetation in the herbaceous stratum is dominated by sphagnum moss, soft rush, Canada rush (*Juncus canadensis*), and steeplebush. This wetland is primarily an open water habitat; the hydrology for this wetland is provided by underground seeps and springs which allow the water to pond within the berms (NPS 2012b). The primary hydrologic function of this wetland is groundwater recharge/discharge and the primary habitat value of this wetland is wildlife habitat due to the presence of sunfish, American bullfrog tadpoles, and Eastern newt. Eurasian watermilfoil (*Myriophyllum spicatum*) is also present in the open water. Other functions and values of wetland 46 are included in table 1.

Wetland 47: Wetland 47 is a PEM/PSS wetland in the ROW. This wetland is approximately 0.08 acre in size. Within the ROW, 50 percent of wetland 47 is considered PEM while 50 percent is considered PSS. The vegetation in the sapling/shrub stratum is dominated by highbush blueberry and Allegheny blackberry (*Rubus allegheniensis*) (NPS 2012b). The vegetation in the herbaceous stratum is dominated by cinnamon fern and sphagnum moss (NPS 2012b). The wetland drains to an unnamed tributary of Van Campen Brook and is characterized as a seep or spring originating from rock strata within the ROW (EcolSciences 2008). The primary hydrologic function of this wetland is groundwater recharge/discharge. Other functions and values of wetland 47 are included in table 1.

Wetland FI: Wetland FI is a very narrow (10-foot-wide) PFO wetland located along the shoreline of the Delaware River within Pennsylvania that extends above and below the existing ROW. This wetland extends along the Delaware River but the portion in the vicinity of the ROW is 0.01 acre in size. The vegetation includes a riparian buffer of sycamore (*Platanus occidentalis*) trees. The primary fishery functions of this wetland are fish and shellfish habitat and an important hydrologic function is sediment/shoreline stabilization. Wildlife habitat and recreation are also important functions due to the proximity to the Delaware River. Other functions and values of wetland FI are included in table 1.

Wetland FI would not be affected by Alternative 2 due to the narrow width of this wetland and the 100-ft buffer that is required along the Delaware River to protect the riparian stream corridor (PPL and PSE&G 2008, 7). Wetland FI is therefore not discussed further in this document.

It is possible that NJDEP or PADEP may identify the existing wetlands along and within the ROW for Alternatives 1, 2, and 2b as Exceptional Value Wetlands, based upon the recent findings of wood turtle and timber rattlesnake (these snakes can forage in wetland areas) surveys that have been conducted along Alternative 2 (EcolSciences 2009b; 2011).

4.1.3 Wetlands along Alternative 3

Within the study area, wetlands along the alternative 3 alignment were field-delineated, and function and value assessments of the wetlands delineated along the alignment were performed (NPS 2011b). Within the boundaries of DEWA, five wetlands were found along the alternative 3 ROW (wetlands 3, 4, 5/6, 8, and 10), are described in more detail below, and are presented in figure 7. These wetlands are not considered rare and unique communities or *Exceptional Value Wetlands.* There is also one wetland along alternative 3 outside park lands. The paragraphs that follow describe the wetlands that exist along alternative 3 within park boundaries.

Wetland 3: Wetland 3 is approximately 0.18 acres and within the ROW of alternative 3, east of the Delaware River, in New Jersey. This wetland is classified as a PEMY (palustrine, emergent, saturated/semi-permanent/seasonal wetland) and consists of a seep that flows from fractured shale and drains to an intermittent stream channel. Wetland 3 is vegetated predominantly with Japanese barberry, an invasive species, and is subdominated by hydrophytic plant species.

Wetland 4: Wetland 4 is approximately 0.49 acres and within the ROW of alternative 3, northeast of wetland 3. This wetland is classified as a PEMY wetland and consists of a seep that flows from fractured shale and drains to an intermittent stream channel. This emergent wetland is vegetated predominantly with steeplebush.

Wetland 5/6: Wetland 5/6 is a wetland complex adjacent to the ROW of alternative 3, east of the Delaware River, in New Jersey. This wetland is approximately 0.22 acres and classified as a PEMY wetland and consists of a seep that flows from glacial till and drains to an intermittent stream channel. This emergent wetland is sparsely vegetated with New York fern, cinnamon fern, large leaved violet (*Viola blanda*), and sedge species (*Carex* spp.).

Wetland 8: Wetland 8 is approximately 0.003 acres and within the ROW of alternative 3, east of the Delaware River, in New Jersey. This wetland is classified as a PEMB (saturated palustrine emergent) wetland and consists of a seep that flows from fractured shale and drains to a perennial stream channel. This emergent wetland is vegetated predominantly with sphagnum moss.

Wetland 10: Wetland 10 is along alternative 3 in New Jersey where the ROW follows the boundary of DEWA. This wetland is approximately 0.29 acres classified as a PSS wetland that is seasonally flooded. Wetland 10 is vegetated mainly with highbush blueberry, cinnamon fern, and red maple saplings.

Wetland NWI-3: Wetland NWI-3 is a PFO4/1E (palustrine, forested, needle-leaved evergreen/broad-leaved deciduous seasonally flooded/saturated wetland) that is located partially outside the boundaries of DEWA and extends beyond the ROW but is within the study area. This wetland is along the existing alternative 3 ROW where it runs alongside the boundary for DEWA. The wetland is vegetated with a mix of needle-leaved evergreen species and broadleaf deciduous species and is seasonally flooded.

In addition to the wetlands described above, wetlands BB and CC are also included in the alignment for alternative 3:

Wetland BB: Wetland BB is located within Pike County, Pennsylvania and lies within the floodplain of Bushkill Creek. This wetland contains separate PEM and PFO portions, but the total size of this wetland is approximately 6.24 acres. The emergent wetland is dominated by skunk cabbage and tussock sedge and is located along an open water stream and small oxbow lake that is likely an old channel of the Bushkill Creek. A small stream also exists within the forested portion of the wetland that is dominated by red maple, but also supports tulip poplar and sourgum. Wetland BB contains both temporary and saturated water regimes; the hydrology for the wetland is provided by the nearby Bushkill Creek and associated tributaries. Wetland BB is located just north of Bushkill Creek, which is characterized as a wild trout stream, stocked trout stream, and wetland greater than 10 acres in size. Therefore, wetland BB is considered an *Exceptional Value Wetland* because it located in the floodplain of waters listed as Exceptional Value under Chapter 93 (relating to water quality) in Pennsylvania State Code (§ 105.17 *Wetlands*). In addition, wetland BB supports endangered species habitat, which also characterizes this wetland as an *Exceptional Value Wetland*. The primary hydrologic functions of this wetland are groundwater recharge/discharge and flood flow alteration due to its proximity to Bushkill Creek and the oxbow lake; the primary habitat value of this wetland is uniqueness/heritage and endangered species habitat. Other functions and values of wetland BB are included in table 1.

Wetland CC: Wetland CC is a small PEM/PSS wetland located near the northern portion of the alignment within Pike County, Pennsylvania. This wetland is approximately 0.22 acre in size. Within the ROW, 70 percent of wetland CC is considered PEM while 30 percent is considered PSS. The emergent vegetation in Wetland CC is dominated by sphagnum moss, Japanese stiltgrass, and steeplebush (NPS 2012b). The scrub shrub vegetation is dominated by smooth alder, highbush blueberry, and winterberry. Hydrology for this wetland is provided primarily by underground seeps and springs that turn into a headwater stream. The primary hydrologic function of this wetland is groundwater recharge/discharge and wildlife habitat is another dominant function. Other functions and values of wetland CC are included in table 1.

In January 2012, a Phase I RT&E habitat suitability assessment was performed within eight separate wetland complexes along alternative 3: wetlands 3, 4, 5, 6, 8, and 10. Hydrology, soils, and vegetation were assessed within the project ROW to determine habitat suitability for the RT&E species. The result of the Phase I RT&E habitat suitability assessment concluded that wetlands 3, 4, 5, 6, and 8 of alternative 3 do not contain the necessary hydrology, soils, and/or vegetation to support the RT&E species. Wetland 10 of alternative 3 does contain suitable hydrology, soils, and vegetation to support the RT&E species. However, wetland 10 is connected to wetlands outside of the proposed ROW area that may have the potential to host the RT&E species, which renders wetland 10 part of an interconnected habitat mosaic (NPS 2012a, 12).

4.1.4 Wetlands along Alternative 4

Inside the study area, wetlands along the alternative 4 alignment were field-delineated in the summer of 2010 (NPS 2011b), and function and value assessments of the wetlands delineated along the alternative 4/5 ROW were performed. Within the boundaries of DEWA, two wetlands were found and are described as wetlands 1 and 2; these wetlands are presented in figure 8. The wetland systems identified along alternative 4 are characterized as PFOs. More detailed descriptions of the wetlands follow:

Wetland 1: Wetland 1 is a forested wetland system east of Totts Gap Road and south of Mountain Road. Wetland 1 is part of Totts Gap, which consists of Totts Gap Natural Heritage Site and Totts Gap Swamp, portions of which are considered a rare and unique community. This wetland is approximately 1.91 acres in size, is classified as a PFO, and consists of a bowl-shaped depression within the floodplain of an

unnamed stream channel. This forested wetland is dominated by red maple, willow oak (*Quercus phellos*), American hornbeam (*Carpinus caroliniana*), and silver maple (*Acer saccharinum*) in the canopy and understory. Japanese stiltgrass, an invasive species, and jack-in-the-pulpit (*Arisaema triphyllum*) were identified as dominant groundcover species. In Pennsylvania, where wetland 1 is located, willow oak is a state endangered tree species.

Wetland 2: Wetland 2 is on the opposite side of the ROW from wetland 1, adjacent to the alternative 4 ROW. This wetland is approximately 0.82 acres in size, is classified as a PFO, and is on a slope above the floodplain of an unnamed tributary to Cherry Creek. This forested wetland is dominated by red maple, willow oak, and silver maple in the canopy with an understory of spicebush. Japanese stiltgrass, an invasive species, was identified as the dominant groundcover species. In Pennsylvania, where wetland 2 is located, willow oak is a state endangered tree species.

Wetland NWI-4: Wetland NWI-4 is a PSS1E/PFO1E wetland that is located outside the boundaries of DEWA and is not discussed further in this document.

In addition to the wetlands described above, wetlands BB and CC are also included in the alignment for alternative 4:

Wetland BB: Wetland BB is located within Pike County, Pennsylvania and lies within the floodplain of Bushkill Creek. This wetland contains separate PEM and PFO portions but the total size of this wetland is approximately 6.24 acres. The emergent wetland is dominated by skunk cabbage and tussock sedge and is located along an open water stream and small oxbow lake that is likely an old channel of the Bushkill Creek. A small stream also exists within the forested portion of the wetland that is dominated by red maple, but also supports tulip poplar and sourgum. Wetland BB contains both temporary and saturated water regimes; the hydrology for the wetland is provided by the nearby Bushkill Creek and associated tributaries. Wetland BB is located just north of Bushkill Creek, which is characterized as a wild trout stream, stocked trout stream, and wetland greater than 10 acres in size. Therefore, wetland BB is considered an *Exceptional Value Wetland* because it located in the floodplain of waters listed as Exceptional Value under Chapter 93 (relating to water quality) in Pennsylvania State Code (§ 105.17 *Wetlands*). In addition, wetland BB supports endangered species habitat, which also characterizes this wetland as an *Exceptional Value Wetland*. The primary hydrologic functions of this wetland are groundwater recharge/discharge and flood flow alteration due to its proximity to Bushkill Creek and the oxbow lake; the primary habitat value of this wetland is uniqueness/heritage and endangered species habitat. Other functions and values of wetland BB are included in table 1.

Wetland CC: Wetland CC is a small PEM/PSS wetland located near the northern portion of the alignment within Pike County, Pennsylvania. This wetland is approximately 0.22 acre in size. Within the ROW, 70 percent of wetland CC is considered PEM while 30 percent is considered PSS. The emergent vegetation in Wetland CC is dominated by sphagnum moss, Japanese stiltgrass, and steeplebush (NPS 2012b). The scrub shrub vegetation is dominated by smooth alder, highbush blueberry, and winterberry. Hydrology for this wetland is provided primarily by underground seeps and springs that turn into a headwater stream. The primary hydrologic function of this wetland is groundwater recharge/discharge and wildlife habitat is another dominant function. Other functions and values of wetland CC are included in table 1.

In January 2012, a Phase I RT&E species habitat suitability assessment was performed within wetlands 1 and 2 along alternative 4. Hydrology, soils, and vegetation were assessed within the project ROW to determine habitat suitability. The result of the Phase I RT&E species habitat suitability assessment concluded that wetlands 1 and 2 of alternative 4 do not contain the necessary hydrology, soils, and/or vegetation to support the RT&E species.

4.1.5 Wetlands along Alternative 5

Inside the study area, wetlands along the alternative 5 alignment were field-delineated in the summer of 2010 (NPS 2011b), and function and value assessments of the wetlands delineated along the alternative 4/5 ROW were performed. Within the boundaries of DEWA, two wetlands were found and are described as wetlands 1 and 2; these wetlands are presented in figure 8. The wetland systems identified along alternative 5 are characterized as PFOs. More detailed descriptions of the wetlands follow:

Wetland 1: Wetland 1 is a forested wetland system east of Totts Gap Road and south of Mountain Road. Wetland 1 is part of Totts Gap, which consists of Totts Gap Natural Heritage Site and Totts Gap Swamp, portions of which are considered a rare and unique community. This wetland is classified as a PFO and consists of a bowl-shaped depression within the floodplain of an unnamed stream channel. This forested wetland is dominated by red maple, American hornbeam, and silver maple in the canopy and understory. Japanese stiltgrass, an invasive species, and jack-in-the-pulpit were identified as dominant groundcover species. In Pennsylvania, where wetland 1 is located, a state endangered tree species exists.

Wetland 2: Wetland 2 is on the opposite side of the ROW from wetland 1, adjacent to the alternative 4 ROW. This wetland is classified as a PFO and is on a slope above the floodplain of an unnamed tributary to Cherry Creek. This forested wetland is dominated by red maple, and silver maple in the canopy with an understory of spicebush. Japanese stiltgrass, an invasive species, was identified as the dominant groundcover species. In Pennsylvania, where wetland 2 is located, a state endangered tree species exists.

Wetland NWI-4: Wetland NWI-4 is a PSS1E/PFO1E wetland that is located outside the boundaries of DEWA and is not discussed further in this document.

In January 2012, a Phase I RT&E species habitat suitability assessment was performed within wetlands 1 and 2 along alternative 5. Hydrology, soils, and vegetation were assessed within the project ROW to determine habitat suitability. The result of the Phase I RT&E species habitat suitability assessment concluded that wetlands 1 and 2 of alternative 5 do not contain the necessary hydrology, soils, and/or vegetation to support the RT&E species.

4.1.6 Evaluation of Wetland Functions and Values

The functional wetland assessment was conducted in accordance with the *Wetlands Functions and Values: A Descriptive Approach* described in the September 1999 supplement to *The Highway Methodology Workbook* (Supplement) by the New England Division of the USACE (USACE 1999). This methodology is commonly referred to as the "New England (NE) Method." The NE Method is an expansion of The Highway Methodology (developed by the New England USACE District) and is geared towards linear projects to determine acceptable wetland mitigation. The Highway Methodology or NE Method uses a descriptive approach to characterize functions and values of wetlands and is typically used for NEPA projects. This method was therefore considered appropriate for use at DEWA. The data requirements for the NE Method are low and require general descriptions of the wetlands; measure techniques for this method are primarily based upon best professional judgment by consensus of an interdisciplinary team.

The method is descriptive and designed to provide a flexible approach that incorporates wetland science along with human judgment regarding more subjective values and benefits. This method takes into account a number of "Considerations/Qualifiers" that are used as indicators or descriptors of particular functions and values. Appendix A of the Supplement (USACE 1999) identifies from three to as many as 32 "Considerations/ Qualifiers" that may be possible indicators of different wetlands functions and values. Ultimately, the "Considerations/Qualifiers" are designed to be flexible and based on best

professional judgment and interdisciplinary team consensus, taking into account other relevant site-specific observations of the evaluator. The Considerations/Qualifiers included in USACE (1999) were slightly modified and tailored for use in this project at DEWA and are presented in attachment B. Using these indicators, the functions and values were determined based upon presence in the wetland. The principal functions and values were also defined based upon important physical aspects of the wetland and/or are of special value due to their economic importance, their uniqueness, or their local, regional, and/or national significance.

Wetland functions are ecosystem properties that are present without regard to any subjective human values. They are considered to be the result of the biologic, geologic, hydrologic, biogeochemical and/or physical processes that take place within a wetland. The existing wetlands mapped during the summer 2010 surveys were evaluated based on wetland functions and values described in NPS *Procedural Manual #77-1: Wetland Protection* (NPS 2012a) and USACE (1999). Functions and values of the wetlands were then further recorded during the April 2012 field survey (NPS 2012b). Functions attributed to wetlands include the following:

1. Groundwater Recharge/Discharge
2. Flood-flow Alteration
3. Fish and Shellfish Habitat
4. Sediment/Toxicant/Pathogen Retention
5. Nutrient Removal/Retention/Transformation
6. Production (Nutrient) Export
7. Sediment/Shoreline Stabilization
8. Wildlife Habitat

Wetland values are considered to be the perceived benefits to society that can be derived from the ecosystem functions and/or other characteristics of a wetland. These values may depend on considerations such as location of the wetland, accessibility, human disturbance or pressures, economics, surrounding land uses, and cultural or historic information. Values attributed to wetlands include the following:

1. Recreation
2. Education/Scientific Value
3. Uniqueness/Heritage
4. Visual Quality/Aesthetics
5. Threatened or Endangered Species Habitat

Functions:

- *Ground water recharge/discharge*—Recharge is the potential of a wetland to contribute water to an aquifer; discharge is the potential of a wetland to discharge groundwater to the surface. The wetland's ability to help maintain stream base flow has also been included in this variable.
- *Flood attenuation/alteration*—The effectiveness of a wetland in reducing flood damage from prolonged periods of precipitation by storing and desynchronizing (i.e., gradually releasing at lower heights/velocities) floodwaters. The economic value of flood protection (NPS) has also been included in this variable.
- *Fish/shellfish habitat*—The effectiveness of seasonal or permanent watercourses associated with a wetland to provide habitat and the essentials necessary for life for a diversity of types and abundance of populations of fish/shellfish and other aquatic organisms. The economic value of

the fishery was also considered in this variable. Both resident and migratory species were considered.

- *Sediment/toxicant retention*—The effectiveness of a wetland to reduce or prevent degradation of water quality by acting as a trap for sediments or toxic substances in runoff water that could adversely affect aquatic and terrestrial life.
- *Nutrient removal*—The effectiveness of a wetland to serve as a trap for nutrients carried by runoff from surrounding uplands or contiguous wetlands, and the wetland's ability to process these nutrients into other forms. The wetland also functions to prevent the adverse effects associated with excess nutrients entering aquifers or surface waters, including streams, rivers, lakes, ponds, or estuaries.
- *Production export*—The effectiveness of a wetland to produce food or other usable products for living organisms (including humans). Detrital export to downstream systems has been included in this variable.
- *Sediment/shoreline stabilization*—The effectiveness of a wetland to stabilize streambanks against shear stresses and/or protect shorelines against erosion by reducing forces caused from waves. Other erosion and sediment control functions, such as reduction of water velocities and binding of the soil, have been included in this variable.

Values:

- *Wildlife habitat*—The effectiveness of a wetland to provide habitat and the essentials necessary for life for a diversity of types and abundance of populations of wildlife species typically associated with wetlands, their associated water bodies, and the wetland edge. Both resident and migratory species were considered. Faunal productivity has also been included in this variable.
- *Recreation (consumptive/non-consumptive) and tourism*—The suitability of a wetland and associated watercourses to provide active and/or passive recreational opportunities for both local and non-local populations. Consumptive use includes activities such as hunting and fishing that diminish the plants, animals, or other resources that are intrinsic to the wetland. Non-consumptive use includes activities such as hiking, birding, boating and canoeing, that do not diminish the resources of the wetland. The economic value of tourism has also been included in this variable.
- *Education/scientific value*—The suitability of a wetland to serve as an "outdoor classroom," as a "reference site" for scientific study or research on ecosystems, or for interpretation.
- *Uniqueness/heritage*—The effectiveness of a wetland or its associated water bodies to provide certain wetland attributes or special functions and values related to aspects of public health, recreation, and habitat diversity. This may include the wetlands overall health and appearance, its role in the overall ecology of the area, or its relative importance as a typical wetland class for the geographic location.
- *Visual quality/aesthetics (NPS/NE Method)*—The effectiveness of a wetland in contributing to the visual or aesthetic quality or pleasing nature of the surrounding landscape.
- *Endangered species habitat*—The suitability of a wetland to support and/or provide the habitat requirements specific to endangered species.

It is important to note that the majority of all wetland areas discussed in this SOF are located partially within an existing ROW for all alternatives and therefore have been previously disturbed. Historical disturbance has occurred as a result of vegetation removal activities during the initial power line construction and installation as well as during vegetation maintenance activities.

Functions and Values for Wetlands along Alternatives 1, 2, and 2b:

Function and value assessments of the wetlands delineated along the alignment for alternatives 1, 2, and 2b were performed and are summarized in table 1, while detailed function and value datasheets are included in attachment B.

TABLE 1: FUNCTIONS AND VALUES OF ALTERNATIVE 1, 2, AND 2B WETLANDS

Wetland	Arnott Fen	Hogback Ridge	Van Campen	Wetland BB	Wetland CC	Wetland 45	Wetland 42	Wetland 46	Wetland 47	Wetland FI
Functions										
Groundwater recharge/discharge	X	X	X	X	X	X	X	X	X	
Flood attenuation/alteration	X	X		X						X
Fish/shellfish habitat	X			X						X
Sediment/toxicant retention	X			X						X
Nutrient removal	X									X
Production export	X	X	X	X	X	X	X	X	X	X
Sediment/shoreline stabilization				X						X
Values										
Wildlife habitat	X	X	X	X	X	X	X	X	X	X
Recreation and tourism										X
Education/scientific	X	X								
Uniqueness/heritage	X	X	X	X						X
Visual quality/aesthetic	X									X
Endangered species habitat	X	X	X	X						

Source: NPS 2012b

Summary of Functions and Values of Alternative 1, 2, and 2b Wetlands – There are 10 wetland areas located along alternatives 1, 2, and 2b. These alternatives are located in a particularly sensitive area of DEWA containing high concentrations of many important and unique natural features including rare limestone formations that support unique calcareous wetlands such as Arnott Fen, the Delaware River riparian corridor, the Hogback Ridge wetlands and the Van Campen Brook riparian area. Arnott Fen, Hogback Ridge wetlands, and the Van Campen wetlands are characterized as rare and unique communities and classified as *Exceptional Value Wetlands* by Pennsylvania and New Jersey, meaning these wetlands are significant resources in park and regional contexts. Arnott fen supports a known population of the federally endangered RT&E species and Van Campen wetland supports the New Jersey state-listed RT&E species. Wetland BB is also considered an Exceptional Value Wetland because it located in the floodplain of waters listed as Exceptional Value under Chapter 93 (relating to water quality) in Pennsylvania State Code (§ 105.17 Wetlands). In addition, wetland BB supports endangered species habitat, which also characterizes this wetland as an Exceptional Value Wetland. These four wetland areas (Arnott Fen, Hogback Ridge, Van Campen, and wetland BB) also provide the most functions and values of any other wetlands along the other alternatives, including providing endangered species habitat. Wetland FI is included in the Delaware River riparian corridor and therefore provides unique and important wildlife habitat as well as numerous wetland

functions/values. The other wetland areas (CC, 42, 45, 46, and 47) are smaller, isolated wetlands that are sustained through groundwater seeps, have been previously disturbed through vegetation maintenance activities, and each of these areas only support three wetland functions/values each. All wetland areas along alternatives 1, 2, and 2b support the three following functions/values: groundwater recharge/discharge (due to the seeps/springs in the area), production export (due to open water and/or wildlife food sources), and wildlife habitat (due to vegetation and microhabitat such as small pools or open water).

Functions and Values for Wetlands along Alternative 3:

Function and value assessments of the wetlands delineated along the alignment for alternative 3 were performed as described below in table 2, while detailed function and value datasheets are included in attachment B.

TABLE 2: FUNCTIONS AND VALUES OF ALTERNATIVE 3 WETLANDS

Wetland	Wetland 3	Wetland 4	Wetlands 5/6	Wetland 8	Wetland 10	Wetland BB	Wetland CC
Functions							
Groundwater recharge/discharge	X	X	X	X	X	X	X
Flood attenuation/alteration				X		X	
Fish/shellfish habitat						X	
Sediment/toxicant retention				X	X	X	
Nutrient removal					X		
Production export	X	X	X	X	X	X	X
Sediment/shoreline stabilization				X		X	
Values							
Wildlife habitat	X	X	X	X	X	X	X
Recreation and tourism							
Education/scientific							
Uniqueness/heritage						X	
Visual quality/aesthetic	X	X	X	X	X		
Endangered species habitat						X	

Source: NPS 2011b; 2012b

Summary of Functions and Values of Alternative 3 Wetlands – There are seven wetland areas located along alternative 3, none of which are considered a rare and unique community. Only wetland BB is considered an Exceptional Value Wetland because it located in the floodplain of waters listed as Exceptional Value under Chapter 93 (relating to water quality) in Pennsylvania State Code (§ 105.17 Wetlands) and supports endangered species habitat. Along alternative 3, only wetland BB supports the values endangered species habitat and uniqueness/heritage. Wetlands 3, 4, and 5/6 support only four wetland functions/values each and wetland CC support only three wetland functions/values. All wetland areas along alternative 3 support the three following functions/values: groundwater recharge/discharge (due to the seeps/springs in the area), production export (due to open water and/or wildlife food sources), and wildlife habitat (due to vegetation and microhabitat such as small pools or open water).

Functions and Values for Wetlands along Alternative 4:

Function and value assessments of the wetlands delineated along the alignment for alternative 4 were performed (table 3).

TABLE 3: FUNCTIONS AND VALUES OF ALTERNATIVE 4 WETLANDS

Wetland	Wetland 1	Wetland 2	Wetland BB	Wetland CC
Functions				
Groundwater recharge/discharge	X	X	X	X
Flood flow alteration	X	X	X	
Fish and shellfish habitat			X	
Sediment/toxicant retention		X	X	
Nutrient removal		X		
Production export	X	X	X	X
Sediment/shoreline stabilization		X	X	
Values				
Wildlife habitat	X	X	X	X
Recreation				
Educational value	X			
Uniqueness/heritage	X		X	
Visual quality/aesthetics	X	X		
Endangered species habitat	X	X	X	

Source: NPS 2011b; NPS 2012b

Summary of Functions and Values of Alternative 4 Wetlands – There are four wetland areas located along alternative 4, one which is considered a rare and unique community (wetland 1 because portions of this wetland are located within Totts Gap Natural Heritage site). Only wetland BB is considered an Exceptional Value Wetland because it located in the floodplain of waters listed as Exceptional Value under Chapter 93 (relating to water quality) in Pennsylvania State Code (§ 105.17 Wetlands) and supports endangered species habitat. However, both wetlands 1 and 2 support a dominant species that is a state endangered tree species in Pennsylvania. All wetland areas along alternative 4 support the three following functions/values: groundwater recharge/discharge (due to the seeps/springs in the area), production export (due to open water and/or wildlife food sources), and wildlife habitat (due to vegetation and microhabitat such as small pools or open water).

Functions and Values for Wetlands along Alternative 5:

Function and value assessments of the wetlands delineated along the alignment for alternative 5 were performed (table 4).

TABLE 4: FUNCTIONS AND VALUES OF ALTERNATIVE 5 WETLANDS

Wetland	Wetland 1	Wetland 2
Functions		
Groundwater recharge/discharge	X	X
Flood flow alteration	X	X
Fish and shellfish habitat		
Sediment/toxicant retention		X
Nutrient removal		X
Production export	X	X
Sediment/shoreline stabilization		X
Values		
Wildlife habitat	X	X
Recreation		
Educational value	X	
Uniqueness/heritage	X	
Visual quality/aesthetics	X	X
Endangered species habitat	X	X

Source: NPS 2011b; NPS 2012b

Summary of Functions and Values of Alternative 5 Wetlands – There are two wetland areas located along alternative 5, one which is considered a rare and unique community (wetland 1 because portions of this wetland are located within Totts Gap Natural Heritage site) . Both wetlands 1 and 2 support the a dominant plant species that is a state endangered tree species in Pennsylvania. All wetland areas along alternative 5 support the three following functions/values: groundwater recharge/discharge (due to the seeps/springs in the area), production export (due to open water and/or wildlife food sources), and wildlife habitat (due to vegetation and microhabitat such as small pools or open water).

4.2 FLOODPLAINS

Floodplains within the parks were identified using a combination of Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps and park Geographic Information System (GIS) data layers. The floodplain within DEWA and MDSR lies along the entire length of the Delaware River and the confluences of larger tributaries to the Delaware River within the parks in New Jersey and Pennsylvania. The floodplain zones within the parks support riparian vegetation communities and wetlands. The paragraphs below describe the location of floodplains within the Preferred Alternative.

4.2.1 Floodplains Affected by Alternatives 1, 2, and 2b

Within the study area, the alignment for alternatives 1, 2, and 2b would be within the floodplain zone of Big Bushkill and Sand Hill creeks within DEWA and the floodplain zone of the Delaware River within DEWA and MDSR (figures 9 through 12). The ROW for alternatives 1, 2, and 2b would span approximately 700 feet of the floodplain for each watercourse. One tower for the existing B-K Line is currently within a floodplain zone within the ROW for alternatives 1, 2, and 2b.

4.2.2 Floodplains Affected by Alternative 3

Within the study area, the proposed transmission line expansion route under alternative 3 within DEWA and MDSR would be constructed within the floodplain zone of the Delaware River (figure 13). The proposed alignment would span approximately 1,320 feet of the floodplain zone just south of Tocks Island, New Jersey. Where the alternative 3 alignment follows the B-K Line, it would cross the floodplain zone of Big Bushkill and Sand Hill creeks.

4.2.3 Floodplains Affected by Alternative 4

Within the study area, where the alternative 4 alignment follows the B-K Line, the transmission line would be constructed within the floodplain zone of Big Bushkill and Sand Hill creeks (figure 14).

4.2.4 Floodplains Affected by Alternative 5

Within the study area, the proposed transmission line expansion route for alternative 5 would not be constructed within any floodplain zones within the boundaries of DEWA and MDSR.

5.0 USE OF THE WETLANDS AND FLOODPLAINS

The applicant's stated purpose for the proposed S-R Line is to strengthen the reliability of the grid at the direction of the regional transmission operator, PJM. Whether there is a need for the proposed S-R Line project is not for the NPS to decide, nor was it a factor in the preparation of the Environmental Impact Statement (EIS) or this SOF. The NPS prepared the EIS and this SOF to determine whether to grant or deny the applicant's proposal for construction and ROW permit within NPS lands. With the implementation of the preferred alternative, the use of the park would remain the same; however, floodplain zones and wetlands are located within the site boundary and would be affected by the preferred alternative 2 as mapped by FEMA or confirmed during previous wetland delineation activities. The proposed use of the park would remain the same and park use is anticipated to follow trends similar to recent years. DEWA has generally received more than 5 million visitors per year in the last few years (NPS 2010b). In the absence of notable anticipated changes in facilities or access, this average visitation is expected to continue and be reflected across user groups.

6.0 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

In identifying a preferred alternative from among those evaluated in the EIS, the NPS considered both the statutory missions of the affected NPS units and the NPS's responsibility to respond to the applicant's request for a permit in light of the fact that the applicant owns easements for the existing transmission line across lands administered by the NPS. The NPS has a responsibility to manage and protect the resources within the units of the national park system. The NPS also has a duty to respect the property rights of those who own lands or other property interests within the boundaries of units of the national park system and not to interfere unreasonably with the legitimate exercise of those property rights.

In considering the applicant's proposal, NPS decision-makers considered the nature and extent of the existing property rights that the applicant claims it could exercise with no additional rights granted by the NPS (for alternative 2b) and the impacts to park resources that would result; in some cases, selection and implementation of that alternative would cause more impacts (to resources other than wetlands) than if the NPS granted the additional ROW that the applicant has requested (for alternative 2). Alternatives 3, 4, and 5 would have fewer impacts on wetlands but would require the applicant to voluntarily exchange their existing easements for new easements or ROWs granted by the NPS; to date, the applicant has shown no inclination to do so. Thus, while these scenarios meet the NEPA mandate to consider reasonable alternatives and mitigation measures that may be outside the agency's authority, the NPS would ultimately have to make a choice based on what it may legally require and implement. Therefore, the NPS has identified alternative 2, the applicant's proposal as the preferred alternative, because while it is true that alternative 2 would result in the highest level of wetland impacts among the action alternatives evaluated (see table 5 below), other factors had greater influence on the selection of alternative 2 than the amount and quality of wetland that would be impacted by each alternative.

TABLE 5: TOTAL ACRES OF WETLAND IMPACTS BY ALTERNATIVE

Alternative	Acres of wetland impact
Alternative 1 (No Action Alternative)	7.51 acres
Preferred Alternative 2	18.65 acres
Alternative 2b	9.16 acres
Alternative 3	2.62 acres
Alternative 4	3.37 acres
Alternative 5	3.16 acres

7.0 PROPOSED IMPACTS TO WETLANDS, FLOODPLAIN AND FLOOD RISK OF THE PROPOSED PROJECT AREA

7.1 IMPACTS TO WETLANDS

Table 6 describes impacts to wetlands for alternative 1, the preferred alternative (alternative 2), and alternatives 2b, 3, 4, and 5. The paragraphs that follow describe the impacts by alternative in more detail.

It is important to note that impacts to wetlands as a result of permanent access roads and crane and tower pad locations were determined based upon the applicant's proposal as a worst-case scenario for Alternative 2 wetland impacts. However, the Park would continue to work the applicant to reduce, avoid, and minimize any impacts to wetlands as the design phase progresses. There are currently no engineering design plans for road typicals to include in this SOF.

TABLE 6: WETLAND IMPACTS BY TYPE AND ALTERNATIVE

Wetland Name	Type of Impact			
	Vegetation Removal — Shrubs/Trees (Acreage)	Permanent Road Impacts (Acreage)	Tower Pad Impacts[a] (Acreage)	Temporary Road Impacts (Acreage)
Alternative 1				
Wetland CC (PEM/PSS)	0.21	N/A		
Arnott Fen (PEM/PSS) EV	0.99[b]			
Hogback Ridge (PEM/PSS) EV	0.02[b]			
Van Campen (PEM/PSS) EV	4.45[b]			
Wetland 42 (PEM/PSS)	0.69[b]			
Wetland 45 (PEM/PSS)	0.86[b]			
Wetland 46 (PEM/PSS)	0.24[b]			
Wetland 47 (PEM/PSS)	0.05[b]			
Alternative 1 Total	**7.51**	**N/A**	**N/A**	**N/A**
Alternative 2				
Wetland BB (PFO) EV	1.05	—	—	—
Wetland CC (PEM/PSS)	0.22	—	—	—
Arnott Fen (PEM/PSS) EV	4.1	—	—	—
Hogback Ridge (PEM/PSS) EV	0.47	—	—	—
Van Campen (PEM/PSS) EV	9.6	0.56	0.23	—
Wetland 42 (PEM/PSS/ PFO)	0.78	0.09	—	—
Wetland 45 (PEM/PSS)	1.09	—	0.12	—
Wetland 46 (PEM/PSS)	0.24	—	—	—
Wetland 47 (PEM/PSS)	0.08	0.02	—	—
Alternative 2 Total	**17.63**	**0.67**	**0.35**	—
Alternative 2b				
Wetland BB (PFO) EV	0.21	—	—	—
Wetland CC (PEM/PSS)	0.21	—	—	—
Arnott Fen (PEM/PSS) EV	1.30	—	—	—
Hogback Ridge (PEM/PSS) EV	0.02	—	0.01	—
Van Campen (PEM/PSS) EV	4.82	0.56	0.23	—
Wetland 42 (PFO)	0.04	—	—	—
Wetland 42 (PEM/PSS)	0.52	0.09	—	—
Wetland 45 (PEM/PSS)	0.75	—	0.10	—
Wetland 46 (PEM/PSS)	0.20	—	—	—
Wetland 47 (PEM/PSS)	0.08	0.02	—	—
Alternative 2b Total	**8.15**	**0.67**	**0.34**	—
Alternative 3				
Wetland 8 (PEM)	—	0.02	—	—
Wetland 10 (PSS)	0.29	—	—	—
NWI-3 (PFO)	1.43	—	—	—
Wetland CC (B-K Line)	0.21	—	—	—

Wetland Name	Type of Impact			
	Vegetation Removal — Shrubs/Trees (Acreage)	Permanent Road Impacts (Acreage)	Tower Pad Impacts[a] (Acreage)	Temporary Road Impacts (Acreage)
Arnott Fen, Van Campen, 42, 47 (B-K Line removal)	—	—	—	0.67
Alternative 3 Total	**1.93**	**0.02**	**—**	**0.67**
Alternative 4				
Wetland 1 (PFO)	1.77	—	—	—
Wetland 2(PFO)	0.71	0.01	—	—
Wetland CC (B-K Line)	0.21	—	—	—
Arnott Fen, Van Campen, 42, 47 (B-K Line removal)	—	—	—	0.67
Alternative 4 Total	**2.69**	**0.01**	**—**	**0.67**
Alternative 5				
Wetland 1 (PFO)	1.77	—	—	—
Wetland 2(PFO)	0.71	0.01	—	—
Arnott Fen, Van Campen, 42, 47 (B-K Line removal)	—	—	—	0.67
Alternative 5 Total	**2.48**	**0.01**	**—**	**0.67**

a. Unknown for alternatives 3, 4, and 5

b. These wetland areas total 7.3 acres and would be allowed to recover under alternatives 3, 4, and 5.

EV = *Exceptional Value Wetland*

7.1.1 Common to All Alternatives

Vegetation Maintenance*:* Woody vegetation would be cleared and managed in all wetland areas for all alternatives and throughout the life of the power line. Clearing refers to the removal of all woody species that have grown above 20 feet in height. In general, all native herbaceous plants would be preserved to the greatest extent possible (PPL 2010b, 8). Emergent wetlands (PEM) would not be affected by vegetation maintenance because they consist of low, herbaceous vegetation that does not require management. However, incompatible trees and shrubs, which are trees that violate the wire zone, or trees that are considered danger trees would be removed from wetland areas.

Wetlands characterized as forested wetlands (PFO) would be affected by tree removal during vegetation management. These areas have been identified in this document for the preferred alternative. Trees would be cut close to the ground, and stumps and root systems would be left in the ground to naturally decompose over time so the decaying root systems can provide additional soil stability as well as hosting native organisms. Trees on the edge of the clearing zone would not be damaged - directional tree felling would occur by hand in order to protect remaining trees. Woody debris, skids, or anything else would not be dragged, in any way, across the surface of the wetlands. Cleared vegetation, including slash piles and timber piles, would be removed from any wetland areas. Downed woody debris including tree stumps would be carried out of the wetlands. Herbicides would not be used in wetland areas in the parks. The only exception to herbicide use would be for stem-treating nonnative invasive plants. Appropriate herbicides would be approved by the NPS for specific treatment use.

Mitigation Measures*:* Mitigation measures would be required to minimize impacts on wetlands both inside and outside the study area within park boundaries. To minimize adverse impacts, a park-specific plan would be developed by the applicant for review and approval by the NPS in consultation with the USFWS

to protect listed species and sensitive habitats at the park (wetlands, rare and unique communities). Wetland mitigation practices are described in detail in Section 7.1 "Wetland Mitigation" of this SOF. In order to implement the "no net loss of wetlands" policy and the goal of net gain for wetlands, Director's Order 77-1 (NPS 2012a) states that for new actions where impacts on wetlands cannot be avoided, proposals must include plans for compensatory mitigation that restores wetlands on NPS lands at a minimum acreage ratio of 1 to 1 for the preferred alternative. The NPS Director's Order 77-1: *Wetland Protection* (NPS 2012) requires that avoidance, minimization, and compensatory mitigation be described in this SOF for wetlands (see Section 7 in this document).

7.1.2 Alternative 1 (No Action)

In Pennsylvania, a total of three wetlands are located along the current ROW and would be affected under alternative 1. Two of these wetlands include the Hogback Ridge wetlands and Arnott Fen, both characterized as rare or unique communities as well as *Exceptional Value Wetlands*. In New Jersey, five wetland areas are located along the current ROW within the park boundaries and would be affected under alternative 1, including the Van Campen wetland complex, characterized as a rare and unique community as well as an *Exceptional Value Wetland*. The paragraphs below describe impacts to individual wetland areas under alternative 1.

Approximately 0.99 acre of the Arnott Fen wetland complex (characterized as a PEM/PSS wetland) is within the B-K Line ROW under alternative 1. In the existing ROW, Arnott Fen contains a diverse emergent vegetation community, including numerous special-status wetland plant species that are not found anywhere else in the study area and is therefore considered an *Exceptional Value Wetland*. Vegetation control measures such as mowing and herbicide use are not currently employed in Arnott Fen and would not be necessary for maintenance under alternative 1. Many of the plant species in the fen in the ROW are herbaceous and compatible with the vegetation maintenance programs previously described, although incompatible shrubs / small trees such as red maple are also present in the fen and would be hand cleared as part of vegetation management.

Approximately 0.02 acre of the Hogback Ridge wetland (characterized as a PEM/PSS wetland) is in the B-K Line ROW under alternative 1. The wetland contains deciduous scrub shrub wetland vegetation and is considered an *Exceptional Value Wetland*. Some of the plant species in the wetland are compatible with the applicant's specifications for vegetation clearing and control; however, incompatible shrub and small tree species such as red maple would be removed by hand clearing.

Approximately 4.45 acres of the Van Campen wetland complex (characterized as a PEM/PSS wetland) is in the B-K Line ROW under alternative 1. The wetland contains emergent and scrub shrub wetland vegetation and is considered an *Exceptional Value Wetland*. Some of the plant species in the wetland are compatible with the applicant's specifications for vegetation clearing and control; however, incompatible shrub and any small tree species would be removed by hand clearing.

In addition to the three wetland areas described above, a total of approximately 2.05 acres of scrub shrub wetlands (wetlands CC, 42, 45, 46, 47) are located within the B-K Line ROW and would be affected by vegetation maintenance activities. Incompatible shrubs and small trees would be removed from these scrub shrub wetlands under alternative 1. The removal of vegetation would increase the amount of open areas of the shrub layer in the wetlands. Open areas facilitate the growth and spread of nonnative invasive plants and also provide more sunlight to the understory, generally comprised of shade-tolerant plant species that cannot persist in full sun. The removal of incompatible shrubs or small trees from scrub shrub wetlands would result in their conversion to emergent wetlands and would cause the emergent understory to be fully exposed. For example, sphagnum moss and cinnamon fern are typical emergent wetland plants beneath the shrub layer that cannot persist in full sun once the shrub layer has been removed.

Although fill would not be placed in wetland areas, habitat conversion is considered a wetland impact because some of the wetland functions and values would change (including fish and wildlife productivity and habitat, threatened and endangered species habitat, vegetation habitat, water purification, and streamflow). Shrub removal in the B-K Line corridor would change functions and values by reducing the vegetation canopy over these wetlands, which would reduce the biomass and change the species composition of the wetland. The reduction in biomass would potentially alter the vegetation and wildlife species that use that wetland. This shift in the vegetation type could diminish available resources for wildlife species that depend on the conditions currently found in the wetland. Therefore, measurable changes to the abundance and diversity of wetland vegetation would occur. These areas would continue to function as wetlands, but there would be changes in the abundance and diversity of wetland vegetation, which could directly affect the use of the area by wildlife and listed species and could allow invasive plant species to colonize wetland areas. Managed ROW corridors do not return to the original species composition or structure and succeed to different wetland types (Jordan et al. n.d., 154). Because shrubs and small trees in the ROW under alternative 1 would continue to be maintained/removed, wetland areas within the ROW would not recover during the period of analysis to become fully functioning scrub shrub wetlands.

The regular maintenance and vegetation management in the ROW would cause disturbance to wetlands, including *Exceptional Value Wetlands* under alternative 1 throughout the period of analysis. Wetland functions and values that would change as a result of vegetation management include fish and wildlife productivity and habitat, threatened and endangered species habitat, vegetation habitat, water quality, and streamflow. Other wetland functions and values are unlikely to change as a result of alternative 1. The no-action alternative would result in impacts on a total of 7.51 acres of wetlands in park boundaries as a result of conversion to either emergent wetlands or scrub-shrub wetlands. Although vegetation removal and maintenance efforts would continue in rare and unique wetland communities, no new development or construction would be allowed under alternative 1. Overall, alternative 1 would result in adverse impacts on wetlands.

7.1.3 Common to All Action Alternatives

Removal of Existing Structures: All action alternatives (2, 2b, 3, 4, and 5) would involve the removal of all or a portion of the B-K Line, as discussed in chapter 2. For all action alternatives, the B-K Line structures would be removed but the foundations for these structures would remain in place. For alternatives 2 and 2b, the S-R Line would be completely re-constructed along the same alignment. The removal of the structures would require constructing access roads (either permanent or temporary, depending on the alternative). Under alternatives 2 and 2b, the removal of the B-K Line would require constructing access roads, and wire pull sites - wire pull sites would not be located in wetland areas. Because access roads would also be required for the construction and long-term maintenance of the new line, adverse impacts from removing the line would be the same (or less than) as the impacts discussed for construction of the S-R Line.

Vegetation Clearing: The ROWs would be cleared of vegetation for the construction of the new double 500-kV transmission line for alternatives 2 through 5, which would affect wetlands. For the analysis of impacts on wetlands, it was assumed that a 350-foot corridor would be cleared of vegetation for the construction of the new double 500-kV transmission line for alternatives 2, 3, 4, and 5. For these alternatives, the corridor would be cleared 175 feet from the centerline of the existing ROW to either side. Under alternative 2b, the applicant proposes to operate the S-R Line within the existing, narrower, ROW. The NPS anticipates that the applicant would require additional area for construction; therefore, it is estimated that under alternative 2b, the applicant would expand the ROW to the extent of their deeded property rights, which ranges from 100 feet to 380 feet. For alternative 2b, the ROW would be cleared on

either side of the centerline to an appropriate width based on the deeded property rights. Clearing would be complete for all action alternatives.

Construction Components: Construction activities that would affect wetlands - if wetland areas cannot be avoided - might include site preparation and construction of access roads, tower foundations, crane pads, wire pull locations, and pulling and splicing sites, as well as the use of heavy equipment and staging areas. These activities would disturb wetland functions and values. Specifically, the construction of access roads would cause increased sedimentation in adjacent wetland areas, thus affecting water clarity and water quality; wetlands can also be affected by siltation and alteration of drainage patterns resulting from access road construction, particularly if access roads are in or next to sensitive wetland areas. No equipment would be driven in wetlands (except for approved road construction) and nothing would be dragged through the wetlands for any reason because compaction can cause damage to soil structure, which determines the ability of a soil to hold and conduct water, nutrients, and air necessary for plant root activity and growth. Tires, treads, or dragged equipment or wood can cause rutting or trenching that would adversely modify the ground-water hydrology. Soil compaction would also increase runoff, thus increasing soil erosion. Soil compaction can also cause changes to hydrology, which would affect wetland function and possibly wildlife use (including special-status species) of the wetland. In addition to direct effects from construction component, indirect effects to wetlands resulting from activities in the adjacent uplands as stated in the RT&E species *Northern Population Recovery Plan* (USFWS 2001, appendix A) include:

- changes in hydrology (from roads, detention basins, irrigation, increases in impervious surfaces, sand and gravel mining);
- degradation of water quality (due to herbicides, pesticides, oil and salt from various sources including roads, agricultural fields, parking lots and residential developments);
- acceleration of succession (from fertilizer runoff); and
- introduction of exotic plants (due to soil disturbance and roads).

Specified best management practices (BMPs) to protect wetlands from increased sedimentation and compaction would be used to minimize and mitigate impacts, as described in Section 7.1 "Wetland Mitigation" of this SOF. All action alternatives would require drilling as part of the construction process and the NPS would require the applicant to submit a drilling plan and post-construction monitoring. There would be no drilling in wetlands. .

7.1.4 NPS Preferred Alternative 2

In Pennsylvania, a total of four wetlands would be affected under alternative 2 within park boundaries. Two of these four wetlands are the Hogback Ridge wetlands and Arnott Fen, both characterized as rare or unique communities as well as *Exceptional Value Wetlands*. In New Jersey six wetland areas would be affected under alternative 2, including the Van Campen wetland complex, characterized as a rare and unique community as well as an *Exceptional Value Wetland*. Table 6 and the paragraphs below describe impacts to individual wetland areas under alternative 2.

Approximately 4.1 acres of the Arnott Fen wetland complex (characterized as a PEM/PSS wetland) is in the 350-foot corridor of the proposed ROW under alternative 2 (figure 15). As described in the vegetation maintenance section above, the majority of the existing herbaceous vegetation in the fen includes compatible plant species, which would not be cleared to prepare for construction activities (PPL and PSE&G 2008, 7). Although the fen is dominated by emergent plant species (80 percent of the fen is considered PEM), a very small portion of the outer edges of the fen does include some incompatible shrubs / small trees, such as red maple, and would be hand cleared for construction and as part of the vegetation

maintenance programs. Downed wood would not be dragged out of the wetland. Access roads have been designed to avoid completely this sensitive wetland and no equipment would ever be driven in this wetland.

Approximately 0.47 acre of the Hogback Ridge wetland (characterized as a PEM/PSS wetland) is located within the 350-foot corridor of the proposed ROW under alternative 2 (figure 16). The wetland contains some incompatible shrub / small tree species, such as red maple that would be hand cleared as part of construction and vegetation maintenance activities, but 60 percent of Hogback Ridge is considered PEM and would not be affected by vegetation maintenance activities. Access roads would not be constructed through the Hogback Ridge wetland and no equipment would ever be driven in this wetland. However, indirect adverse impacts could occur as a result of access road construction, tower construction, and vegetation clearing adjacent to the wetland. These adverse impacts include the potential for impeding the natural flow of water into or out of the wetland area and changes to the movement of wetland wildlife (such as turtles and salamanders) and the distribution of wetland plant seeds.

Approximately 9.6 acres of the Van Campen wetland complex (characterized as a PEM/PSS wetland) is located in the 350-foot corridor of the proposed ROW under alternative 2 (figure 17). Some of the plant species in the wetland are incompatible shrub / small tree species that would be removed by hand clearing for construction and maintenance activities, but 40 percent of this wetland is considered PEM and would not be affected by vegetation maintenance activities. However, approximately 10,000 square feet (0.23 acre) of the wetland vegetation in the ROW is proposed for clearing under alternative 2 because the applicant's proposal includes a tower pad in the wetland area. In addition, 0.56 acre (which includes the limits of construction) of PEM/PSS wetlands that are part of the Van Campen wetland complex would be directly and adversely affected by access roads.

In addition to the rare or unique communities that support the *Exceptional Value Wetlands* discussed above, nine other wetlands would be adversely affected under alternative 2 within park boundaries:

- Wetland BB has both PEM and PFO wetland portions that support plant species (red maple) incompatible with the existence of the power line. This wetland is considered an *Exceptional Value Wetland* because it supports special-status species. Impacts from clearing trees in the forested wetland would occur on 1.05 acres of wetland; no direct impacts from access roads would be expected and impacts to the emergent (PEM) portion of the wetland are not expected because the vegetation is considered compatible and would not require vegetation maintenance (figure 18). No equipment would ever be driven through this wetland.
- Wetland CC is a PEM/PSS wetland near the northern portion of the alignment. Generally, the wetland vegetation is considered compatible plants species (70 percent of wetland CC is considered PEM), but clearing may result in impacts on 0.22 acres of the wetland (figure 19). Direct impacts from access roads would avoid wetland CC and no equipment would ever be driven through this wetland.
- Wetland 42 has both PEM/PSS and PFO wetland areas partially located in the proposed ROW. Impacts from clearing trees would occur on 0.04 acres of the forested (PFO) wetland in the proposed ROW (figure 20). Some of the wetland vegetation is considered compatible plants species (40 percent of wetland 42 is considered PEM), but clearing may result in impacts on 0.74 acres of the PEM/PSS wetland in the proposed ROW (figure 20). Access roads would directly and permanently affect approximately 0.09 acre of the PEM/PSS wetland. With the exception of the access road, no equipment would ever be driven through this wetland.
- Wetland 45 is a PEM/PSS wetland in the ROW. Some of the wetland vegetation is considered compatible plants species (20 percent of wetland 45 is considered PEM), but clearing may result in impacts on 1.09 acres of the PEM/PSS wetland in the proposed ROW (figure 21). The

construction of the tower pads would permanently affect 0.12 acre of this wetland. No equipment would ever be driven through this wetland.

- Wetland 46 is a PEM/PSS wetland that surrounds a pond in the ROW. Some of the wetland vegetation is considered compatible plants species (30 percent of wetland 46 is considered PEM), but clearing may result in impacts on 0.24 acre of this wetland in the proposed ROW (figure 22). Direct impacts from access roads would avoid wetland 46 and no equipment would ever be driven through this wetland.
- Wetland 47 is a PEM/PSS wetland in the ROW. Some of the wetland vegetation is considered compatible plants species (50 percent of wetland 47 is considered PEM), but clearing may result in impacts on 0.08 acres of the PEM/PSS wetland in the proposed ROW (figure 23). Access roads would permanently affect approximately 0.02 acre of this wetland (figure 23). With the exception of the access road, no equipment would ever be driven through this wetland.

The removal or felling of trees in forested wetland areas or shrubs in scrub shrub wetlands would increase the amount of open canopy in the wetland areas. Open canopy facilitates the growth and spread of nonnative invasive plants, which spread into forested or scrub shrub wetland areas. Open canopy also provides more sunlight to the understory and shade-tolerant plant species cannot persist in full sun. In forested wetlands, shallow-rooted species protect each other from potential wind damage; whenever trees are removed from a forested wetland, the possibility of blowdowns or windthrow (trees uprooted or broken by wind) increases (MIDNR 1992, LC-3). Edge trees also protect shallow-rooted species by shielding them from the prevailing wind; it is suggested that as many edge trees as possible be left on the prevailing wind side of the cleared area (MIDNR 1992, LC-3). Therefore, the removal of trees in the wetland and along the forested wetland edge would increase the open canopy and could cause an increased potential for blowdowns to occur, which could further adversely affect the wetlands where trees have been removed.

Tree removal in forested wetlands would result in the conversion of wetland habitat type from a forested wetland to an emergent or scrub shrub wetland. In addition, the removal of incompatible shrubs or small trees from scrub shrub wetlands would result in their conversion to emergent wetlands. The removal of the shrub layer from these PEM/PSS wetlands would cause the emergent understory to be fully exposed. For example, sphagnum moss and cinnamon fern are typical emergent wetland plants beneath the shrub layer of wetlands along alternative 2 that cannot persist in full sun once the shrub layer has been removed. Although fill would not be placed in wetland areas during vegetation clearing activities, habitat conversion is considered a wetland impact because some of the wetland functions and values would change (including fish and wildlife productivity and habitat, threatened and endangered species habitat, wildlife canopy habitat, water purification, and hydrology).

It has been demonstrated that removing trees from a forested wetland does not interrupt the prevailing ground water hydrology of the site but evaporation and evapotranspiration may be significantly increased (Cutlip 1986). Tree removal in the B-K Line corridor and in forested wetlands would change functions and values by reducing the vegetation canopy over these wetlands, which would reduce the biomass and change the species composition of the wetland (Cutlip 1986). The reduction in biomass would potentially alter the vegetation and wildlife species that use that wetland. This shift in the vegetation type could lessen available resources for wildlife species that depend on the conditions currently found in the wetland. Therefore, measurable changes to the abundance and diversity of wetland vegetation would occur. These areas would continue to function as wetlands, but the changes to vegetation could directly affect the use of the area by wildlife and listed species and could allow invasive plant species to colonize wetland areas.

The regular maintenance and vegetation management in the ROW would cause disturbance to wetlands, including *Exceptional Value Wetlands* under alternative 2 throughout the life of the power line. Wetland functions and values that would change as a result of vegetation management include fish and wildlife

productivity and habitat, threatened and endangered species habitat, vegetation habitat, water quality, and hydrology. Managed ROW corridors do not return to the original species composition, and because they are artificially maintained, natural succession or evolution of the wetland is interrupted (Jordan et al. n.d., 154). In other words, because northern forested wetlands may take 50 years to reach maturity (Kusler 2006, iii) and because trees and shrubs would be maintained/removed, these wetland areas would never recover during the life of the power line to become fully functioning forested or scrub shrub wetlands.

Construction impacts described under alternative 2 would cause both permanent and temporary changes to wetland functions and values, including those designated as having *Exceptional Value Wetlands*. Site preparation and construction of the access roads would destroy all wetland functions and values. Heavy equipment operation in the ROW during the construction of access roads across a ROW in a forested wetland has been shown to interrupt the natural hydrologic regime of the forested wetland and cause the impoundment of water (Cutlip 1986). The construction of access roads both adjacent to and through wetlands would fragment the wetlands, resulting in changes to hydrology and impeding water movement, ground-level wildlife movement, and the seed distribution of wetland plants. Access roads would also reduce the ability of wetlands to perform functions such as groundwater discharge/recharge, sediment/toxicant retention, nutrient removal, flood flow alteration, and/or storage, and production export may be temporarily decreased due to temporary disturbance adjacent to the wetland. Access roads would also cause the wetlands' stormwater/nutrient assimilative capacity to be lost and construction vehicles along the roads could introduce toxic substances (oil and grease). During construction activities, siltation/runoff into wetland areas could occur but would be contained with approved BMPs as discussed under "Common to All Action Alternatives".

Overall, alternative 2 would adversely impact a total of 18.65 acres within park boundaries. Conversion to scrub shrub and/or emergent wetlands as a result of vegetation clearing and maintenance activities, including rare and unique communities and *Exceptional Value Wetlands* would occur within 17.63 of the total acreage. Access roads and tower pads would permanently destroy an additional 1.02 acres of wetlands. Overall, alternative 2 would result in adverse impacts on wetlands as a result of vegetation removal and maintenance, and the access roads, and tower foundations portions of which would affect rare and unique wetland communities as well as *Exceptional Value Wetlands*.

7.1.5 Alternative 2b

In Pennsylvania, a total of four wetlands would be affected under alternative 2b. Two of these four wetlands are the Hogback Ridge wetlands and Arnott Fen, both characterized as rare or unique communities as well as *Exceptional Value Wetlands*. In New Jersey six wetland areas would be affected under alternative 2b, including the Van Campen wetland complex, characterized as a rare and unique community as well as an *Exceptional Value Wetland*. Table 6 and the paragraphs below describe impacts to individual wetland areas under alternative 2b.

Approximately 1.30 acres of the Arnott Fen wetland complex (characterized as a PEM/PSS wetland) is located in the corridor of the proposed ROW under alternative 2b. Some incompatible shrubs / small trees such as red maple exist in the fen and would be hand cleared for construction and as part of the vegetation maintenance programs. No new access roads or tower foundations would be placed in the Arnott Fen wetland complex.

Approximately 0.02 acre of the Hogback Ridge wetland (characterized as a PEM/PSS wetland) is located in the corridor of the proposed ROW under alternative 2b. Because the wetland contains deciduous scrub shrub wetland vegetation, most of the plant species in the wetland would not be disturbed. Incompatible shrub / small tree species such as red maple exist in the wetland area and would be hand cleared as part of construction and vegetation maintenance activities. Access roads would not be constructed through

Hogback Ridge wetland. A tower pad would also be partially located in the wetland, affecting approximately 0.01 acre of the wetland. Indirect adverse impacts could result from access road construction and vegetation clearing adjacent to the wetland. These activities would adversely affect the wetland in the same manner as described in detail above for alternative 2.

Approximately 4.82 acres of the Van Campen wetland complex (characterized as a PEM/PSS wetland) is located in the corridor of the proposed ROW under alternative 2b. Some of the plant species in the wetland are incompatible shrub / small tree species that would be removed by hand clearing for construction and maintenance activities. Additionally, approximately 10,000 square feet (0.23 acre) of the wetland vegetation in the ROW is proposed for clearing under alternative 2b because the applicant's proposed plan includes a tower in the wetland area that would require constructing a tower pad. Also, approximately 0.56 acre of PEM/PSS wetlands that are part of the Van Campen wetland complex would be directly and adversely affected by access roads. These activities would adversely affect the wetland in the same manner as described in detail above for alternative 2.

In addition to the rare or unique communities that support wetlands discussed above, nine other wetlands would be adversely affected under alternative 2b.

- Wetland BB is a PFO wetland in the proposed ROW under alternative 2b and is considered an *Exceptional Value Wetland*. Impacts from clearing trees in the forested wetland would occur on 0.21 acre of the wetland; no direct impacts from access roads would be expected.
- Wetland CC is a PEM/PSS wetland near the northern portion of the alignment. Generally, the wetland vegetation is considered compatible plants species, but clearing may result in impacts on 0.21 acres of the wetland. Direct impacts from access roads would avoid wetland CC.
- Wetland 42 has both PEM/PSS and PFO wetland areas partially located in the proposed ROW. Impacts from clearing trees would occur on 0.04 acres of the forested (PFO) wetland in the proposed ROW and impacts from clearing shrubs would occur on 0.52 acres of the PEM/PSS wetland in the proposed ROW. Access roads would directly and permanently affect approximately 0.09 acre of the PEM/PSS wetland.
- Wetland 45 is a PEM/PSS wetland in the ROW. Impacts from clearing shrubs / small trees would occur on 0.75 acre of this wetland. A tower pad would affect 0.10 acre of this wetland.
- Wetland 46 is a PEM/PSS wetland that surrounds a pond in the corridor. Impacts from clearing shrubs / small trees would occur on 0.20 acre of this wetland.
- Wetland 47 is a PEM/PSS wetland in the ROW. Impacts from clearing shrubs / small trees would occur on 0.08 acre of this wetland; access roads would directly and permanently affect approximately 0.02 acre of this wetland.

Overall, alternative 2b impacts on wetlands due to construction and associated activities and vegetation clearing would result in the degradation or loss of 8.15 acres of wetlands through conversion to scrub shrub and/or emergent wetlands, and impacts due to access roads and tower pads would permanently affect 1.01 acres of wetlands. The total impacts (acreage) of alternative 2b are less than the impacts for alternative 2 because the cleared corridor is narrower under alternative 2b. Rare or unique wetland communities as well as *Exceptional Value Wetlands* would be permanently altered by access road and tower pad construction. Overall, adverse impacts on wetlands would occur under alternative 2b.

7.1.6 Common to Action Alternatives 3 through 5

Restoration of the B-K Line*:* For alternatives 3, 4, and 5, the portion of the B-K Line between the Bushkill Substation and the eastern boundary of DEWA would be permanently removed and the ROW would be restored. The ROW would be allowed to ultimately return to forested habitat over the long term, including wetlands that are currently maintained through vegetation clearing and tree removal. Approximately 7.3 acres of wetlands within the Park boundary would be allowed to recover under these alternatives (includes wetland acreage in the existing B-K Line ROW at Arnott Fen, Hogback Ridge, Van Campen, and wetlands 42, 45, 46, 47). Spur roads would be required on a temporary basis to remove the line and would affect a maximum of 0.67 acre of wetlands. After the line is removed, the spur roads would be removed and returned to preconstruction conditions; there would be no permanent impacts on wetlands. No periodic maintenance would be required; after construction, wetland areas would no longer be impacted by tree removal. Therefore, approximately 8.4 acres of wetlands in the B-K Line ROW would be expected to recover under alternatives 3, 4, and 5. While the wetlands may not become fully functioning in the period of analysis of the associated EIS (15 years), the process would begin and would be a beneficial impact.

7.1.7 Alternative 3

Numerous small emergent wetland areas occur in the existing transmission line ROW under alternative 3 but would generally not be affected by construction activities or vegetation maintenance because they are herbaceous plant species that are compatible with the applicant's specifications for vegetation clearing and control. Three wetland areas under alternative 3 would be adversely affected under this alternative (table 6).

- Wetland 8 is a small PEM wetland in the corridor that is vegetated predominantly with sphagnum moss. Adverse impacts would occur on 0.02 acre of wetland 8 because an access road would be constructed through the wetland. The hydrology of this wetland arises from a seep, so impacts on this wetland as a result of an alteration of hydrology from access roads and other construction activities in the wetland are possible due to ponding and/or impoundment of water.
- Wetland 10 is a PSS wetland in the corridor of alternative 3. Some of the plant species in the wetland are incompatible shrub / small tree species (red maple) that would be removed by hand clearing for construction and maintenance activities. Impacts from clearing shrubs / small trees would occur on 0.29 acre of the wetland.
- NWI-3 is a PFO wetland in the corridor of alternative 3 that supports evergreen and deciduous species. Approximately 1.43 acres of NWI-3 would be adversely affected as a result of vegetation clearing and tree removal. Removing trees in this wetland would convert it from a forested wetland to a scrub shrub and/or emergent wetland. Because this wetland is seasonally flooded, habitat conversion of this forested wetland could impact the hydrology of the wetland because fewer trees (biomass) would exist in this wetland.

In addition to wetland impacts in the alternative 3 corridor, wetland vegetation along the B-K Line corridor would be affected along the portion of alternative 3 from the Bushkill Substation to the western boundary of DEWA. Vegetation would be cleared and maintained, and access roads would be required to upgrade the line for alternative 3 but only 0.21acre of wetland CC would be affected by these activities. Under alternative 3, there are four stream crossings required by a permanent access road proposed within the park, but there are no plans to widen the bridges and there are no associated wetlands beyond the stream channels. If it is determined that the bridges need to be widened and/or improved, construction would be done with no impacts to the water body through construction of a bridge or other structure that would completely span the channel (i.e., no pilings, fill, or other support structures in the stream habitat).

Under alternative 3, general impacts on wetland functions and values as a result of construction and removing shrubs/trees would be similar to those discussed in detail under alternative 2, although total impacts (acreage) would be far less. Overall, alternative 3 would adversely affect wetlands due to vegetation clearing that would result in the loss of 1.93 acres of wetlands and due to the construction of access roads that would result in the loss of 0.02 acre of wetlands. Wetlands in rare or unique communities would not be affected under alternative 3. Spur roads would be required on a temporary basis to remove the line and would affect a maximum of 0.67 acre of wetlands. After the line is removed, the spur roads would be removed and returned to preconstruction conditions; there would be no permanent impacts on wetlands. Approximately 7.3 acres of wetlands within the Park boundary would be allowed to recover through the revegetation of the B-K Line. Although the B-K Line from the Bushkill Substation to the eastern boundary of DEWA would be removed and revegetated and all construction activities would be short term, the regular maintenance of the alternative 3 ROW and the access roads would cause disturbance to occur throughout the period of analysis. Therefore, the trees cleared under alternative 3 would never be allowed to mature in the ROW and would not recover during the period of analysis to return to fully functioning wetlands. Overall, alternative 3 would result in adverse impacts on wetlands.

7.1.8 Alternative 4

Two wetland areas under alternative 4 would be adversely affected under this alternative (table 6). Wetlands 1 and 2 are contiguous PFO wetlands in the proposed ROW. Approximately 1.77 acres of wetland 1 and 0.71 acre of wetland 2 would be adversely affected as a result of vegetation clearing and tree removal under alternative 4. Both wetlands support red maple, which is an incompatible tree species that would be removed. Alternative 4 would adversely affect approximately 2.48 acres of forested wetlands (wetland 1, wetland 2), not including wetlands affected by removal of the B-K Line from the Bushkill Substation to the western boundary of DEWA, as described below. In addition to vegetation clearing and tree removal, adverse impacts would occur on 0.01 acre of wetland 2 from access road construction activities in the wetlands. Other impacts from construction activities under alternative 4 would be similar to those discussed under "Common to All Action Alternatives," including specified BMPs to minimize impacts.

In addition to wetland impacts in the alternative 4 corridor, wetland vegetation along the B-K Line corridor would be affected along the portion of alternative 4 from the Bushkill Substation to the western boundary of DEWA. Vegetation would be cleared and maintained, and access roads would be required to upgrade the line for alternative 4 but only 0.21 acre of wetland CC would be affected by these activities.

General impacts on wetland functions and values as a result of construction and removing shrubs/trees for alternative 4 would be similar to those discussed in detail under alternative 2, although total impacts (acreage) would be less. Overall, alternative 4 would affect wetlands due to construction activities and vegetation clearing that would result in the total loss of 2.69 acres of wetlands through conversion to scrub shrub and/or emergent wetlands and due to access roads that would permanently affect 0.01 acre of wetlands. Portions of wetland 1are considered a rare or unique community that would be affected under alternative 4. Spur roads would be required on a temporary basis to remove the B-K Line and would affect a maximum of 0.67 acre of wetlands. After the line is removed, the spur roads would be removed and returned to preconstruction conditions; there would be no permanent impacts on wetlands. Approximately 7.3 acres of wetlands within the Park boundary would be allowed to recover through the revegetation of the B-K Line. Although the B-K Line from the Bushkill Substation to the eastern boundary of DEWA would be removed and revegetated and all construction activities would be short term, the regular maintenance of the alternative 4 ROW and the access roads would cause disturbance to occur throughout the period of analysis. Therefore, the trees cleared under alternative 4 would never be allowed to mature in the ROW and would not recover during the period of analysis to become fully functioning wetlands. Overall, alternative 4 would result in adverse impacts on wetlands.

7.1.9 Alternative 5

Two wetland areas under alternative 5 would be adversely affected under this alternative (table 6). Inside the study area, alternative 5 would follow the same route through DEWA and APPA as alternative 4, with the exception of the portion of the B-K Line from the Bushkill Station to the western boundary of DEWA. Alternative 5 would adversely affect approximately 2.48 acres of forested wetlands (wetland 1, wetland 2). Additionally, the construction of access roads would adversely affect 0.01 acre of wetlands under alternative 5 (wetland 2).

Overall, alternative 5 would affect wetlands due to construction activities and vegetation clearing that would result in the loss of a total of 2.48 acres of wetlands through conversion to scrub shrub and/or emergent wetlands and due to access roads that would permanently affect 0.01 acre of wetlands. Portions of wetland 1 are considered a rare or unique community that would be affected under alternative 5. Spur roads would be required on a temporary basis to remove the B-K Line and would affect a maximum of 0.67 acre of wetlands. After the line is removed, the spur roads would be removed and returned to preconstruction conditions; there would be no permanent impacts on wetlands. Although the B-K Line from the Bushkill Station to the eastern boundary of DEWA would be removed, all construction activities would be short term and 7.3 acres of wetlands within the Park boundary would be allowed to recover. The regular maintenance of the alternative 5 ROW and the access roads would cause disturbance to occur throughout the period of analysis. Therefore, the trees and shrubs cleared under alternative 5 would never be allowed to mature in the ROW, which would prevent these wetland areas from becoming fully functioning wetlands. Overall, alternative 5 would result in adverse impacts on wetlands.

7.2 FLOOD RISK OF THE PROPOSED PROJECT AREA

Floodplain zones, as mapped by FEMA, are located within the site boundary. The NPS has adopted guidelines pursuant to Executive Order 11998, "Floodplain Management" stating that it is NPS policy to restore and preserve natural floodplain values and avoid environmental impacts associated with the occupation and modification of floodplains.

It is important to note that impacts to floodplains as a result of permanent access roads and crane and tower pad locations were determined based upon the applicant's proposal as a worst-case scenario for Alternative 2 floodplain impacts. However, the Park would continue to work the applicant to reduce, avoid, and minimize any impacts to floodplains as the design phase progresses. There are currently no engineering design plans for road typicals to include in this SOF. Figures 9 through 14 present floodplains affected by each alternative for this project.

7.2.1 Common to All Alternatives

Vegetation Management: Vegetation would be cleared or managed in floodplain areas for all alternatives. PPL and PSE&G have separate vegetation management plans because they are distinct utility companies working in different states.

Mitigation Measures: Mitigation measures would reduce impacts from construction, operation, and maintenance activities. None of the mitigation measures would eliminate impacts on floodplains; however, measures would minimize the potential of flooding or adverse impacts on floodplains.

7.2.2 Alternative 1 (No Action)

Inside the study area, no widening of the ROW would occur as part of the no-action alternative. The existing line and ROW span approximately 700 feet of the floodplain of the Delaware River in DEWA

(MDSR) and of Bushkill Creek in DEWA. Overhead transmission line crossings such as this have no impact on the floodplain. Two existing transmission line structures (approximately 30 feet by 30 feet) are in the floodplain. No new development or new structures would be placed in the floodplain under alternative 1. The periodic maintenance of the transmission line, specifically the clearing of vegetation in the ROW in the floodplain, may affect some natural floodplain values (which include vegetation) that contribute to ecosystem quality (NPS 2002). However, the periodic clearing of vegetation in the ROW in floodplain areas would not alter floodplain storage or obstruct floodwaters and no new development would occur in the floodplain under alternative 1.

7.2.3 Common to All Action Alternatives

Removal of Existing Structures*:* All action alternatives (2, 2b, 3, 4, and 5) would involve the removal of the B-K Line from the Bushkill Substation to the eastern boundary of DEWA. This would include removal of the B-K Line structures, but the foundations for these structures would remain in place. For alternatives 2 and 2b, the S-R Line would be constructed along the same alignment. The removal of the structures would require the construction of access roads (either permanent or temporary, depending on the alternative) along the B-K Line to allow access to and removal of the structures. The impacts of removing the structures are discussed under each alternative.

Vegetation Clearing*:* The ROWs would be cleared of vegetation for the construction of the new double 500-kV transmission line for alternatives 2 through 5, which could affect floodplains. Alternatives 2, 3, 4, and 5 include clearing up to 350 feet; the ROW would be extended up to 175 feet from either side of the centerline of the existing ROW. Under alternative 2b, the applicant proposes to operate the S-R Line within the existing ROW. The NPS anticipates that the applicant would require additional area for construction; therefore, it is estimated that under alternative 2b, the applicant would expand the ROW to the extent of their deeded property rights, which ranges from 100 feet to 380 feet. For alternative 2b, the ROW would be cleared on either side of the centerline to an appropriate width based on the deeded property rights. Clearing would be complete for all action alternatives.

Construction Components: Construction activities that would affect floodplains include the construction of access roads, tower foundations, crane pads, wire pull locations, pulling and splicing sites, and staging areas.

7.2.4 NPS Preferred Alternative 2

Under alternative 2, the preferred alternative, vegetation clearing would be nearly complete in the 350-foot corridor. Vegetation clearing would be avoided in sensitive areas such as riparian corridors along the Delaware River (PPL and PSE&G 2008, 7), which support floodplain vegetation. Specifically, vegetation would not be cleared in the 100-foot buffer near perennial waterways, such as the Delaware River (PPL and PSE&G 2008, 7). Even so, some vegetation beyond the buffer areas would be cleared in the floodplain and would affect natural floodplain values (which include vegetation) that contribute to ecosystem quality (NPS 2002). A maximum of 14.3 acres of vegetation in the floodplain would potentially be maintained and could be removed if incompatible plant species exist.

The overhead transmission line for alternative 2 would cross approximately 700 feet of the floodplain of the Delaware River in DEWA (MDSR) and Bushkill Creek in DEWA. The overhead transmission line crossing would have no impact on the floodplain, but associated activities may adversely affect floodplains. An existing tower is partially located in the floodplain of Bushkill Creek and a second existing tower is partially located in the floodplain of Sand Hill Creek. The applicant would place two new, larger towers in the same locations, over an area of approximately 0.002 acre. The construction of these support structures for the transmission line would not result in any increase in flood hazard either as a result of increased

flood elevations or changes in flow carrying capacity of any of the streams being crossed by the overhead lines. However, portions of the access roads required for maintenance and construction purposes would be located in some floodplain areas. Access roads would affect 0.14 acre of the floodplain. Once the transmission line is operational, vegetation maintenance would be required in the new ROW, including floodplains as described for alternative 1. Overall, adverse impacts on floodplains would result from access roads, new tower pads, and vegetation clearing within floodplains under alternative 2. To minimize adverse impacts on natural and beneficial floodplain values, mitigation measures would be implemented as discussed previously; BMPs would be used during construction activities; and certain areas would be revegetated per vegetation plans approved by the NPS to reduce erosion into streams, wetlands, and floodplains.

Van Campen Brook Bridge Replacement. A stream crossing is proposed which would be a replacement of an existing bridge. The construction would not occur within the wetland boundary of the creek (inside the ordinary high water marks on either bank).

Unnamed Tributary to Sand Hill Creek Crossing. A stream crossing is proposed to cross an unnamed tributary to Sand Hill Creek as part of access road construction. The construction would not occur within the wetland boundary of the creek (inside the ordinary high water marks on either bank).

7.2.5 Alternative 2b

Under alternative 2b, vegetation would be cleared in the corridor of the proposed ROW under alternative 2b, except in sensitive areas such as the riparian buffer along the Delaware River (PPL and PSE&G 2008, 9) and buffers as described for alternative 2. However, some vegetation beyond the buffer areas would be cleared in the floodplain, which would affect natural floodplain values (which include vegetation) that contribute to ecosystem quality (NPS 2002). A maximum of 8.35 acres of vegetation in the floodplain would potentially be maintained and could be removed if incompatible plant species are present.

The overhead transmission line for alternative 2b would cross approximately 700 feet of the floodplain of the Delaware River in DEWA (MDSR) and the floodplain of Bushkill Creek in DEWA. Overhead transmission line crossings would have no impact on floodplains; however, structures, clearing, and access roads may adversely affect floodplains. An existing tower is partially located in the floodplain of Bushkill Creek and a second existing tower is partially located in the floodplain of Sand Hill Creek. Similar to alternative 2, the applicant would place two new, larger towers in the same locations, over an area of approximately 0.002 acre. Additionally, the construction of access roads would affect approximately 0.14 acre of the floodplain under alternative 2b.

Floodplains would be adversely impacted as a result of construction of access roads, and new tower pads and vegetation clearing in floodplains under alternative 2b. To minimize adverse impacts on natural and beneficial floodplain values, BMPs would be used during construction activities as described for alternative 2.

7.2.6 Common to Action Alternatives 3 through 5

Restoration of the B-K Line*:* Under alternatives 3, 4, and 5, the portion of the B-K Line between the Bushkill Substation and the eastern boundary of DEWA would be permanently removed and the ROW would be restored. The removal of this portion of the B-K Line would not be conducted in floodplain areas. The ROW (approximately 53 acres within NPS boundaries) would be allowed to ultimately return to forested habitat over the long term. While natural communities would not return to mature conditions in the period of analysis of the associated EIS (15 years), the process would begin and would create a beneficial impact on floodplains.

7.2.7 Alternative 3

Construction and vegetation clearing would occur in floodplain zones under alternative 3. Vegetation would be cleared in the 350-foot corridor, except in sensitive areas such as riparian corridors along the Delaware River (PPL and PSE&G 2008, 9) as described for alternative 2. However, some vegetation would be cleared in the floodplain, which would affect natural floodplain values (which include vegetation) that contribute to ecosystem quality (NPS 2002). A maximum of 7.93 acres of vegetation in the floodplain would be cleared if incompatible plant species were present. Overhead transmission line crossings would have no impact on the floodplain, but associated activities may adversely affect floodplains. Approximately 0.06 acre within the floodplain would be cleared and adversely affected by proposed access roads in the study area for alternative 3. For alternative 3, tower pads, and pulling and splicing sites are unknown at this time.

Alternative 3 would also include the removal and upgrade of the B-K Line from the Bushkill Substation to the western boundary of DEWA would adversely affect floodplains. The applicant would place two tower pads within floodplains, totaling approximately 0.002 acre. The construction of these support structures for the transmission line would not result in any increase in flood hazard either as a result of increased flood elevations or changes in flow carrying capacity of any of the streams being crossed by overhead lines. Portions of access roads required for maintenance and construction purposes would be located in floodplain areas. Specifically, alternative 3 would require the development of two access roads by Bushkill Creek to remove and upgrade the B-K Line; these access roads would impact 0.16 acre in the floodplain.

Overall, a total of 0.222 acre of the floodplain (0.06 acre + 0.16 acre + 0.002 acre) would be affected by permanent access roads and new tower pads; vegetation would be cleared in the floodplain under alternative 3. These activities would adversely impact floodplains, but BMPs would be used during construction activities to minimize impacts on natural and beneficial floodplain values.

7.2.8 Alternative 4

No construction or vegetation clearing would occur in any floodplain zones within the boundaries of DEWA, APPA, or MDSR under alternative 4. Therefore, no access roads would be constructed in the floodplain, although tower pad, and pulling and splicing sites are unknown at this time.

Alternative 4 would include the removal and upgrade of the B-K Line from the Bushkill Substation to the western boundary of DEWA would adversely affect floodplains. The applicant would place two tower foundations within floodplains, totaling approximately 0.002 acre. The construction of these support structures for the transmission line would not result in any increase in flood hazard either as a result of increased flood elevations or changes in flow carrying capacity of any of the streams being crossed by overhead lines. Portions of access roads required for maintenance and construction purposes would be located in floodplain areas. Specifically, alternative 3 would require the development of two access roads by Bushkill Creek to remove and upgrade the B-K Line; these access roads would impact 0.16 acre in the floodplain.

Overall, approximately 0.162 acre of the floodplain (0.16 acre + 0.002 acre) would be affected by construction of access roads, tower pads under alternative 4, resulting in adverse impacts on floodplains. To minimize adverse impacts on natural and beneficial floodplain values, BMPs would be used during construction activities as described in section 10 of this SOF.

7.2.9 Alternative 5

No construction or vegetation clearing would occur in any floodplain zones within the boundaries of DEWA, APPA, or MDSR under alternative 5. The B-K Line from the Bushkill Substation to the western boundary of DEWA would be maintained periodically as described for alternative 1, but would not be part of the S-R Line. Specifically, clearing vegetation in the ROW in the floodplain would adversely affect natural floodplain values (which include vegetation) that contribute to ecosystem quality (NPS 2002). However, the periodic clearing of vegetation in the ROW would not alter floodplain storage or obstruct floodwaters, and there would be no development in the floodplain.

8.0 MITIGATION MEASURES

8.1 WETLAND MITIGATION

8.1.1 Preferred Alternative Wetland Impact Avoidance and Minimization Practices

Overall, the preferred alternative 2 would result in a total of 18.65 acres of adverse impacts on wetlands as a result of vegetation removal and maintenance, permanent access roads, and tower pads. Of the total, access roads and tower pads would permanently fill 0.67 and 0.35 acre respectively.

The most critical mitigation measures to the NPS are those that avoid and minimize adverse impacts to park resources. The applicant has outlined mitigation measures that they would implement and that the NPS would require as conditions of the permit, most notably:

- The applicant has conducted additional consultation with the USFWS and agreed to implement necessary measures to avoid and minimize adverse impacts to the federally listed RT&E species.
- Installation of foundations for towers would involve drilling rather than blasting, which would minimize the potential for fracturing limestone formations, and geotechnical investigations would be performed prior to finalizing specific foundation design.
- Different design options, structure types, and construction methods would be utilized that would reduce or eliminate the need for access road construction near wetlands, assuming these different options do not increase impacts elsewhere.
- The access road originally proposed through Arnott Fen would not be constructed. An alternative road outside of wetland areas has been identified as was described under alternative 2.
- No access roads would be constructed within 200 feet of the Middle Delaware Scenic River.

These proposed changes in project design have been incorporated into the alternative 2 description and are integral components of the preferred alternative.

As per Director's Order 77-1 (NPS 2012), the applicant would compensate for unavoidable impacts to wetlands through funding the completion of several wetland restoration and rehabilitation projects. Compensation for wetland impacts includes a combination of compensatory mitigation projects within the park that includes wetland restoration, stream restoration, and removal of invasive plant species from high-quality wetlands.

The preferred alternative 2 would require additional vegetation clearing in wetland areas on each side of the ROW in both Pennsylvania and New Jersey portion within the park as well as proposed permanent access roads within wetland areas (including streams which are riverine wetlands).

Specific wetland mitigation practices that have been incorporated into the proposed project and that NPS would require include the following:

- Installation of foundations for towers would involve drilling rather than blasting, which would minimize the potential for fracturing limestone formations, and geotechnical investigations would be performed prior to finalizing specific foundation design. No drilling would occur in wetlands. Any drilling within the ground water source of a wetland would be monitored for adverse impacts to water quality. The location of sampling wells, installation, and analysis of pre- and post-construction data would be completed by a third party certified hydrologist hired by the applicant and managed by NPS park staff. The hydrologist would also certify that drilling would not create preferential ground water flow paths that would alter wetland hydrology at or near the drill sites.
- The stream (riverine wetland) crossings evaluated in this document would not be impacted below the ordinary high water line of the channel.
- The Park would continue to work with the applicant to reduce, avoid, and minimize impacts to wetlands as the design phase progresses. There are currently no engineering design plans for road typicals to include in this SOF. Roads would not be constructed without NPS approved plans. Road alignments through wetlands, as identified in this SOF, would be analyzed for opportunity to realign the road around the wetland by creating a new road or by using existing roads and designing short secondary roads where access into the wetland is absolutely necessary (e.g., Van Campen Wetland Complex, and Wetlands 42 and 47; Alternative 2; Figures 17, 20, and 23 may have opportunity for road realignment out of wetlands). The analysis would be done by a third party consultant hydrologist and wetland scientist that would be funded by the applicant and managed by NPS. This road realignment analysis would be completed for each road segment proposed in a wetland and done before any construction activity occurs in wetlands. Any realignment would be incorporated into the engineering drawings and approved by NPS before any construction begins.
- Crane pad or tower pad locations in wetlands, as identified in this SOF, would be analyzed for opportunity to relocate the pads out of wetlands (e.g., Hogback Ridge Wetland, Alternative 2, figure 16 may have opportunity for pad relocation out of the wetland). The analysis would be done by a third party consultant hydrologist and wetland scientist that would be funded by the applicant and managed by NPS. This pad relocation analysis would be completed for each pad proposed to be located in a wetland and done before any construction activity occurs in wetlands. Any relocation would be incorporated into the engineering drawings and approved by NPS before any construction begins.
- Proposed road alignments through floodplains would be analyzed for opportunities to realign the road in order to minimize impacts to floodplain processes by moving the proposed road alignment to a better location, or by utilizing existing roads instead of creating new ones, and by designing short secondary roads where access into the floodplain is absolutely necessary. The analysis would be done by a third party consultant hydrologist that would be funded by the applicant and managed by NPS. This road realignment analysis would be completed for each road segment proposed in a floodplain and done before any construction activity occurs in floodplains. Any realignment would be incorporated into the engineering drawings and approved by NPS before any construction begins.
- All roads (either to be proposed in floodplains or proposed in wetlands as reviewed in this SOF) would be designed to minimize adverse impacts to surface and ground water hydrology in both floodplains and wetlands. Prior to any road construction activity in floodplains or wetlands, engineering drawings would be analyzed by a third party consultant hydrologist with a knowledge

of each site location's surface and ground water conditions. This consultant would be funded by the applicant and managed by NPS. The drawings would be evaluated for adverse impacts on floodplain and wetland hydrology, appropriate depth of road base, appropriate porosity of fill material, and the number and types of culverts or other surface water transfer structures. Any changes would be incorporated into the final road design drawings and specifications before any construction begins.

- No access roads would be constructed within 200 feet of the Middle Delaware Scenic River.
- With the exception of proposed access roads in wetland areas as described in this SOF, no equipment would ever be driven through wetland areas (including streams) for construction activities (including staging, tower construction, and pulling and splicing), vegetation removal, long-term vegetation or facility maintenance, access, or any other reason.
- Vegetation removal practices would be detailed in a Vegetation Management Plan. Vegetation removal would not commence until NPS approves the Vegetation Management Plan that will include, but not be limited to, the following specifications:
    - No vegetation less than 20 feet in height would be removed for any reason at any time.
    - Trees over 20 feet in height would be cut close to the ground, and stumps and root systems would be left in the ground to naturally decompose over time so the decaying root systems can provide additional soil stability as well as hosting native organisms.
    - Trees on the edge of the clearing zone would not be damaged by the clearing process - directional tree felling would occur by hand in order to protect remaining trees.
    - Cleared vegetation, including slash piles and timber piles, would be removed from any wetland areas. Downed woody debris would be carried out of the wetlands.
    - Cleared vegetation or woody debris, skids, or anything else would not be dragged, in any way, across the surface of the wetlands.
    - Any chipped wood would not be scattered in any wetland area or within 150 feet of a wetland area.
    - There would be no vegetation burning within the boundaries of the parks.
    - A professionally prepared harvesting contract would be prepared for and approved by the NPS before any woody species are removed.
    - Tree-clearing contractors would be selected by the applicant that are certified and experienced in low-impact tree clearing.
- An on-site construction monitor would be selected by NPS and would be funded by the applicant and managed by NPS to work with the park staff and construction personnel during construction activities to ensure all field work is compliant with all aspects of this document and NPS permits.
- A third party contractor would be selected and managed by NPS and funded by the applicant to complete the identification, delineation, and functions and values evaluation of all compensatory wetland mitigation projects. The number of projects would depend on the type of restoration or rehabilitation that each potential site offers and how much compensatory credit acres can be gained by completing each project. There needs to be a total of 70 credit acres gained as compensation for the 70 credit acres of impact. Some projects are identified in this document and additional projects would have to be identified in order to gain a total of 70 credit acres of compensation.

- A third party contractor(s) would be selected and managed by NPS and funded by the applicant to complete all tasks necessary for completing all wetland restoration or rehabilitation compensatory mitigation projects. Tasks and specifications would be approved by NPS and may include, but are not limited to: NEPA compliance, design, data collection, engineering and environmental studies (if necessary), contracting and on-site construction monitoring of all wetland restoration or rehabilitation projects proposed as wetland impact compensation for this utility project. Other tasks are listed in Section 7.1.2 Proposed Wetland Compensatory Mitigation.

- All work related to the completion of the compensatory mitigation projects, including construction, would be funded by the applicant. All work related to the completion of compensatory mitigation projects would begin and progress concurrently with the construction of the power line project within NPS boundaries. Before completion of the power line project within NPS boundaries, any funds necessary to complete the projects would be transferred to NPS or a designated third party 60 days before completion of the power line construction. At that time, third party contractor(s) will be selected and managed by NPS and funded by the applicant to manage the completion of all tasks related to completion of the restoration or rehabilitation projects.Long-term pre- and post-construction monitoring plans (containing types of variables to be monitored, frequency and method of sampling, target conditions or performance standards over time, performance bond values, and contingency actions based on what problems might occur in the particular restoration situation) will be created and implemented by third party environmental consultants that would be funded by the applicant, and selected and managed by NPS, for each compensatory wetland mitigation project.

- Performance bonds would be posted by the applicant, 60 days before completion of the power line construction within NPS boundaries, for each compensatory mitigation project. The amount of funds for each bond would be identified in the monitoring plans and depend on what types of post-construction problems that may evolve on each wetland restoration project that would require adjustment or repair. The access roads (addressed in this document) have construction limits of ten feet on either side of the centerline. The wetland area beyond the edges of the 20-foot construction zone would not be disturbed in any way. No other permanent or temporary access roads would be placed in the wetlands.

- The tower pad (addressed in this document) construction zones each measure approximately 10,000 square feet (0.23 acre) and the wetland area beyond the edges of the construction zones would not be disturbed in any way.

- There is one stream crossing bridge replacement required along a permanent access road proposed in this document (Van Campen Brook). There are no wetlands adjacent to the banks of the riverine wetlands below the ordinary high water mark on the channel banks. If it is determined that the bridge needs to be widened and/or improved, construction would be done with no impacts to the riverine wetlands through construction of a bridge or other structure that would completely span the channel (i.e., no pilings, fill, or other support structures in the stream habitat). There would be no equipment driven in the stream channel for construction or any other reason.

- There is also a stream crossing proposed across an unnamed tributary to Sand Hill Creek as part of access road construction. The construction would not occur within the wetland boundary of the creek (inside the ordinary high water marks on either bank). If it is determined that the bridge needs to be widened and/or improved, construction would be done with no impacts to the riverine wetlands through construction of a bridge or other structure that would completely span the channel (i.e., no pilings, fill, or other support structures in the stream habitat). There would be no equipment driven in the stream channel for construction or any other reason.

8.1.2 Proposed Wetland Compensatory Mitigation

For the purposes of implementing Executive Order 11990, "Protection of Wetlands", the NPS has determined that any area classified as wetland habitat according to the USFWS *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979) is subject to Director's Order 77-1: *Wetland Protection* (NPS 2012a) and the implementation procedures outlined in the *Procedural Manual #77-1: Wetland Protection* (NPS 2012a). Director's Order 77-1 states that for new actions where impacts to wetlands cannot be avoided, proposals must include plans for compensatory mitigation that restores wetlands on NPS lands (NPS 2012a). Therefore, compensatory mitigation would be required for this project because adverse impacts to wetlands would occur (table 7).

A detailed wetland mitigation plan and appropriate state and federal permits would be required for the proposed wetland compensations. These documents would be prepared at a later date when design and survey efforts have been completed for the wetland mitigation sites. The funding source for the compensation projects would be the applicant, which is consistent with the funding source restrictions listed in *Procedural Manual #77-1* (NPS 2012a). Therefore, the NPS commitment for funding of the compensatory restoration would meet the requirements and restrictions of Section 5.2.3, paragraph 6 of *Procedural Manual #77-1*.

A ratio of 4:1 was determined (four credit acres of compensatory wetland per acre of impact) as necessary to replace the functions and values of the very high quality wetlands (Arnott Fen, Hogback Ridge, Van Campen, and wetland BB). Other wetlands impacted by this project (CC, 45, 42, 46, and 47) are generally PEM/PSS wetlands that are already partially located within the existing ROW, are adversely affected by current maintenance activities and have been determined to be of moderate to high functional quality. These wetlands would be compensated at a rate of 2:1. Compensatory mitigation ratios were determined after considering:

- The size of the wetland area and the quantity, quality, and value of the functions being impacted. There are 16 acres of wetlands impacted by alternative 2 that are rare and unique wetland habitats, threatened or endangered plant and animal species habitats, and/or designated *Exceptional Value Wetlands.* The functional assessments rate these wetlands as having very high quality.

- The quantity, type, quality, and value of the functions being replaced that would result after restoration or rehabilitation efforts on the proposed compensation areas. The restoration or rehabilitation sites were chosen to provide the greatest variety and value of functions possible. However, newly restored or rehabilitated wetlands may never fully replace the functions to the level of quality that it took to create (thousands of years) the functions in the impact wetlands.

- How much the proposed compensation efforts would offset or replace the same functions and values lost in the impacted wetlands (i.e., the amount of in-kind versus out-of-kind functional replacement that will occur). The compensation efforts would replace similar types of wetland habitat functions, i.e., those associated with forested habitat that would be lost, however, the functions would not equal the same exceptional-value forested habitat functions that would be impacted.

- The temporal loss of wetland functions that will occur in the compensation efforts. In the compensation wetlands the habitat conditions will take many years to evolve to a moderately mature state where the target functions have become established. For example, it will take a number of years (probably greater than 60) for young trees in a restored forested wetland habitat to evolve into providing a moderately functioning forested wetland habitat.

- The likelihood of full compensatory mitigation success is unclear. Some of the compensatory mitigation projects may not succeed in maturing to provide the expected or targeted functions and values. Therefore, this uncertainty also influenced the credit acre ratio determination.

There are 16 acres of high quality wetland being impacted that would require 64 credit acres (at a 4 to 1 ratio) of compensation. There are 3 acres of moderate quality wetland being impacted that would require 6 credit acres (at a 2 to 1 ratio) of compensation. Therefore, a total of 70 wetland credit acres are necessary to compensate for the wetland impacts.

Investigations were conducted in May of 2012 to identify wetland compensation sites, to determine site locations and feasibility, rank sites by project potential, and record pre and post restoration or rehabilitation functions and values (attachment B). The goal of the evaluation was to select feasible sites (located within the watersheds of the impact sites where ever possible), which would provide wetland restoration acre credits towards the impacts from the preferred alternative. Potential sites were identified prior to investigation by NPS park staff as well as identified in-field, and were located exclusively on park (DEWA) property. Numerous potential wetland mitigation sites were visited in the field by an interdisciplinary team and evaluated for wetland functions and values. The functions and values assessment for the wetlands in the proposed mitigation sites was conducted using what is commonly referred to as the "NE Method," as previously described in Section 4.1.6 of this SOF. All proposed wetland compensation sites are on DEWA lands managed by the NPS and either within the same wetland system as the impacted wetland, within the same watershed, or in another nearby watershed within the DEWA NPS unit, as required by Director's Order 77-1: *Wetlands Protection* (NPS 2002).

There are nine compensatory mitigation projects described in this document. Attachment C presents the photographic record from site assessments for each of these sites. The completion of these projects would provide a total of 99 compensatory wetland mitigation credits which is more than enough to offset the 70 impact credit acres required. A third party contractor would be selected and managed by NPS, and funded by the applicant, to evaluate the projects in detail. A decision would be made to eliminate some projects based on a better understanding of what functions and values the projects can provide, practicality of completing the projects, expected success of the project, and other factors. Table 7 below provides a summary of the proposed compensatory wetland mitigation, table 8 describes the proposed wetland mitigation projects in more detail, and table 9 describes the proposed invasive plant species removal projects in high-value wetlands at DEWA.

1. There are three types of compensatory mitigation identified in the park that can provide compensatory credit acres. Restored forested wetland through the restoration of hydrologic conditions and planting with herbaceous, shrub, and tree species. The restored forested wetlands through the restoration of hydrology and planting would result in a significant improvement in the functions and values of the degraded wetland areas. Therefore, one acre of restoration would produce one credit acre for use as compensation.

2. Restored riverine habitat through stream channel stabilization, hydraulic improvements, and habitat rehabilitation. The restoration of riverine habitat through stream channel stabilization and replanting would produce limited functional improvement including shade and organic matter input to the fish habitat and the reduction of erosion and sediment loading to the stream. Therefore, every 500 feet of stream bank restoration (both banks stabilized and replanted and assuming a 20-foot wide zone of restoration) would be the equivalent of one credit acre for use as compensation.

3. Rehabilitation of wetlands by removing non-native plant species and replanting with native shrub and tree species. The wetland rehabilitation action of removing non-native plants and replanting the area with native shrub and tree species would produce limited functional improvement

including the restoration of native wetland shrub wildlife habitat. Therefore, ten acres of wetland rehabilitation, where non-native plants are removed and replanted with native plants, would produce one credit acre for use as compensation.

TABLE 7. SUMMARY OF PROPOSED COMPENSATORY WETLAND MITIGATION

IMPACT ACREAGE AND CREDIT ACRES NEEDED FOR COMPENSATION:	RESTORATION OR REHABILITATION CREDIT ACRE RATIOS:	COMPENSATION CREDIT-ACRE TOTALS*:
• Wetland Impacts: 16 acres high quality @ 4:1 = 64 credit acres needed for compensation • Wetland Impacts: 3 acres moderate to high quality @ 2:1 = 6 credit acres needed for compensation **TOTAL CREDIT ACRES NEEDED FOR COMPENSATION: 70**	• Wetland Restoration: 1 credit acre of compensation requires 1 acre of restoration • Stream Restoration: 1 credit acre of compensation requires 500 feet of restoration ** • Invasive Plant Species Removal: 1 credit acre of compensation requires 10 acres of invasive species removal	• Wetland Restoration: 78.97 acres equals 78.97 credit acres • Stream Restoration: 8,900 feet of restoration equals 17 credit acres • Invasive Plant Species Removal: 36.39 acres of invasive plant removal equal 3 credit acres **TOTAL CREDIT ACRES AVAILABLE AFTER COMPENSATION PROJECTS THAT ARE IDENTIFIED AS IN THIS DOCUMENT, ISSUED JULY 2012) ARE COMPLETE: 99**

*A third party contractor would be selected and managed, by NPS, and funded by the applicant to complete the identification, delineation, and functions and values evaluation of all compensatory mitigation projects. The number of projects would depend on the type of restoration or rehabilitation that each potential site offers and how much compensatory credit acres can be gained by completing each project. There needs to be a total of 70 credit acres gained as compensation for the 70 credit acres of impact. All of the compensation projects presented here would provide more credit acres then what is required in order to compensate for the impacts. The projects will be evaluated in detail and a decision will be made to eliminate some projects based on a better understanding of what functions and values the projects can provide, practicality of completing the projects, expected success of the project, and other factors.

**assumed a maximum 20-foot wide channel for stream restoration.

TABLE 8. PROPOSED COMPENSATORY MITIGATION PROJECTS

Project #	Restoration Project Name	Restoration Project Type	Existing Functions and Values at Mitigation Site	Gained Functions and Values as a Result of Mitigation
1	Watergate and Van Campen Projects (Dams #6-10)	• Dam removal • Wetland restoration (17.85 acres) • Stream restoration (5,600 linear feet)	• Groundwater recharge/discharge • Floodflow alteration • Fish and shellfish habitat • Wildlife habitat • Recreation	Would improve all existing functions and values and add : • Educational/scientific value – road to site and adjacent parking lot provides direct accessibility; ADA compliance would be improved; good access to perennial stream, open water, and variety of wetland classes (emergent, scrub-shrub) • Uniqueness/heritage – wetland class diversity would be improved; riparian stream corridor vegetation would be improved through removal of invasive plant species • Visual quality/aesthetics – primary viewing areas would yield more natural views free of human disturbance through removal of dams/berms and reduction of mowed/maintained grass • Endangered species habitat – RT&E species nesting and foraging habitat and connectivity would be enhanced. Would change/convert the following values: • Recreation – this value would be converted from an open water fishing opportunity to a streamside fishing opportunity; picnicking areas would be in more natural habitats instead of mowed/maintained grass areas; hiking would be enhanced through the addition of boardwalks through wetland areas (instead of the existing grassed areas) • Fish and shellfish habitat – this value would be converted from an open water habitat to a stream habitat with connected floodplains and emergent wetland vegetation
2	Miller Wetland Project	• Wetland restoration (13.16 acres) • Stream restoration (200 linear feet)	• Groundwater recharge/discharge • Floodflow alteration • Fish and shellfish habitat • Sediment/toxicant retention • Nutrient removal • Production export • Wildlife habitat • Endangered species habitat	Would improve all existing functions and values, specifically: • Wildlife habitat – improved through removal of invasive species which are dominant in the understory of the forested wetland adjacent to Van Campen Brook; improved connectivity for reptile and amphibian species from emergent wetland to Van Campen Brook; restoration of scrub-shrub/emergent wetland habitat through removal of berms along agricultural fields • Sediment/toxicant retention – improved by restoring scrub-shrub/emergent wetland habitat through removal of berms along agricultural fields • Nutrient removal– improved by restoring scrub-shrub/emergent wetland habitat through removal of berms along agricultural fields • Endangered species habitat – known RT&E habitat upstream of site would be enhanced and connectivity would be improved

Project #	Restoration Project Name	Restoration Project Type	Existing Functions and Values at Mitigation Site	Gained Functions and Values as a Result of Mitigation
3	Peters Valley Connectivity Projects (Mill Pond)	• Dam modification • Wetland restoration (19.75 acres) • Removal of fill in wetland (0.1 acre) • Stream restoration (2,500 linear feet) • Culvert replacement • RT&E habitat connectivity	• Groundwater recharge/discharge • Floodflow alteration • Fish and shellfish habitat • Sediment/toxicant retention • wildlife habitat • Endangered species habitat	Would enhance all existing functions and values, specifically: • Endangered species habitat – RT&E foraging habitat and connectivity would be expanded through conversion of shallow open water to mucky, tussock habitat. Would change/convert the following value: • Fish and shellfish habitat – this value would be converted from an open water habitat to a stream habitat with connected floodplains and emergent wetland vegetation
4	Camp Kittatinny Pond	• Wetland restoration (17.7 acres)	• Groundwater recharge/discharge • Floodflow alteration • Fish and shellfish habitat • Sediment/toxicant retention • Production export • Wildlife habitat • Recreation • Endangered species habitat	Would improve all existing functions/values, specifically: • Fish and shellfish habitat – No brook trout in downstream area may be able to restore trout to area • Endangered species habitat – Fringe and downstream wetlands possible RT&E habitat that would be enhanced Would add the following functions/values : • Educational/scientific value – road to site provides direct accessibility; ADA compliance could easily be improved at this site since topography is not steep; wildlife habitat value would be improved; good access to perennial stream, open water, and variety of wetland classes (emergent, scrub-shrub) • Uniqueness/heritage – wetland class diversity would be improved; site would be improved through removal of invasive plant species along berm and upland areas • Visual quality/aesthetics – primary viewing areas would yield more natural views free of human disturbance through removal of dams/berms and old dock anchors/pilings Would change/convert the following value: • Recreation – this value would be converted from an open water fishing opportunity to a more passive wildlife viewing opportunity; hiking would be made available through the addition of boardwalks through wetland areas (instead of the existing grassed areas)

Project #	Restoration Project Name	Restoration Project Type	Existing Functions and Values at Mitigation Site	Gained Functions and Values as a Result of Mitigation
5	Birchenough Pond	• Wetland restoration (4.03 acres) • Stream restoration (500 linear feet)	• Groundwater recharge/discharge • Floodflow alteration • Fish and shellfish habitat • Sediment/toxicant retention • Nutrient removal • Sediment/shoreline stabilization • Wildlife habitat • Recreation • Endangered species habitat	Would improve all existing functions and values, specifically: • Endangered species habitat – upstream wetlands possible RT&E habitat that would be enhanced and connectivity of habitat increased • Fish and shellfish habitat – this value would be improved by restoring aquatic connectivity through dam removal • Wildlife habitat – this value would be improved through removal of invasive plant species Would change/convert the following value: • Recreation – Site accessibility (via road) is good and parking is available, but it is unlikely fishing currently occurs at this site due to the shallow water depth and difficulty of accessing the shoreline (deep muck); this value would be converted to a more passive wildlife viewing opportunity
6	Sussex Vo-Tech Pond	• Wetland restoration (1.36 acres) • Stream restoration (100 linear feet)	• Groundwater recharge/discharge • Floodflow alteration • Fish and shellfish habitat • Sediment/toxicant retention • Nutrient removal • Sediment/shoreline • Wildlife habitat • Recreation	Would improve all existing functions and values, specifically: • Endangered species habitat –possible RT&E habitat that would be enhanced and connectivity of habitat increased • Fish and shellfish habitat – this value would be improved by restoring aquatic connectivity through dam removal Would change/convert the following value: Recreation – Historically fishing may have been possible, but it is unlikely that recreation is occurring at this site since water level is shallow and below normal due to breach of dam; also limited site accessibility and lack of trails
7	Blaufarb Pond	• Wetland restoration (4.77 acres)	• Groundwater recharge/discharge • Fish and shellfish habitat • Wildlife habitat • Recreation	Would improve all existing functions and values, specifically: • Fish and shellfish habitat – this value would be improved by restoring aquatic connectivity through dam removal • Wildlife habitat – this value would be improved through removal of invasive plant species

Project #	Restoration Project Name	Restoration Project Type	Existing Functions and Values at Mitigation Site	Gained Functions and Values as a Result of Mitigation
8	Community Drive / Arnott Fen Road Project	• Road removal • Wetland restoration (0.25 acre)	• Groundwater recharge/discharge • Floodflow alteration • Fish and shellfish habitat • Sediment/toxicant retention • Nutrient removal • Production export • Wildlife habitat • Educational/scientific value • Uniqueness/heritage • Visual quality/aesthetics • Endangered species habitat	Would improve all existing functions/values, specifically: • Fish and shellfish habitat – road/berm removal would allow connectivity between upper and lower open water habitat at Arnott Fen • Visual quality/aesthetics – would be improved through removal of invasive plant species on raised road/berm and return to natural fen habitat • Endangered species habitat – Known RT&E habitat would be enhanced through road/berm removal; RT&E connectivity would be expanded through conversion of road/berm to mucky, tussock habitat; removal of visitor access through area would reduce potential illegal collection of RT&E species
9	Invasive Plant Species Removal Projects	• Removal of invasive plant species in high-quality wetlands (36.39 acres)	Varies at 11 locations	Would improve all existing functions and values

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TABLE 9. PROPOSED MITIGATION - INVASIVE PLANT SPECIES REMOVAL PROJECTS IN HIGH-VALUE WETLANDS

Patch Number (figure 38)	Invasive Plant Species	March 2012 Status	Location	Site Type	Acres of Site Occupied by Invasive Plants	Comment
1	*Phragmites australis*	Untreated	Thunder Mountain Pond	Pond shoreline	0.1	Perimeter of pond shoreline approximately 1000 meters. Emergent shoreline zone about 2 acres. Total area of Pond about 15 acres.
2	*Phragmites australis*	Untreated	Catfish Outlet Wetland	Emergent wetland with shrubs; dominated by sedges and sphagnum	0.2	Emergent opening in shrub wetland drained by headwaters of Yards Creek. Two discrete patches of *Phragmites australis*, totaling about 1/4 acre.
3	*Phragmites australis*	Untreated	Hogback Wetlands	Emergent wetland	0.5	Emergent wetland located adjacent to Blaufarb Pond; highest of the linear wetlands on the northwestern side of Hogback Ridge. Two discrete patches of *Phragmites australis*, each about 1/4 acre in shallow water.
4	*Phragmites australis*	Untreated	Route 602 Roadbank / Millbrook Gap	Wet seep at road shoulder	0.1	Occurs in wet seep along Rte 602 road shoulder, Millbrook-Blairstown Rd, beginning just uphill (south) of ROW. Patches on both sides of road for about 0.1 mile.
5	*Phragmites australis*	Previously treated; needs follow-up	Woods Road Beaver Pond	Beaver-influenced wetland	4	Reported in 2008 and treated in 2010.
6	*Phragmites australis*	Previously treated; needs follow-up	Rattlesnake Mountain	Wetland dominated by sphagnum moss	4.25	Wetland between AT and Woods Rd, below and north of Rattlesnake Mtn. Originally documented in 1998 (site NPS098), observed in 2008/2009; treated in 2010.
7	Unknown	Acreage uncertain	Walpack Bend	RT&E habitat	3 (wetland) + 10 (buffer)	Supports a globally rare plant community and drains to waters supporting wetlands-dependent special concern wildlife (RT&E)
8	Unknown	Acreage uncertain	Birchenough Pond wetlands	Pond and wetland system	Unknown	Stream drains to Peters Valley; high value wetland - T&E drainage system. Entire area within Old Mine Road, Old Mine Road Dirt, Birchenough Cutoff Road.
Fig 26	*Rosa multiflora, Berberis thunbergii*	Untreated	Miller Wetland	Riparian wetland near Van Campen Brook	11.61	Understory of forested wetland dominated by invasive shrub species
Fig 27	*Rosa multiflora, Rubus occidentalis*	Untreated	Peters Culvert	Riparian wetland near UNT Little Flat Brook	1.67	Understory of forested wetland dominated by invasive shrub species
Fig 36	*Phragmites australis*	Untreated	Blaufarb Pond	Pond and wetland system	0.96	Two discrete patches of *Phragmites australis* in a high quality wetland near a heron rookery
TOTAL					**36.39 acres**	

In order to complete the power line project the applicant would fund the completion of all work necessary to complete the compensatory mitigation projects described in this document including the preparatory work and construction activities. In addition to the preliminary studies and data collection required for each compensatory mitigation project (as described for each project in the following sub-sections), the preparatory work and construction activities for each project may also include, but not be limited to, the following:

- Feasibility studies. Each project would require an initial feasibility study to determine what additional field work would be needed in order to design the project.

- Assessment, delineation, and monitoring of existing wetlands and hydrologic conditions including ground and surface water hydrology and riverine hydraulics. Biological and geomorphologic study of the existing utilized habitats for species of concern as well as in-depth study of the hydrologic conditions and any associated stream morphology at the restoration sites and at reference sites would be required in order to complete the design of the wetland compensation projects.

- Function assessments

- All state and federal permits

- NEPA compliance

- Conceptual design

- Engineering drawings, including planting, grading, structure removal, invasives treatment

- Construction actions including herbicide applications, earth moving, erosion control, engineered log jams, stream-bank bioengineering, structure removal, planting, and hauling and disposal

The paragraphs that follow describe the proposed mitigation projects.

1. Watergate and Van Campen Restoration Project, Dams #6 through #10 (figures 24 and 25)

Restoration goals at this site would be varied and diverse and include elements both relating to the functions and values of the existing resources as well as enhancing the recreational utilization of the site. However, these seemingly competing goals would be achieved through a design process utilizing extensive biological and geomorphologic study of the existing utilized habitats for species of concern as well as in-depth study of the groundwater table and associated stream morphology here and in reference conditions would be required to implement design. Channel relocation outside of the existing electrical ROW is a potential option, limiting future direct and indirect impacts to the stream. Restoration efforts here would have species-specific goals, therefore restoration design would require coordination and detailed study of these target species in specific habitat as well park-specific expertise.

Actions included in this mitigation project includes the removal or partial breach of the Dams #6 through #10 along Van Campen Brook and associated wetland restoration presents the most complete approach to the restoration of a complex wetland and riverine system within the park, with the greatest opportunity for educational, outreach and interpretive areas with handicapped access. The proposed project would include patchwork repair, channel reshaping and correction of historic impacts and resulting instabilities on Van Campen Brook starting upstream with Millbrook Village and ending downstream at the Cutoff Road Dam. The result of this work would include the restoration of over a mile of stream reach (5,400 linear feet) and the removal, naturalization, or partial breach of seven dams, also resulting in the restoration of up to 17.85

acres of wetland as well as hydrologic and habitat connectivity increases with existing wetland habitats. Elements of this restoration would include:

- Restoration of a stable stream channel at the footbridge at Millbrook Village. Installation of woody debris and other overhead cover structures in Van Campen Brook for the purpose of enhancing and stabilizing the habitat. This reach is known to support brook trout downstream. Use of toe wood, sod, log vanes, digger logs, and other habitat structures is proposed, along with in-floodplain woody debris structures for terrestrial habitat.
- The restoration of existing off-line floodplain ponds into wetlands, fed by groundwater and surface water.
- The improvement of Dam #6 and creation of wetlands and baseflow diversion extension channels through wetlands restored in the Dam #10 impoundment to foster brook trout and create nesting, overwintering, and foraging habitats for RT&E species within active portions of Van Campen Brook, as well as to provide refugia during high flows through a connected wetland matrix. RT&E species are known to utilize the gravel bars in this area for nesting and overhead cover for overwintering. By creating stable channel meanders bends, additional gravel point bars could develop to maintain this critical habitat. New channel covering 15 feet of channel fall could be created through the existing Dam #10 berm and picnic area, approximately double the number of point bars and overhead cover features for RT&E species habitat while still maintaining the point bars in the vicinity of Dam #6 and the overhead cover downstream of Dam #8. Additional habitat through side channels in the wetland restoration areas is not quantified in this estimate. A B3/2 cobble/boulder stream with a maximum step pool slope of 4% could be created, transitioning to a C3 stream type and flyfishing area before transitioning to the existing stream channel at the abandoned bridge below Dam #8.
- The removal, naturalization or reconnection of aquatic connectivity through Dams #7, #8 and #9 on Van Campen Brook, and the shifting of the main baseflow channel habitat outside of the existing utility right-of-way where feasible.
- The removal of Dam #10 and restoration of its impoundment to spring seep and floodplain connected wetlands. Linking the floodplain and wetland restoration projects, the creation of a handicapped accessible wetland interpretative boardwalk and the creation of handicapped-accessible brook trout fly fishing locations in Van Campen Brook. These areas would include full handicapped access through the restored wetlands and adjacent to channel restoration areas with specific boulder clusters, log structures and habitat features specifically for brook trout.
- A net reduction in the maintained or mowed area for this site, provided through the naturalization and restoration of wetlands and lower maintenance costs for the park.
- Removal of the Cutoff Road Dam, through the use of portable pneumatic hammers and other hand equipment to limit disturbance. Dam debris and cobble backwater sediment, if properly sized and broken, could be allowed to transport downstream as bedload or it may have to be removed and replanted. Alternately, this material would be removed. This would result in the restoration of approximately 200 linear feet of Van Campen Brook below the Watergate area to its original cobble and bed rock conditions, the rehabilitation of benthic riffle habitat in that reach and a naturalized riffle of approximately 2-3% slope, instead of the flat backwater conditions it experiences now.
- Relocation of a historic structure and bank stabilization.
- Invasive plant species management along the entire riparian corridor from Millbrook Village to the Watergate area. As these are sensitive areas, much of this work would need to be conducted by hand and coordinated with species-specific time of year restrictions.

Preliminary Studies and Data Collection Required

In order to complete design work here, the following data and study would be required:

- Recreational usage study of the existing Watergate facilities.
- Detailed study of the overwintering, foraging and nesting habitats for resident RT&E species. Specifically identifying these sites and describing through geomorphic analysis can characterize the level of floodplain access, sediment sizing, and frequency of inundation required to maintain these conditions is key to a successful restoration design.
- Fish electroshocking, and other in-channel habitat and benthic analysis to determine the present and future utilization of the reach by brook trout and other fish, as well as the benthic macroinvertebrates seasonally utilizing the stream. This data can be correlated to reference conditions to aid in the design of the channel relocation and ADA accessible fly fishing area.
- Detailed 0.5' contour topographic survey of the work area, including delineation of all wetland features, existing utilities, structures, and trees greater than 0.5' diameter at breast height (DBH).
- Detailed geologic and geotechnical study of the site, characterizing bedload and bedrock features, confining layers, and existing soils.
- Groundwater monitoring, particular in the vicinity of the existing surface water features and groundwater seeps.
- Full fluvial geomorphic analysis including WARSSS assessment, reference reach survey, sediment sampling and the development of a sediment rating curve for this as well as other Van Campen Brook sites.
- Monitoring of baseflow stage, suspended sediment, DO and other water quality parameters in Van Campen Brook.
- Detailed hydrologic and hydraulic analysis to determine critical design threshold discharges, ultimate discharges, and sediment entrainment / stability predictions.
- Cultural analysis of the site and its historic structures.
- RT&E investigation of existing and potential habitat creation/restoration.
- Forest stand delineation and identification of critical species and specimens on the site.

2. Miller Wetland Project (figure 26)

The goals of this project is to restore wetlands adjacent to the road and hillside seeps occurring there and through connectivity with existing wetlands and beaver activity located in the Van Campen Brook floodplain. The project is located along Old Mine Road, is adjacent to farm land and associated RT&E habitat in emergent wetland areas. Total wetland restoration potential is approximately 13.16 acres. This project site is named for the former Miller Farm located along Old Mine Road, the Miller Wetland project represents another opportunity to restore and enhance wetlands within the Van Campen Brook watershed.

Although some habitat and restoration could occur in Van Campen Brook, this is not seen as a primary focus of the restoration project at this location as the stream is in overall good condition with varied and diverse habitats reflecting not only the wild trout stream characteristics found upstream, but the braiding and delta-forming sediment processes which accompany its lessened slope and high sediment bedload as it enters the Delaware River Valley. Wetland diversity and connectivity can be achieved here through grading and replication of grade controls to mimic beaver activity, manipulation of the shallow ground water table, and as well as extensive invasive species removal and native vegetation planting. It is estimated that approximately 200 linear feet of stream restoration would occur at this site.

Additional restoration practices here would include the removal of the berm to improve the connectivity of existing high quality emergent wetlands with adjacent forested wetlands, the removal of approximately 11.61 acres of invasive species within the work are as well as the adjacent forested wetlands (mostly through hand removal and spot treatments), and the grading of marginal upland areas located between existing agricultural land and high quality wetland to restore those areas to emergent and scrub-shrub wetlands. Work in existing forested areas would focus on removal of invasive species, uplift the channel which flows out of the existing wetland complex, and the removal of select trees while leaving others on hummocks to create a mosaic of forested, scrub and emergent wetlands combined with low riparian floodplain. Channel uplift could be accomplished with a combination of woody debris structures, riffle grade controls, and other structures designed to mimic and encourage natural beaver activity.

Preliminary Studies and Data Collection Required

In order to complete design work here, the following data and study would be required:

- Detailed study of the overwintering, foraging and nesting habitats for resident herpetofauna.
- Fish electroshocking, and other in-channel habitat and benthic analysis to determine the present and future utilization of the small tributary to Van Campen Brook by forage fish and other small species, as well as seasonal utilization by benthic macroinvertebrates.
- Detailed 0.5’ contour topographic survey of the work area, including delineation of all wetland features, existing utilities, structures, and trees greater than 0.5’ DBH.
- Detailed geologic and geotechnical study of the site, characterizing bedload and bedrock features, confining layers, and existing soils.
- Groundwater monitoring, particular in the vicinity of the existing surface water features and groundwater seeps near Old Mine Road and Van Campen Brook.
- Detailed hydrologic and hydraulic analysis to determine critical design threshold discharges, ultimate discharges, and detailed water budget to evaluate groundwater and surface water integration in the proposed wetlands.
- Cultural analysis of the site and its historic structures.
- RT&E investigation of existing and potential habitat creation/restoration.
- Forest stand delineation and identification of critical species and specimens on the site.

3. Peters Valley Wetland Restoration Projects (figures 27 through 31)

Restoration goals at this site are proposed in three phases, with each part enhancing the connectivity of the wetland habitats and hydrology, as well as restoring wetlands and protecting RT&E species. The three phases of this project would include a culvert repair, increasing connectivity and habitat in the wetland above the mill pond, and stream restoration of the unnamed tributary to Little Flat Brook as well as riparian wetland restoration.

Peters Valley is a combination of forest, wetland, and an inhabited historic settlement. The mitigation site is bounded at the northern end by an existing culvert crossing over the unnamed tributary to Little Flat Brook, followed by extensive wetlands that support RT&E species, a historic mill area, and area of channel confinement, followed by the New Jersey Route 615 road crossing, and then proceeding downstream until its confluence with Little Flat Brook and Flat Brook.

Peters Culvert Repair

The first phase of this restoration is the replacement of the existing culvert at the gravel road crossing with a bottomless culvert would enable connectivity where the existing culvert presently does not allow. The wetland downstream of the culvert crossing has critical RT&E habitat, which is also partially maintained via a historic mill dam. By designing the culvert to be depressed and able to be over-topped, this would prevent road sediment from washing into the sensitive downstream wetlands and impacting habitat, as well as minimize potential thermal pollution to the wetland which is sustained through a cold-water stream and seep hydrology. This could be accomplished with a pre-cast or cast in place culvert or plate arch structure, where the concrete is designed to be suitable as a driving surface. The width of this structure could easily be reduced as the road served only two structures; a minimum width of 12' is proposed. Additionally, restoration work here would propose the by-hand removal of gravel which has historically washed into the wetland and impacted it, and allow the wetland to self-restore following the removal of this accidental fill. As an interim stopgap measure, super silt fence could be erected to protect the wetland prior to culvert repair. The Peters culvert repair would restore wetlands at the site by removing road fill from approximately 0.1 acre of wetlands. Also, approximately 1.67 acres of invasive species control in wetland areas would occur at this site.

Peters Mill Pond, Step Pool, and Connectivity

The second phase of this restoration relates to preserving and increasing connectivity and habitat in the wetland above the mill pond. This wetland downstream of the culvert crossing has critical RT&E habitat, which is maintained through stream flow as well as an existing intact and historic mill dam. Therefore it is critical that groundwater interactions are validated prior to design, and that the mill pond water surface is maintained through the restoration.

The mill basin has extensive sediment deposition which fills it with only approximately 1' of water depth in most locations. Through the mechanical blowing and hand placement of compost and soil mix into the impoundment, approximately 0.93 acres of new emergent wetland habitat would be restored. Adding organic fill material to create a series of braided and sinuous channels and open water pockets would replicate similar muck pools and sinuous channels upstream. This dam is not seen as feasible for removal as it governs the water surface elevation within sensitive wetlands, and therefore, the option of naturalizing its appearance and constructing a rock ramp or B3/2 cobble/boulder step pool in front of it for aquatic connectivity was selected. In this way RT&E habitat can be restored and extended, and connectivity for brook trout can be extended upstream in the watershed all the way to the base of the Peters C, D and E dams.

Route 615, through the introduction of a bottomless and significantly oversized culvert with multiple cells to convey both base flow channel conditions, flood flows and wetlands / floodplain connectivity benches, could foster safe connectivity for RT&E species between the Mill Pond wetlands and the reaches immediately connected to the Little Flat Brook below. The existing concrete pipe through the road berm does not allow upstream passage creates debris jams and is in poor condition. Over-road passage is limited by the risk of RT&E collisions with roadway traffic. Design of this culvert would be similar to the culvert designed above on the unnamed tributary to Little Flat Brook; however, it need not be designed to be overtopped, as Route 615 is a major paved road. The culvert would accommodate the entire width of Route 615 and its shoulder, making it approximately 50 feet long. The culvert could be pre-cast or cast-in-place concrete, with dyed and molded concrete to replicate the appearance of the historic stone structures immediately adjacent. Coupled with a fence system, either stacked stone or other proven methods, RT&E species could be prevented from entering the roadway and would be funneled through the intended crossing area. Additionally, these corrections of flow regime would restore connectivity and passage for brook trout for a greater range of flow regimes, not just base flow as presently exists through the 615 pipe crossing. Approximately 300 linear feet of stream would be restored as part of the Route 615 portion of this project.

Unnamed Tributary to Little Flat Brook Riparian Wetlands

Below Route 615, the reach of the unnamed tributary to Little Flat Brook and its associated floodplain has evidence of pasture conversion with tiling, ditching, or grading to expedite surface and shallow groundwater drainage. Much of the stream has been artificially relocated to the south valley wall, indicating a prior straightening and drainage of the valley. Although the stream is recovered in many instances, portions exist where incision below the former base elevation has occurred, as well as a corresponding drying of the floodplain and conversion of floodplain wetlands (many of which are covered in a combination of non-native plants including Autumn olive, multiflora rose, and barberry). Through a manipulation of the stream channel base elevation, as well as through minor grading work and invasive shrub removal, the entire unnamed tributary to Little Flat Brook valley could be converted to high quality riverine wetlands with RT&E connectivity. This would result in approximately 18.82 acres of restoration and combined rehabilitation, to be determined after a feasibility study. Also, approximately 2,200 linear feet of stream restoration would occur along the unnamed tributary at this site.

Preliminary Studies and Data Collection Required

In order to complete design work in Peters Valley, the following data and study would be required:

- Recreational and cultural investigation of the Peters Valley, indicating the past and present uses, historic uses, and unique cultural value of the site.

- Detailed study of the overwintering, foraging and nesting habitats for resident RT&E species as well as other species of concern. Specifically identifying these sites and describing through geomorphic analysis can characterize the key conditions for inclusion in restored wetland habitat and for preservation of existing habitats.

- Fish electroshocking, and other in-channel habitat and benthic analysis to determine the present and future utilization of the reach by brook trout and other fish, as well as the benthic macroinvertebrates seasonally utilizing the stream.

- Detailed 0.5’ contour topographic survey of the work area, including delineation of all wetland features, existing utilities, structures, and trees greater than 0.5’ DBH.

- Detailed geologic and geotechnical study of the valley, characterizing bedload and bedrock features, confining layers, and existing soils. Identification of the transition in geology to the Flat Brook valley, and the unique features occurring there is critical to a successful restoration design.

- Groundwater monitoring, particular in the vicinity of the existing surface water features and groundwater seeps in the existing wetlands.

- Full fluvial geomorphic analysis including WARSSS assessment, reference reach survey, sediment sampling and the development of a sediment rating curve for this valley as well as higher tributaries in the valley.

- Monitoring of baseflow stage, suspended sediment, DO and other water quality parameters in UNT to Little Flat Brook.

- Detailed hydrologic and hydraulic analysis to determine critical design threshold discharges, ultimate discharges, and sediment entrainment / stability predictions.

- RT&E investigation of existing and potential habitat creation/restoration. This may include radio telemetry and direct observation.

- Traffic Study of Rt. 615 for constructability evaluation.

- Forest stand delineation and identification of critical species and specimens on the site.

4. Camp Kittatinny Pond Wetland Restoration Project (figures 32 and 33)

The goal of this project includes wetland restoration through dam removal at both the upper and lower Camp Kittatinny Ponds. Specific actions at Camp Kittatinny would include removing an earthen, stone, and concrete dam and replace it with a series of gradual grade controls to turn the 8-acre basin into approximately 11.05 acres of floodplain emergent and scrub-shrub wetland. By maintaining the shallow ground water table and re-grading accumulated sediments, and building the floodplain with dam materials, a continuation and preservation of existing high quality wetlands upstream could be maintained. The restoration would include stabilizing numerous side channels to prevent the incision of channels and reduction of groundwater elevations in the valley edges, preserving sensitive, RT&E species habitat wetlands. A variety of braided and single thread channels, along with connected floodplain wetlands, would restore historic functions and values to this valley, as well as provide the potential to enhance existing recreation opportunities at the site.

The work would occur nearly entirely within the footprint of the existing basin and lower dam. Field investigation revealed that the stream quickly stabilized below the dam into a stable C4 stream type with connected wetlands and beaver-created grade controls. Restoration techniques would couple large woody debris structures with riffle grade control structures to restore floodplain wetlands and provide geologic grade control. Additional wetland restoration potential above the main basin in open water controlled by beaver or road berm structures were identified and assessed in-field. While much of this area is existing wetland, opportunities to restore additional wetlands and control invasive species exist here. Approximately 6.65 acres of additional wetland could be restored here. Together with integration of the existing groundwater seep wetlands at the site, the potential exists to create a connected floodplain wetland system with stream connectivity to more isolated headwater scrub shrub and forested seeps. Therefore, this entire wetland restoration project (both upper and lower ponds) would restore at total of approximately 17.7 acres of wetlands.

Preliminary Studies and Data Collection Required

In order to complete design work for Camp Kittatinny, the following data and study would be required:

- Recreational and cultural investigation of the site. Camp Kittatinny pond has a former dock area and a sunken rowboat, indicating previous recreational usage.

- Detailed study of the RT&E species occurring in groundwater seeps in the perimeter of the pond area.

- Fish electroshocking, and other in-channel habitat and benthic analysis to determine the present and future utilization of the reach by brook trout and other fish, as well as the benthic macroinvertebrates seasonally utilizing the stream.

- Detailed 0.5' contour topographic survey of the work area, including delineation of all wetland features, existing utilities, structures, and trees greater than 0.5' DBH.

- Detailed geologic and geotechnical study of the valley, characterizing the geology and any special concerns. Sediment and bedload study would be required for restoration design.

- Groundwater monitoring, particular in the vicinity of the existing surface water features and groundwater seeps in the existing wetlands.

- Full fluvial geomorphic analysis including WARSSS assessment, reference reach survey, and general geomorphology to show departure from reference conditions and restoration potential.

- Detailed hydrologic and hydraulic analysis to determine critical design threshold discharges, ultimate discharges, and sediment entrainment / stability predictions.

- Forest stand delineation and identification of critical species and specimens on the site.

5. Birchenough Pond Wetland Restoration Project (figure 34)

The goal of the Birchenough Pond project involves stabilizing a poor condition earthen/beaver dam complex by restoring emergent wetlands within its ponded area. This project has a high probability of success and is relatively low risk. Coupled with the potential for RT&E habitat upstream and connectivity with it in the rest of Peters Valley, the site has excellent potential to restore historic wetland and riparian functions and values as well as restore aquatic connectivity. Overall, this project would create aquatic connectivity between the downstream reaches and the high value headwater wetland complexes above the dams.

Specific actions include stabilizing the water surface elevation and creating connectivity through a series of step pools. The project would allow the restoration of approximately 500 linear feet of stream, the removal of two concrete and stone dams, and the restoration of approximately 4.03 acres of wetlands through grading and planting of fringe areas and restoration of the ponded area. The site has paved and gravel road access and a confined valley at the point of the dam, making it a relatively easy project to stabilize and restore the floodplain wetlands. Portions of the existing open water habitat on the site have the potential to be filled with soil material from grading and creating fringe wetland habitat along the valley edges where historic fill and potential agricultural draining (prior conversion) of wetlands has occurred. This would restore wetlands though surface water and groundwater connection, and these wetlands would be adjacent

to existing scrub shrub and emergent habitats. The existing farmstead structures would remain in place in this option, with the potential remaining to rehabilitate these structures for interpretive purposes.

Downstream of the existing ponded area, the stream channel is a B3/1 cobble stream type with bedrock and boulder control. The channel is incised but generally stable except in the vicinity of two dams. The upstream-most dam is partially breached while the lower dam is intact, with base flow going under the same and fine silty deposits and gravel behind the dam. Restoration of the stream between the ponded area and the lower concrete dam would include lifting the channel to create a C3 cobble stream on approximately a 2-4% slope, utilizing step pools, boulders and woody debris for habitat, grade control, and flow diversity to provide aquatic connectivity for a variety of fish, reptile and amphibian species. If the existing roadway was not removed, an 8% step pool would be required to connect the dam with the stream at the road crossing.

Preliminary Studies and Data Collection Required

In order to complete design work for Birchenough Pond, the following data and study would be required:

- Cultural investigation of the road and existing structures at the site.
- Phase II RT&E study of the site. Phase I RT&E assessment was informally completed as part of the mitigation assessment, and tussock sedge, deep muddy pools, and surface/groundwater connection were identified as dominating portions of the wetland. This indicates that the habitat may be potential RT&E habitat.
- Fish electroshocking, and other in-channel habitat and benthic analysis to determine the present and future utilization of the reach, as well as the benthic macroinvertebrates seasonally utilizing the stream.
- Detailed 0.5’ contour topographic survey of the work area, including delineation of all wetland features, existing utilities, structures, and trees greater than 0.5’ DBH.
- Detailed geologic and geotechnical study of the valley, characterizing the geology and any special concerns. Sediment and bedload study would be required for restoration design.
- Groundwater monitoring, particular in the vicinity of the existing surface water features and groundwater seeps in the existing wetlands.
- Full fluvial geomorphic analysis including WARSSS assessment, reference reach survey, and general geomorphology to show departure from reference conditions and restoration potential.
- Detailed hydrologic and hydraulic analysis to determine critical design threshold discharges, ultimate discharges, and sediment entrainment / stability predictions.
- Forest stand delineation and identification of critical species and specimens on the site.
- Recreational study. Although no evidence of recreation was observed, passive uses such as bird watching may be occurring.

6. Sussex Vo-Tech Pond Wetland Restoration Project (figure 35)

The goal of this project is to restore the open water area to emergent wetlands and natural channels as well as to ensure stability of the emergent and fringe wetlands upstream of the site. The Sussex Vo-Tech pond site is an existing earthen and stone dam, which has been partially breached. Presently it has a 5-foot water surface elevation with a dam height of approximately 8 feet. Stabilizing the dam, partially lifting the governing water surface elevation to pre-breach levels, and installing a series of step pools or rock ramps as a B3/2 stream type has the potential to create connectivity with the stream and wetlands above it, as well as the opportunity to restore approximately 1.36 acres of emergent wetlands. The existing stream valley below the dam is of an ideal shape to restore approximately 100 linear feet of stream, and has the added potential of wetting the existing forested floodplain. The stream system would be a typical cobble stream with slope between 2-4% or a step pool system with a slope of 4-6% depending on the level of water surface manipulation required to meet goals. An upstream riffle grade control combined with fringe grading to restore wetlands in the berm and side slope fill areas would restore the open water area to emergent wetlands with dendritic channels. The upper riffle grade control would ensure stability of the emergent and fringe wetlands upstream.

Preliminary Studies and Data Collection Required

In order to complete design work for Sussex Vo-Tech Pond, the following data and study would be required:

- Cultural investigation of the road and existing structures at the site.
- Phase II RT&E study of the site. Phase I RT&E assessment was informally completed as part of the mitigation assessment, and tussock sedge, deep muddy pools, and surface/groundwater connection were identified as dominating portions of the wetland. This indicates that the habitat may be potential RT&E habitat.
- Fish electroshocking, and other in-channel habitat and benthic analysis to determine the present and future utilization of the reach, as well as the benthic macroinvertebrates seasonally utilizing the stream.
- Detailed 0.5’ contour topographic survey of the work area, including delineation of all wetland features, existing utilities, structures, and trees greater than 0.5’ DBH.
- Detailed geologic and geotechnical study of the valley, characterizing the geology and any special concerns. Sediment and bedload study would be required for restoration design.
- Groundwater monitoring, particular in the vicinity of the existing surface water features and groundwater seeps in the existing wetlands.
- Full fluvial geomorphic analysis including WARSSS assessment, reference reach survey, and general geomorphology to show departure from reference conditions and restoration potential.
- Detailed hydrologic and hydraulic analysis to determine critical design threshold discharges, ultimate discharges, and sediment entrainment / stability predictions.
- Forest stand delineation and identification of critical species and specimens on the site.

- Recreational study. Although no evidence of recreation was observed, passive uses such as bird watching may be occurring.

7. Blaufarb Pond Wetland Restoration Project (figure 36)

The goal of this project includes removing a dam structure to restore emergent wetlands at the site and removal of invasive plant species in high-quality wetland areas. Changing the existing hydrology could potentially support other types of wetlands as well. Because of the simplicity of the site and lack of known RT&E presence, this site is low risk and presents a high probability of success in restoring historic wetland functions and values. Although access to Blaufarb Pond is limited and cuts through sensitive habitats of the Hogback Ridge, removal of the historic impoundment has the potential, due to its shallow depth, to restore 4.77 acres of emergent wetland habitat immediately connected and adjacent to existing high quality wetlands. The dam is a stacked-stone structure and has been heavily naturalized by beaver and increased from 3 to 4 feet in elevation to nearly 6 feet in elevation over the lower bedrock outcropping below the dam. It has the potential to date to the original Dutch settlements in the area, meaning its pond may be relatively free of disturbance and was likely a prior wetland. This pond additionally has no inlet streams conveying bedload, and, therefore its bottom may only consist of organic sediment deposition of detritus. Removing the dam structure would expose what was likely a pre-European settlement horizon of sediments, or close to that elevation, which could be manipulated to restore emergent wetlands to the site and potentially utilize the existing seed bank below the pond. Additionally as part of this restoration, management of two adjacent common reed grass (*Phragmites australis*) stands is proposed, totaling approximately 0.96 acre. This management is critical to restoring the emergent wetlands in Blaufarb and preventing impact to other high quality adjacent wetland complexes.

Preliminary Studies and Data Collection Required

In order to complete design work for Blaufarb Pond, the following data and study would be required:

- Cultural investigation of the existing structures at the site and historic uses.
- Detailed 0.5’ contour topographic survey of the work area, including delineation of all wetland features, existing utilities, structures, and trees greater than 0.5’ DBH.
- Detailed geologic and geotechnical study of the berm and adjacent area, characterizing the geology and any special concerns.
- Groundwater monitoring study.
- Detailed hydrologic and hydraulic analysis to determine critical design threshold discharges, ultimate discharges, and sediment entrainment / stability predictions.
- Forest stand delineation and identification of critical species and specimens on the site.

8. Community Drive / Arnott Fen Road Wetland Restoration Project (figure 37)

The goal of this project includes the removal of the existing road berm through the Arnott Fen to protect high quality, sensitive fen habitat in this area from human access and potential for disturbance and take of RT&E species. The removal of the road through the fen could potentially create small amounts of wetlands and increase habitat and hydrologic connectivity between the upper and lower wetland cells. An estimated 0.25 acre of wetland could be gained here, although much of the road, particularly the central portions, is already exhibiting wetland characteristics.

The water surface between the upper and lower cells of the fen (as divided by the road) is approximately 1 foot in elevation difference. With the berm approximately 2' high, removal of approximately the first foot of berm freeboard should put the groundwater table at the surface of the road berm and restore the area to wetlands without impacting the upper wetland cell. The addition of random boulders, spaces so they are not used for pedestrian access, would restore any basking habitat lost through grading activities. It is recommended that invasive species removal be conducted on the road berm as part of this restoration. Additionally, this excess fill material can be wasted in one of the other wetland restoration sites to convert open water, as there is no suitable place to waste fill in Arnott Fen.

Preliminary Studies and Data Collection Required

In order to complete design work for Community Drive / Arnott Fen, the following data and study would be required:

- Cultural investigation of the existing road and any historic uses.
- Detailed 0.5' contour topographic survey of the work area, including delineation of all wetland features, existing utilities, structures, and trees greater than 0.5' DBH.
- Detailed groundwater monitoring through the road berm and adjacent areas and wetland gauging / groundwater study. Understanding the flow of groundwater and effect of the berm is paramount prior to disturbance.
- Detailed hydrologic and hydraulic analysis to determine critical design threshold discharges, ultimate discharges, and sediment entrainment / stability predictions.
- Evaluation of the RT&E usage of the road berm and determining the functions and values lost in removing this upland habitat.

9. Invasive Plant Species Removal Projects (figure 38)

In addition to the project listed above, invasive species control is also proposed at various locations throughout the park to improve wetland functions and values. Invasive plant species can decrease native plant diversity and disrupt ecosystems. The NPS has a mandate to preserve native species diversity and natural ecosystems. To mitigate impacts to wetlands at the park, the NPS would improve the overall functionality and values of 36.39 acres of high-quality wetlands at the park through the removal of invasive plant species at 11 separate wetland areas The invasive species removal would target primarily common reed grass (*Phragmites australis*) but also include shrub species such as multiflora rose and Japanese barberry. This work would take place during the appropriate time of year to maximize the potential treatment of the invasive plant species. Any pesticides or other treatment types used would have to be approved in advance by the NPS. A Pesticide Use Log maintained for all applications would be required and submitted to the NPS. Table 9 and figure 38 provide additional information regarding each of the proposed locations where invasive plant species would be removed from high quality wetlands in the park.

8.1.3 Proposed Monitoring Plan

Long-term monitoring of the restored wetlands would be required to ensure success of the restoration projects. Long-term monitoring plans (containing types of variables to be monitored, frequency and method of sampling, target conditions over time, performance bond values, and contingency actions based on what problems might occur in the particular restoration situation) will be created and implemented by a third party environmental consultants that would be funded by the applicant, and selected and managed by NPS.

8.2 FLOODPLAIN MITIGATION

The design of structures within the floodplain would incorporate methods for minimizing flood damage, as contained in the National Flood Insurance Program "*Floodplain Management Criteria for Flood-Prone Areas"* (CFR 44, 60.3) and in accordance with any state or county requirements for flood-prone areas. Floodplain mitigation measures that have been incorporated include:

- Avoid construction or clearing vegetation within floodplains and floodplain buffers.
- Construct dikes or conveyance ditches to divert or carry flood flows away from the site.
- Modify structures to provide sufficient elevation above the flood crest (e.g., place structures on columns, walls, piles, or piers).
- Restore watershed conditions to eliminate accelerated runoff caused by soil compaction, poor vegetation cover, or the unnatural conveyance of water by roads, ditches, or trails.
- Proposed road alignments through floodplains would be analyzed for opportunity to realign the road in order to minimize impacts to floodplain processes around by moving the proposed road alignment or by using existing roads and designing short secondary roads where access into the floodplain is absolutely necessary. The analysis would be done by a third party consultant hydrologist that would be funded by the applicant and managed by NPS. This road realignment analysis would be completed for each road segment proposed in a floodplain and done before any construction activity occurs in floodplains. Any realignment would be incorporated into the engineering drawings and approved by NPS before any construction begins.
- Compensate lost natural floodplain values.

9.0 SUMMARY

For the preferred alternative, alternative 2, a total of 18.65 acres of wetland would be adversely impacted as a result of vegetation removal and maintenance, the construction of access roads, and tower pad construction. Vegetation clearing and maintenance activities would affect 17.63 acres of wetlands within park boundaries through a maintained, permanent, conversion to scrub shrub and/or emergent wetlands. Access roads and tower pads would permanently destroy 1.02 acres of wetlands through construction activities. With the exception of these access roads and tower pads, no equipment would be driven through wetland areas.

The mitigation proposed in exchange for the wetland impacts would assure no net loss of wetlands on NPS-managed lands. The specific locations for compensation, the schedule for project completion, the funding sources, and other details relating to wetlands compensation have been described in this document and were determined in consultation with the NPS and appropriate resource agencies. A total of 70 credit acres of compensation is described previously and summarized below in table 10. The NPS therefore finds that the preferred alternative, as stipulated, is consistent with Executive Order 11990 and the policies and procedures found in Director's Order 77-1 and *Procedural Manual #77-1* (NPS 2002, 2012a).

TABLE 10. SUMMARY OF PROPOSED COMPENSATORY WETLAND MITIGATION

IMPACT ACREAGE AND CREDIT ACRES NEEDED FOR COMPENSATION:	RESTORATION OR REHABILITATION CREDIT ACRE RATIOS:	COMPENSATION CREDIT-ACRE TOTALS*:
• Wetland Impacts: 16 acres high quality @ 4:1 = 64 credit acres needed for compensation • Wetland Impacts: 3 acres moderate to high quality @ 2:1 = 6 credit acres needed for compensation **TOTAL CREDIT ACRES NEEDED FOR COMPENSATION: 70**	• Wetland Restoration: 1 credit acre of compensation requires 1 acre of restoration • Stream Restoration: 1 credit acre of compensation requires 500 feet of restoration ** • Invasive Plant Species Removal: 1 credit acre of compensation requires 10 acres of invasive species removal	• Wetland Restoration: 78.97 acres equals 78.97 credit acres • Stream Restoration: 8,900 feet of restoration equals 17 credit acres • Invasive Plant Species Removal: 36.39 acres of invasive plant removal equal 3 credit acres **TOTAL CREDIT ACRES AVAILABLE AFTER COMPENSATION PROJECTS (THAT ARE IDENTIFIED AS IN THIS DOCUMENT, ISSUED JULY 2012) ARE COMPLETE: 99**

*A third party contractor would be selected and managed, by NPS, and funded by the applicant to complete the identification, delineation, and functions and values evaluation of all compensatory mitigation projects. The number of projects would depend on the type of restoration or rehabilitation that each potential site offers and how much compensatory credit acres can be gained by completing each project. There needs to be a total of 70 credit acres gained as compensation for the 70 credit acres of impact. All of the compensation projects presented here would provide more credit acres then what is required in order to compensate for the impacts. The projects will be evaluated in detail and a decision will be made to eliminate some projects based on a better understanding of what functions and values the projects can provide, practicality of completing the projects, expected success of the project, and other factors.

**assumed a maximum 20-foot wide channel for stream restoration

10.0 REFERENCES

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