Environmental Assessment
Part 1 - Resource Identification
Enclosure C - Description of Aquatic Habitat

PPL Bell Bend Nuclear Power Plant
Salem Township, Luzerne County, PA

1. Introduction

The BBNPP site has been thoroughly studied to provide documentation of flora, fauna, and aquatic resources.

There are 159.0 acres of wetland, 6.62 acres of waterbodies, and 24,014 feet of stream within the Project Boundary (BBNPP ACOE Third Preliminary JD Wetland Mapping, Normandeau, 2011). The aquatic resource descriptions provided in this document focus on regions surrounding the proposed impacts of BBNPP construction. The Wetland and Watercourse Impact Map for the ACOE and DEP, included as Enclosure D1 and D2, provide the location of all wetlands and water bodies within the Project Boundary. Enclosure A1 (Jurisdictional Determination documentation) includes a map and summary table of all delineated wetlands within the project site including wetland classifications, acreages, and coordinates of each individual wetland.

Many of the upland and aquatic areas within the BBNPP site boundary have been altered by land use practices including recreation, agriculture, logging, canal transportation and electric power generation. Much of the original forest cover was cleared and the remainder became fragmented as a result of these activities. No active timber cutting for these purposes has recently occurred within the Project Boundary. Current vegetation management consists largely of agricultural crop production and maintenance of transmission line corridors. In addition, infrastructure construction has caused topographic alterations within the BBNPP Project Boundary altering surface water flow paths and dividing wetlands. These land use practices resulted in stream channelization, stream erosion, and sediment deposition in the stream valleys creating some of the poor habitat characteristics and substrate embeddedness problems documented in the report findings and summarized in this Environmental Assessment.

2. Aquatic Habitats

2.1 North Branch Susquehanna River Watershed: Stream Habitat: General Habitat, Food Chain Production, Macroinvertebrate and Fish Communities

The project site is located on the west side of the North Branch of the Susquehanna River (NBSR), a navigable waterway. The NBSR flows from north to south past the SSES, makes a broad 90 degree turn to the west, and flows to the south of the Project Boundary before reaching Berwick, PA.

Streams and waterbodies within the NBSR watershed and the project boundary include the NBSR, the North Branch Canal (NBC), the NBC outfall channel, and unnamed tributaries to the NBSR.

The habitat in the NBSR in the vicinity of the proposed BBNPP intake structure is similar to habitat found both upstream and downstream of the proposed intake structure (Unistar, 2011). An Instream Flow Incremental Methodolgy (IFIM) Study has been completed on the NBSR. This purpose of this study was to determine the impact of a small change in NBSR flow on aquatic habitat. The study documents existing usable habitat area for eight aquatic species at various NBSR flows using historical data from the United States Geological Survey (USGS) NBSR Wilkes-Barre gage and current field data collected specifically for this study. The results of this study are included in the draft report "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users," within Appendix B of this JPA.

Fish studies were completed on the NBSR between 2004 and 2007 in the vicinity of the SSES intake structure and the proposed BBNPP intake structure. A majority of the fish species collected were from the following families: Cyprinidae (minnow family), Centrarchidae, and Percidae (perch family). The following fish species were abundant: spotfin and spottail shiner, white sucker, bluntnose minnow, smallmouth bass, walleye, quillback, northern hog sucker, shorthead redhorse, and rock bass (Unistar, 2011). The NBSR sustains recreational fisheries for several fish species including smallmouth bass, muskellunge, yellow perch, bluegill, redbreast sunfish, northern pike, channel catfish, walleye, and bullhead, among others (Unistar, 2011). No migratory species have been collected in the reach of the river surrounding the BBNPP intake structure (Unistar, 2011).

Macroinvertebrate communities on the NBSR are diverse and characteristic of a large river system. The dominant groups collected during sampling in 2007 were Ephemeroptera (mayflies), Coleoptera (beetles), and Mollusca (snails and clams). Many taxa were present in relatively low proportions (less than 2%); a large proportion of the total number of organisms was contributed by a few taxa including the mayfly *Anthopotamus*, a beetle *Stenelmis*, and fingernail clam *Musculium* (Unistar, 2011). Many of the pollution intolerant taxa collected were Ephemeroptera, Plecoptera, or Trichoptera (EPT) species. Anthopotamus (mayfly) was the dominant EPT taxa collected. All samples collected on the NBSR were similar with no significant differences (Unistar, 2011).

Five species of mussel were observed during the "Mussel Survey in the Susquehanna River in the Vicinity of the Proposed Bell Bend Nuclear Power Plant Site," study including the Yellow Lampmussel, a protected specie. The Yellow Lampmussel was widely distributed throughout the sampling area. One Green Floater, another protected specie was observed during macroinvertebrate sampling but not during the mussel survey (Normandeau, 2011). This section of NBSR is typical of habitat found upstream and downstream of the BBNPP site and otherwise provides no unique or protected habitat (Unistar, 2011). In 2010, the PFBC changed the classification of the Yellow Lampmussel and the Green Floater from species of special concern to rare.

The habitat in the NBSR provides adequate nesting, spawning, rearing, resting, migration, feeding opportunities, and escape cover. Vegetation production, leaf matter, macroinvertebrates, and a variety of fish species all contribute to food chain production.

Lake Took-A-While is a 30 acre lake located within the Riverlands Recreation Area. A small portion of the southern tip of the lake is located within the Project Boundary. The lake is maintained for recreational use with some manicured grass banks. Some lacustrine fringe wetlands with dense wetland vegetation also border the lake. The lake provides habitat to numerous fish species including bass, sunfish, minnows and catfish (Ecology III, 2000). Lake Took-A-While discharges into the NBC.

A portion of the NBC is located with the project boundary. "A Field Survey of Fish and Aquatic Macroinvertebrates at the Proposed Bell Bend Nuclear Power Plant Site," documents fish and macroinvertebrates that were sampled at three stations within the NBC. A total of seven fish species (59 individuals) were collected. Bluegill and green

sunfish were the two most dominant species. The fish species present are common in warmwater lentic waterbodies in eastern PA. Midges were the dominant macroinvertebrate collected. No other EPT species and no mussel species were collected (Normandeau Associates, 2011).

The lake and canal system provides unique open water habitat to the area including adequate nesting, spawning, rearing, resting, migration, feeding opportunities and escape cover and is an important part of food chain production.

The NBC outfall channel is a manmade channel formed by overflow and seepage from the NBC and adjacent wetland that discharges directly into the NBSR. The NBC outfall channel has intermittent flow controlled by a weir at the NBC. The channel becomes increasingly incised as it approaches the NBSR. The steep, high banks are primarily vegetated with some areas of instability.

Normandeau Associates evaluated fish species within the NBC outfall channel. The fish species were comprised of warm water fish characteristic of both lentic and lotic systems. A total of 160 fish representing 12 species were collected. Golden shiner was the most abundant species comprising 27% of the total catch. A single brook stickleback species was collected during sampling which is considered a candidate species in Pennsylvania. No previous occurrences of the brook stickleback are known in the vicinity of BBNPP. This species was likely introduced through human action, such as a fisherman dumping bait fish, because the NBC and adjacent waters are not the typical habitat preferred by this species (A Field Survey of Fish and Aquatic Macroinvertebrates at the Proposed Bell Bend Nuclear Power Plant Site, Normandeau, 2011).

In the report "Bell Bend Project Site: Supplemental Field Assessments for PPL Riverlands" the NBC outfall channel habitat was rated marginal using the EPA Rapid Bioassessment Protocol due to characteristics such as poor pool variability, channel alteration, low channel sinuosity, and bank stability. Multiflora rose is dominant along the NBC outfall channel. Substrate embeddedness measurements were also performed at two reaches within the NBC outfall channel. Downstream, towards the Susquehanna River, good substrate conditions existed dominated by cobble and gravel while

embeddedness measurements at the upper reach indicated high substrate embeddedness (LandStudies, 2010).

Macroinvertebrates collected at two locations on the NBC outfall channel indicated fair to poor water quality. A total of 28 taxa were collected. The community was dominated by sow bugs (*Caecidotea*, 25%), moths (*Neocataclysta*, 21%), midges (Chironomidae, 15%), and flatworms (*Phagocata*, 10%). These four groups constituted about 71% of the macroinvertebrate community in the outfall channel. For a complete inventory of macroinvertebrates collected see the report "Supplemental Field Assessments for PPL Riverlands" (LandStudies, 2010). Additional macroinvertebrate information is provided in "A Field Survey of Fish and Macroinvertebrates" (Normandeau, 2011).

The unnamed Tributary to Lake Took-A-While is not a navigable waterway. It is located southeast of the BBNPP site and its drainage area is not part of the Walker Run watershed. Macroinvertebrate results for sampling conducted on the unnamed tributary to Lake Took-A-While are included in the Field Survey of Fish and Aquatic Macroinvertebrates (Normandeau, 2011). The macroinvertebrate community was dominated by the amphipod Gammarus and only one EPT species was collected which compromised 0.3% of the collection. This may indicate either poor benthic habitat conditions or poor water quality.

An additional unnamed tributary to the NBSR flows southeastward from the Project Boundary and empties into the NBSR about 0.8 mi upstream from the Walker Run confluence. It is not a navigable waterway. Its drainage area is not part of the Walker Run watershed. Studies were not completed on this stream because there are no planned stream impacts to this unnamed tributary.

2.1.1 Walker Run Watershed

Walker Run is a second order tributary to the NBSR and enters the NBSR at approximately river mile 164. It is not a navigable river. Walker Run is a relatively small stream, but is the largest in the immediate vicinity of the Project Boundary. It flows south toward the NBSR and west of the BBNPP footprint.

Walker Run is shallow and flows through a mixture of agricultural and forested lands. It is listed as a Cold Water Fishery by PADEP Chapter 93 Water Quality Standards. Walker Run supports reproducing brown trout populations; therefore all wetlands

hydrologically connected to Walker Run or its tributaries are considered exceptional value (EV) wetlands.

Walker Run has two unnamed tributaries. Neither are navigable waterways. Unnamed Tributary 1 (also referred to as UNT1 or the Eastern Tributary) flows along the eastern and southern site boundaries of the BBNPP footprint and discharges into Walker Run on the southwest side of the site. Tributary 2 (UNT2) is a tributary to Tributary 1. It flows south from the BBNPP power block (originating in the "teardrop wetland") and is piped beneath agricultural fields before emptying into the unnamed tributary.

According to "Walker Run Surveys: Wild Trout Habitat Assessment," Walker Run stream characteristics change significantly throughout the length of the watercourse. In this study, Walker Run and its tributaries were evaluated using the EPA Rapid Bioassessment Protocol. In general, upstream of Beach Grove Road, stream habitat is optimal to near optimal due to adequate shade, low substrate embeddedness, and sufficient riffle areas. The reach downstream of Beach Grove Road has marginal habitat quality attributed to greater substrate embeddedness, greater sediment deposition, fewer riffle areas, channelization, poor bank stability and poor vegetative protection (LandStudies, 2009). Despite these negative characteristics, a reproducing brown trout population was documented both downstream and upstream of Beach Grove Road. See the "Walker Run Trout Enhancement Plan" (LandStudies, 2010) for detailed existing characteristics of Walker Run relating to ideal brown trout habitat. Other species of fish that were relatively abundant within Walker Run include blacknose dace, creek chub, white sucker, and tessellated darter (A Field Survey of Fish and Macroinvertebrates at the Proposed Bell Bend Nuclear Power Plant Site, Normandeau, 2011).

"Walker Run Surveys: Wild Trout Habitat Assessment," also evaluates macroinvertebrates populations. Using the Hilsenhof Biotic Index, sampling results coupled with macroinvertebrate tolerance values were used to indicate water quality. Generally, macroinvertebrates collected upstream of Beach Grove Road indicated very good water quality while downstream reaches indicated good to fair water quality. The blackfly, *Prosimulium,* was the dominant taxa collected in Walker Run. The EPT group generally comprised a large number of the taxa identified (LandStudies, 2009).

"Bell Bend Project Site: Supplemental Field Assessments for the Walker Run Watershed" discusses habitat, macroinvertebrates, and substrate embeddedness in the

unnamed tributaries. Habitat characteristics of the unnamed tributaries to Walker Run were rated marginal due to poor epifaunal substrate, pool variability, and low channel sinuosity. The unnamed tributaries had a high embeddedness rating with a dominant substrate of silt and sand. Portions of Tributary 1 did not contain flow during summer 2010. Tributary 2 is piped beneath a corn field which serves as a habitat barrier.

Macroinvertebrates collected at unnamed tributaries 1 and 2 indicated fair to poor water quality. The community at Tributary 1 was dominated by pill clams (*Pisidium*), scuds (*Hyalella*), freshwater worms (*Oligochaeta*), and midges (Chironomidae). The community at Tributary 2 was dominated by midges and pill clams (LandStudies, 2010). Ephemeroptera was the dominant EPT taxon (LandStudies, 2009).

For a complete inventory of macroinvertebrates collected in the Walker Run Watershed see the "Walker Run Surveys: Wild Trout Habitat Assessment" (LandStudies, 2009), "Bell Bend Project Site: Supplemental Field Assessments for the Walker Run Watershed" (LandStudies, 2010), and "A Field Survey of Fish and Aquatic Macroinvertebrates at the Proposed Bell Bend Nuclear Power Plant Site" (Normandeau, 2011).

Vegetative production, leaf matter, macroinvertebrates, and a variety of fish species all contribute to food chain production within the Walker Run watershed. Plant species and plant community structure diversity provide adequate nesting, spawning, rearing, resting, migration, feeding and escape cover for wildlife. There is ample food supply for insect, amphibian, and avian populations. Fragmented forested areas serve as buffers to segments of Walker Run, the unnamed tributaries 1 and 2, and some wetland areas. These buffers provide valuable habitat for terrestrial and aquatic species. Wetlands, both forested and emergent, appear hydrologically connected to the unnamed tributaries and provide excellent habitat. Within the project boundary some reaches of Walker Run have productive wetland complexes adjacent to the stream channel. A reach of Walker Run south and west of the power block footprint is severely incised and manipulated with no forested cover. Few wetlands are connected to the stream throughout this reach.

2.2 Wetlands: General Habitat and Food Chain Production

Wetland types within the project boundary include Palustrine Emergent Wetland (PEM), Palustrine Scrub/Shrub Wetland (PSS), Paulstrine Forested Wetland (PFO) and open water areas. There are no named wetlands or swamps within the project boundary.

"A Field Survey of Plant Communities at the Proposed Bell Bend Nuclear Power Plant Site," describes the wetland types found within the project boundary. Typical PEM wetlands within the project boundary include a diverse group of herbaceous hydrophytic plants including soft rush, sedges, arrow-leaf tearthumb, common boneset, giant goldenrod, seedbox, nutsedges, blue vervain, New York ironweed, swamp aster, cut-leaf coneflower, broad-leaved cattail, reed canary grass and purple loosestrife.

Several large PSS wetlands are located in the western part of the Project Boundary. Hydrophytic shrubs are also a component of many wetland habitat types across the Project Boundary. Spicebush is overwhelmingly the most abundant wetland shrub on site. Other frequently occurring wetland shrubs include: highbush blueberry, meadowsweet, alders, silky dogwood, arrow-wood and grey dogwood.

Palustrine forested wetlands are the principal wetland habitat type within the Project Boundary. Large contiguous blocks of this wetland type extend across the western section of the Project Boundary. Trees commonly found in wetland forest habitat include red maple, silver maple, black gum, pin oak and river birch. In addition, upland preferring species such as white ash and yellow poplar are present on upland microsites scattered throughout some forested wetlands. Wetland forest understories are comprised largely of spicebush, highbush blueberry, arrow-wood, and winterberry. Skunk cabbage is predominant in the groundcover along with sedges, jewelweed, sensitive fern, clearweed, cinnamon fern, stout woodreed grass, and swamp dewberry" (Normandeau, 2011).

The majority of wetlands and ponds evaluated in the "Wetlands Functions and Values Assessment" were found to have adequate nesting, spawning, rearing, resting, migration, feeding and escape cover for wildlife. Wildlife habitat qualified as a principle function for most wetlands due to habitat connectivity, ample food supply for insect, amphibian, and avian populations, plant species and community structure diversity, as well as changing seasonal wetland uses. Many wetlands provide ideal habitat for a

large range of wildlife including mammals, birds, amphibians or reptiles. The PPL Riverlands Property has also been identified by The Pennsylvania Audubon Society as an Important Bird Area (IBA). Wetlands within the Walker Run watershed are considered EV due to reproducing brown trout populations in Walker Run.

Wetlands evaluated as not-suitable wildlife habitat during the Wetland Functions and Values Assessment include Wetlands 2, 3, 5, 13, 15, 22-24, 33, 49A, B and C, 54, 55, and 62 shown on the Wetland JD Map and Wetland and Watercourse Impact Map in Enclosures A1 and D1, respectively (note: wetland expansions or additions resulting from the third JD were not evaluated). These wetlands are small, lack plant community diversity, and/or are surrounded by developed upland.

Although habitat was identified as a principle function of the proposed wetland impact areas at the Riverlands property, this area has a large invasive species population including purple loosestrife, mile-a-minute, and multiflora rose (LandStudies, 2011).

Five ponds exist within the BBNPP Project Boundary. Johnson's Pond and the Farm Pond are spring fed. The Beaver Pond was created by beaver activity around an existing culvert crossing. The beaver dam at the Beaver Pond was removed and a weir structure installed to re-establish the open water that existed upstream of the beaver dam. Unnamed Ponds 1 and 2 are isolated ponds east of Confers Lane. All ponds are shallow. Johnson's Pond is the deepest with up to 5 foot water depths.

3. Habitat for Threatened and Endangered Species

The Pennsylvania Natural Diversity Inventory indicated multiple species of concern listed below:

- Indiana Bat (endangered) – United States Fish and Wildlife Service, PA Game Commission
- Butterflies (species of special concern) – Baltimore Checkerspot and Mulberry Wing – PA Department of Conservation and Natural Resources
- Mussels (PA rare) - Yellow Lampmussel and Green Floater– PA Fish and Boat Commission
- Northern Cricket Frog (PA endangered) – PA Fish and Boat Commission

"A Field Survey of Terrestrial Flora and Fauna," documents the species found within the BBNPP Project Boundary, including threatened, endangered, and species of concern. Butterfly surveys were documented in this report. Baltimore Checkerspot and Mulberry Wing butterflies were not found on-site. The life cycle of the Baltimore Checkerspot is tied closely to its host plant, turtlehead (*Chelone glabra*). Turtlehead was not found in the wetlands at the BBNPP site. The Mulberry Wing butterfly prefers tall grass meadow and sedge meadow habitat. These habitats occur in moderate amount at the BBNPP site (Normandeau, 2011).

The proposed BBNPP is located in close proximity to overwintering hibernacula for Indiana Bats. The results of a Bat Mist Net Survey are included in the Terrestrial Flora and Fauna Report. Despite suitable habitat, no Indiana bats were captured (Normandeau, 2011). An additional study, requested by the USFWS, was completed in fall 2010 and revised in fall 2011. The "Indiana Bat Roost Tree Survey Report" evaluates the interior forests and forest edges within the Project Boundary to identify potential roost trees (PRTs) and to qualify the Indiana bat habitat found within the Project Boundary. Out of the 255 PRTs indentified in the interior forest survey area, 118 were live, 114 were dead, and 23 were partially dead. Roost types included 252 PRTs with exfoliating or defoliating bark, 13 with suitable crevices, and 5 with suitable cavities. The United States Department of the Interior (USDOI) criteria recommends a minimum of 6 potential roost trees (PRTs) per acre for interior forest. Of the eighteen forest area interior sites studied, five exceeded the USDOI recommended PRT density. Forested wetlands generally exceeded this threshold and also contained higher densities of high quality PRTs. The aggregate PRT density within interior forest uplands and the interior forest on the site, as a whole, was slightly below the recommended threshold, however one upland site had significantly higher PRT density than the others (19.4 PRTs per acre). As a whole, 1.7 high quality PRTs per acre were identified within the interior forest studied.

Of the 286 PRTs identified along forest edges, 192 were live, 77 were dead, and 17 were partially dead. Roost types included 295 exfoliating or defoliating bark, 4 with a crevice, and 1PRT with a cavity suitable for roosting. USDOI suggests a minimum PRT density of 1.0 PRT per 500 feet along forest edges. Thirteen of the 18 forest area edges characterized met this criterion. The 286 PRTs observed resulted in 1.9 PRTs per 500 ft

across the forest edge studied. The forest edges as a whole yielded 0.6 high quality PRTs per 500 ft (Normandeau, 2011).

One Northern Cricket Frog call was heard by Normandeau Associates during field surveys south of the BBNPP footprint. The call was heard near the farm pond, which will not be impacted by project construction or operation. The Northern Cricket Frog had not been heard prior and has not been heard since, near the farm pond or at any other location within the BBNPP Project Boundary. The Northern Cricket Frog has also never been sighted within the BBNPP Project Boundary. Habitat preferences include sunny, shallow ponds with abundant vegetation in the water and on the shore and slow-moving, algae covered water courses with sunny banks (NYDEC, 2009). The BBNPP project will not affect the existing ponds on-site. In addition the planned mitigation on Walker Run should benefit any potential Northern Cricket Frog populations through increasing the quantity and quality of wetlands adjacent to Walker Run. Details regarding the mitigation plans can be found in Section R of the JPA.

A "Mussel Survey in the Susquehanna River in the Vicinity of the Proposed Bell Bend Nuclear Power Plant Site" was completed near the proposed intake structure location. The survey revealed relatively wide distribution of the Yellow Lampmussel. The Yellow Lampmussel is relatively abundant within the main stem of the Susquehanna River but is less common in tributaries to the Susquehanna and other river systems (Normandeaeu, 2010). Its condition is considered vulnerable to relatively stable by the PA Natural Heritage Program. One Green Floater was collected during macroinvertebrate sampling on the NBSR completed by Ecology III in 2007 (Normandeau, 2010). The Green Floater is considered imperiled by the PA Natural Heritage Program. This species is not common in Pennsylvania but has been found in the Susquehanna, Delaware, and Ohio river drainages (Unistar, 2011). The Green Floater prefers pools and other calm areas within streams with hydrologic stability (Unistar, 2011). This section of NBSR is typical of habitat found upstream and downstream of the BBNPP site and otherwise provides no unique or protected habitat.

4. Environmental Sanctuaries and Study Areas

There is one environmental study area and wildlife sanctuary that is adjacent to and within a small portion of the Project Boundary. PPL owns and operates the Riverlands Recreation Area, a 400 acre strip of land east of US 11 and west of the NBSR. This

tract of land contains a nature center, a recreation area with ball fields and picnicking pavilions, Lake Took-A-While and a Wetlands Nature Area. A portion of the Recreation Area, Wetlands Nature Area and Lake Took-A-While lie within the Project Boundary. The Wetlands Nature Area provides an area for nature study and educational programs and was designated an Urban Wildlife Sanctuary in 1988. The Humane Society of the United States Urban Wildlife Sanctuary Program fosters a greater understanding and appreciation of wildlife in urban areas by encouraging stewardship practices that improve conditions for wild animals, and by promoting humane solutions for resolving human-wildlife conflicts, when they occur. PPL also prohibits hunting, fishing, trapping and pets within the Wetlands Nature Area.

5. Water Quantity and Stream Flow

5.1 Streams

5.1.1 NBSR Watershed

The NBSR flows southeast through high, flat-topped plateaus separated by steep-sided valleys. As it flows downstream, the NBSR is joined by the Lackawanna River where it turns southwest and flows towards Sunbury, PA" (Unistar, 2011). Major upstream tributaries include the Lackawanna and the Chemung rivers. The total drainage area above the proposed BBNPP site is approximately 10,240 square miles (Unistar, 2011).

An east-west trending ridge runs along the north side of the BBNPP and SSES site. The ground surface is highest in elevation along the ridge top; surface elevation decreases to the east and south toward the NBSR. Surface drainage from the ridge, the BBNPP and SSES sites, and adjacent farmlands drains via small creeks southward and eastward toward the NBSR. These creeks include Walker Run and small unnamed tributaries. Confer's Lane acts as the drainage divide between the NBSR and Walker Run watershed within the BBNPP Project Boundary. Runoff from the SSES flows eastward towards the NBSR and does not enter the Walker Run watershed.

The USGS has two river gages upstream and downstream of the BBNPP site. Table 1 provides a summary of the gages.

Table 1. Summary of USGS River Gages Upstream and Downstream of BBNPP

	Wilkes-Barre	Danville
USGS Gage No.	01536500	01540500
Distance from BBNPP intake	20 miles upstream	26 miles downstream
Drainage area	9,960 sq miles	11,220
Daily flow record	April 1899 to present	April 1905 to present
Long-term average flow	13,700 cfs	15,500 cfs

The flow in the river at BBNPP is largely unregulated. The ACOE operates eight reservoirs upstream from BBNPP, all of which provide flood control. Three of the ACOE reservoirs -- Cowanesque, Tioga-Hammond and Whitney Point -- also provide low flow augmentation. However, the combined usable storage of these eight reservoirs, excluding uncontrolled flood storage, amounts to approximately two-thirds of one inch of runoff within the NBSR watershed at BBNPP.

There are also numerous recreation and municipal water supply reservoirs upstream from BBNPP, but these reservoirs are relatively small and contribute relatively little flow regulation.

Susquehanna River flows vary significantly throughout the year. As is typical of streams in this region, the lowest river flows generally occur in September and October and the highest flows in March and April. The river flow at BBNPP generally reflects the flow at the Wilkes-Barre gaging station, due to the relatively small drainage area between the gage and BBNPP. Table 2 shows the flows as recorded at Wilkes-Barre that are exceeded at various percentages of time during the year and by month, based on the 111-year flow record. (To determine flow rates at BBNPP for purposes evaluating the potential effects of BBNPP on the local, riverine aquatic habitat, flows at the Wilkes-Barre gage are increased by 2.8 percent to reflect the increased drainage area at BBNPP).

The reach of the NBSR in the vicinity of BBNPP is a pool, at least at relatively low flows. The pool begins at the SSES Environmental Laboratory (approximately 0.2 miles upstream from the BBNPP intake location) and extends downriver approximately 0.7

miles. At a river flow of 1,570 cfs, the estimated average width and depth of the pool are 790 ft and 5 ft, respectively, equivalent to a volume of approximately 110 million gallons.

Table 2. River Flow Exceedances at Wilkes-Barre (April 1899-March 2010)

Percent Time Exceeded	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
100 (minimum)	532	1,010	1,060	2,100	5,210	2,000	1,350	787	716	532	658	627	860
90	1,690	3,300	3,700	7,000	11,000	5,160	2,600	1,450	1,100	1,040	1,180	1,930	3,070
80	2,660	4,500	4,758	10,300	14,400	6,690	3,270	1,890	1,410	1,290	1,540	3,260	4,850
70	3,980	5,600	5,990	13,900	17,000	8,180	3,930	2,310	1,670	1,580	1,910	4,570	6,400
60	5,440	7,100	7,186	17,600	20,200	9,970	4,746	2,860	2,000	1,890	2,490	5,910	8,090
50	7,400	9,100	8,800	22,100	24,000	12,000	5,775	3,480	2,440	2,290	3,360	7,540	10,200
40	10,100	11,500	11,100	27,300	28,400	14,600	7,194	4,240	3,000	2,810	4,500	9,548	12,500
30	14,100	14,900	14,680	34,200	34,000	18,000	9,172	5,220	3,840	3,700	6,000	12,700	15,700
20	20,300	21,000	21,120	44,200	42,700	22,500	12,820	7,080	5,310	5,434	9,000	17,000	20,700
10	32,500	32,500	34,100	64,900	58,520	31,800	19,300	11,100	8,270	9,000	16,000	24,620	30,100
0 (maximum)	329,000	210,000	179,000	229,000	206,000	206,000	329,000	142,000	95,300	244,000	151,000	123,000	184,000

The NBC watershed begins east of Confers Lane at the unnamed tributary to Lake Took-A-While as well as an additional unnamed tributary which flows into the northern segment of the NBC near the temporary laydown area. The unnamed tributary to Lake Took-A-While is fed by spring sources and surface water runoff. It flows southeast from the BBNPP site and empties into the NBSR via Lake Took-A-While and the NBC about 0.8 mi upstream from the Walker Run confluence. Its drainage area is not part of the Walker Run watershed. Flushing events are expected to occur within the unnamed tributary to Lake Took-A-While.

Lake Took-A-While is a constructed lake that covers approximately 30 acres. Hydraulically, Lake Took-A-While and the NBC both function as stormwater impoundments that are large in proportion to the watersheds that they serve. The presence of these impoundments results in a very slow hydrologic response to a storm event. Flushing events do not occur within the NBC.

The hydrology within the NBC outfall channel is subject to high flows in the NBSR as well as artificially controlled by the weir at the NBC. Flow from the weir outlets into the NBC outfall channel which carries storm flows from the weir to the NBSR. Groundwater discharge provides minimal flow to the NBC outfall channel. Over time, the channel has deteriorated into its present ditch-like condition. Flushing events are expected to occur in the NBC outfall channel during high flows.

5.1.2 Walker Run Watershed

Walker Run and other small streams in the vicinity of the Project drain from the east-west trending ridge north of the project boundary and flow southward toward the NBSR. Water levels in Walker Run appear to be heavily influenced by surface runoff and from upstream drainages to the north and northwest of the site in addition to springs and snowmelt. The majority of spring flow is located upstream of Beach Grove Road, however a few springs are located downstream. Walker Run is a low to moderate gradient stream with a gradient drop from Upper Walker Run to Lower Walker Run of almost 290 ft over a distance of approximately 4 mi. Walker Run's drainage area to the NBSR is about 4.1 mi^2 (Unistar, 2011).

The majority of Walker Run, south of Beach Grove Run, is incised. The incised nature of the stream causes a disconnection between the stream and the floodplain.

Floodwaters are confined to Walker Run with little access to the floodplains except during high flow events. High flows "trapped" within the stream channel increase the bank erosion and sediment embeddedness problems documented throughout the southern portion of Walker Run. Most wetlands adjacent to Walker Run provide limited storage for upland surface water runoff but rarely receive stream floodflows.

A large forested wetland complex exists south of the proposed BBNPP footprint and adjacent to Walker Run. Although portions of this channel are incised, a strong connection remains between the groundwater, stream, and floodplain.

Stream flow data collected between November 2009 and June 2010 indicate that Walker Run is a balanced system (not gaining or losing), although a statistical analysis was not performed to determine if the results can be considered significant (Bell Bend Project Site: Supplemental Field Assessments for the Walker Run Watershed, LandStudies, 2010).

The removal of a beaver dam on Walker Run south of the BBNPP footprint affected the hydrology of the stream and the adjacent wetland. Prior to this beaver dam removal, backwater conditions existed upstream of the beaver dam on Walker Run and its Tributary 1. Beavers were trapped and relocated and the beaver dam was removed on April 12, 2010. Beaver dam removal resulted in a small decrease (6 inches) in local groundwater elevation based on changes in observed water levels in piezometers installed before dam removal. Beaver dam removal improved the flushing capacity of Walker Run.

Tributary 1 to Walker Run has a drainage area of about 0.68 mi^2 and an approximate length of 2.1 miles (Unistar, 2011). It is fed by both surface water runoff and groundwater discharge from spring seeps and wetlands. A culvert crossing and weir structure is located on Tributary 1 forming the surface water body named the "Beaver Pond." Beaver activity around the old culvert structure formed the pond before culvert replacement. The north/south reach of the unnamed tributary below the Beaver Pond is incised due to a man-made berm that runs adjacent to the stream preventing floodflows from accessing the floodplain. Downstream, the east-west reach of Tributary 1 is well connected to its floodplain, helping to attenuate floodflows and stabilize the stream. Current impediments to flushing events within the unnamed tributary include the weir structure and an existing culvert restriction between wetlands 10 and 12.

Tributary 2 is fed primarily by multiple springs within the tear drop wetland, but also receives surface water runoff. Tributary 2 is piped underneath a fallow crop field. A grassed waterway is also present for high flows overtopping the pipe. The pipe limits but does not eliminate the flushing ability of Tributary 2.

5.2 Wetlands: Water Quantity and Streamflow

The wetlands within the BBNPP Project Boundary perform various hydrologic functions including groundwater discharge and recharge, storm and floodwater storage and control, and flushing characteristics. For a summary of all the functions and values of the wetlands within the BBNPP project boundary and how each wetland affects hydrology within the watershed see the "Wetland Functions and Values Report" (LandStudies, 2011). The existing hydrology of the permanent and temporarily impacted wetlands is described below. Impacts as well as wetland reference numbers are shown on the Wetland and Watercourse Impact Location Map for ACOE and DEP, Enclosures D1 and D2.

Wetland 5 is a small, isolated wetland east of North Market Street. The wetland is a groundwater discharge point on a hillside. The wetland is considered isolated because discharged water is reabsorbed and does not affect Walker Run flow conditions. The soils down slope seem to have a high infiltration rate. The discharge is likely seasonal.

Wetland 11, or the "teardrop" wetland, is the result of multiple groundwater seeps at the base of the wooded slope east of Tributary 2 and groundwater seeps forming an intermittent drainage channel to the north. Groundwater recharge is minimally occurring in the wetland. The wetland is not permanently flooded and is located in a flat valley bottom where depressions may hold and infiltrate runoff affecting floodflows downstream. A diffuse but channelized flow forms (Tributary 2) in the northern portions of the wetland. The flow varies from above to below ground. The underground flow comes out at 3 distinct headcut locations in the middle of the wetland. From the headcuts, the flow is channelized until it is piped underneath agricultural fields at the base of the wetland before discharging into Tributary 1.

Wetland 12 begins south of Beach Grove Road and east of Johnson Pond and follows Tributary 1 to Walker Run. A culvert under an old farm lane acts as the southeastern

boundary of the wetland and as a separation between the forested and emergent vegetated areas. Hydrology is provided by groundwater seeps and surface water runoff.

Tributary 1 is formed by the Johnson Pond outlet as well as two drainage features originating from culvert pipes under Beach Grove Road. Groundwater discharge and recharge vary seasonally in this area. An existing culvert crossing is located at the southern tip of the Beaver Pond. A beaver dam previously existed on the manmade crossing, creating a large pond upstream. The beaver dam was removed as part of the culvert replacement.

Downstream of the Beaver Pond to the 90 degree bend in Tributary 1 the wetland is inundated during winter and spring with drier conditions during the summer months. Seasonal groundwater discharge and recharge is likely occurring. The wetland is flat and capable of detaining surface water runoff from surrounding upland during rain events, minimally affecting floodflows in Tributary 1. Two channels of water fed by surface water runoff from the west building parking lot and Confers Lane feed the wetland and Tributary 1 during rain events. These two flat but channelized flows join within the wetland and then flow to Tributary 1 as it begins to flow in an east-west direction. Tributary 1 appears to have been channelized throughout the north-south section, especially west of the West Building where berms have been built on either side of the stream. The berms appear to be sidecast from digging out the channel and limit the connection of Tributary 1 and surrounding wetland except during high flow events.

The source of hydrology for the wetland associated with the east-west reach of Tributary 1 appears to be overland flow, groundwater upwellings when the water table is high, as well as excess stream flow from Tributary 1 and Tributary 2. The culvert causes backwater conditions, therefore floodflow alteration is a suitable function of this wetland. The wetland can hold and infiltrate some surface runoff from surrounding upland areas. During larger storm events the east-west stream reach will overflow its banks and utilize the surrounding flat wetland. In smaller rain events the stream channel is defined enough that flow will remain in the channel. In this area, the wetland performs stream stabilizing functions. Seasonal groundwater recharge and discharge is believed to be a suitable function in the east-west area of the wetland. The topography, lack of standing water, and constricted outlet are some characteristics that imply recharge is occurring.

Wetland 10 is an emergent wetland adjacent to wetland 12, separated by the farm lane and culvert crossing. This wetland is unique because hydrologic conditions were significantly affected by a beaver dam. The beaver dam was located on Walker Run, downstream of the confluence with Tributary 1. The beaver dam caused significant backwater to inundate the area surrounding the tributary raising groundwater elevations. Inundation increased with proximity to the beaver dam. The beaver dam was removed in April 2010, affecting the hydrologic conditions in this wetland. The removal of the beaver dam drained the inundated area and caused intermittent flow within Tributary 1 during dry months. The wetland also contains sandy soils, and flat, favorable topography to detain and infiltrate surface water runoff and seasonal high flow from Tributary.

Within this wetland, Tributary 1 to Walker Run channel appears to have been historically straightened and channelized for agricultural use. This wetland can retain higher volumes of water under flood conditions than in normal or average rainfall conditions. This wetland receives overland flow from surrounding uplands and excess flow from the eastern tributary during rain events. The culvert located at the upstream edge of this emergent wetland creates floodflow storage upstream in Wetland 12; however, this reduces the amount of flow wetland 10 can receive during a storm. Flushing events are infrequent due to flat topography, low channel grade, and intermittent channel flow within Tributary 1.

Wetland 18 surrounds an open water pocket east of Confers Lane. The hydrology of this wetland is stable with regard to seasonal water fluctuations; remaining saturated and inundated throughout the year. It collects direct precipitation as well as surface water runoff and likely has a water table at or near the soil surface during wet periods. This wetland does not have an outlet, however prior to land alteration for transmission line construction the wetland likely drained towards wetland 25 to its east. Water is retained in this wetland until it evaporates, infiltrates, or is used by plants through evapotranspiration.

Wetland 19, south of the BBNPP site and east of Confers Lane, is a forested wetland associated with the Susquehanna River watershed. This wetland is contiguous with wetland #20, although a portion lies outside the BBNPP Project Boundary. The wetland is large compared to the size of its watershed. Its large area and flat topography make it

suitable to store surface water runoff from surrounding uplands and therefore influence floodflows in the downslope watershed. Hydrology is provided by surface runoff during rain events. Additional hydrology may be provided by seasonal groundwater discharge. This wetland is inundated during the winter months. The wetland is flat and water drains slowly towards an undefined swale at the center of the wetland. The swale runs southeast towards wetland #20. The soils observed appear to be fine-grained silts with a less permeable clay layer near the surface. As a result, infiltration rates appear to be very slow but limited groundwater recharge is likely occurring. There is a slight indication of diffuse flow and there is no distinct channelization or erosion.

Wetland 49 consists of three separate wetlands designated A, B, and C. These wetlands are manmade and were created by grading around the existing SSES facilities. One of these small wetland pockets (49A) is an isolated depression located on fill adjacent to the switchyard fence. This wetland does not affect hydrology. The other two small wetlands (49B and 49C) receive stormwater runoff from the switchyard and SSES. Wetland 49B is an emergent grass wetland that briefly receives stormwater flow before it outlets through a culvert into 49 C. Wetland 49C is a rip-rap, steeply-sloped basin with wetland vegetation at the bottom of the basin. Inlet and outfall pipes are present in the basin. Water may be briefly retained before it is discharged into the unnamed tributary to Lake Took-A-While. These wetlands could minimally affect floodflows, however, significant quantities of water do not appear to be detained based on basin design.

Wetlands 37, 38, and 43 are located at PPL Riverlands. Wetland drainage areas are extremely small because walking trails and roads create artificial boundaries. Two distinct hydrologic areas will be impacted; the flat, emergent wetlands adjacent to the intake structure access roads and walking trails, and the forested wetland directly adjacent to the NBC outfall channel. The flat emergent wetland areas receive direct rainfall and some road/walking trail runoff. These wetlands are perched on a compacted fill layer preventing groundwater recharge or discharge. Direct precipitation and poorly drained soils contribute to the hydrology of this wetland. Due to the flat topography, lack of an outlet, and impermeable layer, evaporation and evapotranspiration are assumed to be removing water from the wetland. A portion of these wetlands are within the floodplain of the NBSR and could provide flood conveyance and storage during large occasional flood events. These wetlands also collect and temporarily store stormwater runoff; however, the wetlands adjacent to the NBC outfall channel do little to decrease

flood flows as the channel is severely incised. Towards the NBC weir the wetland topography is flatter.

Wetland 44 is located east of an access road/walking trail. The north boundary of the wetland is defined by the NBC outfall channel. This wetland is primarily PFO wetland with some emergent areas. A large raised area, likely an old fill pile exists between the wetland and the NBSR to the east. The NBC flows north to south dividing the wetland. The topography flat, but the majority of the area drains slowly towards the NBC outfall channel. The hydrologic conditions of this wetland change significantly with the seasons. During wet seasons the majority of the wetland retains water for long periods of time and exhibits diffuse flow with high interspersion of vegetation and water. Hydrology is provided by direct precipitation, occasional stream overflow from the canal, and close proximity to groundwater.

This wetland seasonally provides groundwater recharge and discharge. A compact soil layer exists approximately 18-24 inches deep. This could potentially serve as a barrier between the surface and groundwater limiting recharge or discharge. This wetland retains water due to its flat topography, dense vegetation, and the slow movement of water through the wetland. Thus, the wetland has the capability to provide some flood storage if the NBC were to overflow or if the NBSR experienced a large flood event. However, the small size of the wetland compared to the watershed would be of little significance in providing this function.

6. Water Quality

6.1 NBSR Watershed

NBSR water quality has been significantly degraded by mining practices and other anthropogenic sources. SSES has monitored water quality on the Susquehanna since 1968. Water quality in the NBSR in the vicinity of the BBNPP site has improved steadily since the early 1970's (Unistar, 2011). The water quality improvements have been attributed to a reduction in abandoned mine drainage and a reduction in point source pollutants from municipal wastewater treatment plants and industries. According to the Environmental Report in the BBNPP Combined Licensing Application, the most obvious water quality improvement in the NBSR has been the reduction in total iron levels along with decreasing concentrations of several other water quality indicators including

turbidity, sulfate, and total suspended solid. pH and alkalinity have increased on the NBSR over the past 30 years, resulting from reduced mining within the watershed. Between 2002 and 2008 the pH ranged from 6.8 to 7.8. Specific conductance has also decreased as a result of declining mining operations (Unistar, 2011).

The Nescopeck Creek, a tributary to the NBSR downstream of the BBNPP project site, is impaired by acidic drainage from abandoned mines within its watershed. Currently the affects of abandoned mine drainage on the NBSR at the confluence with the Nescopeck is contained to the NBSR south shoreline and traceable effects dissipate within 0.6 miles of the confluence (Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users, Normandeau, 2011).

Recent dissolved oxygen measurements of the NBSR reveal good aeration, near saturation. Measurements ranged from 8.9 mg/L to 11.0 mg/L (Unistar, 2011). Nitrate, ammonia, and total phosphorus concentrations can be slightly elevated which is typical of rivers in agricultural areas that also receive sewage treatment plant effluents. Fecal coliform was at detectable levels in each river sample. No minor or trace metal concentrations are elevated in the NBSR except iron concentrations which range from undetectable to slightly elevated. Radionuclides were tested for in 2008, none were detected (Unistar 2011).

Appendix A of the JPA, Items 30 and 31, provide additional information regarding stream bottom sediment substrate composition and a sediment analysis for the presence of hazardous dredgate and pollutants. The full report, "Sediment Characterization Report Bell Bend Nuclear Power Plant, Susquehanna River, Berwick, Pennsylvania" (AECOM, 2011) is provided in Appendix B.

"Bell Bend Project Site: Supplemental Field Assessments for PPL Riverlands" documents the macroinvertebrates collected at the NBC outfall channel. The macroinvertebrates collected indicated fair to poor water quality using the Hilsenhoff biotic index, even at the downstream reach (LandStudies, 2010).

The only data collected on the unnamed tributary to Lake Took-A-While (with headwaters southeast of SSES) indicative of water quality was the macroinvertebrate sampling described in "A Field Study of Fish and Aquatic Macroinvertebrates." The macroinvertebrate community was dominated by the amphipod Gammarus and only one

EPT species was collected which comprised 0.3% of the collection. This may indicate either poor benthic habitat conditions or poor water quality (Normandeau, 2011).

6.2 Walker Run Watershed

In general, the incised nature throughout the majority of Walker Run prevents adequate filtering of high flows which are trapped within the banks. Wetlands along the stream may detain and filter surface water runoff but rarely receive high stream flows from banks over-topping.

Water quality parameters were similar for Walker Run and its tributaries. The pH values typically fell between 7.0 and 7.9. The alkalinity of Walker Run ranged between 5.9 mg/L and 38 mg/L, which is lower than the NBSR. This is expected since the specific conductance and TDS of the water are also low (Unistar, 2011).

High specific conductivity values were measured at the discharge pipe of Tributary 2 (Unistar, 2011). These measurements indicate a high proportion of groundwater from springs in the teardrop wetland. These results were corroborated in the "Bell Bend Project Site: Supplemental Field Assessments for the Walker Run Watershed" (LandStudies, 2010).

According to the Environmental Report in the Combined License Application, total dissolved solid measurements ranged from 45-80 mg/L within the project boundary. Dissolved oxygen typically measure 9.0 mg/L or greater. Nitrate, ammonia, total Kjeldahl nitrogen, organic nitrogen, and total nitrogen were detected in the creeks on occasion, but at concentrations less than 1.5 mg/L. Ammonia nitrogen was somewhat elevated in Walker Run in April 2008. Orthophosphate was detected in one sample collected in October 2008. All metal concentrations measured were either low or not detectable. Manganese was found at higher levels in the creeks than in the NBSR due to groundwater discharges from springs and wetlands which commonly contain higher levels of manganese and iron (Unistar, 2011).

Fecal coliform bacteria and total coliform bacteria were detected in all creek samples (Unistar, 2011). Farm animals and septic tanks probably account for the majority of the detections.

Macroinvertebrates in Walker Run were collected and identified. Sampling results coupled with macroinvertebrate tolerance values were used to indicate water quality. Generally, macroinvertebrates collected upstream of Beach Grove Road indicated very good water quality while downstream reaches indicated good to fair water quality. Macroinvertebrates collected at both unnamed tributaries indicated fair to poor water quality (Walker Run Surveys: Wild Trout Habitat Assessment Report, LandStudies, 2009).

6.3 Wetlands

Many of the wetlands within the BBNPP property boundary provide filtering functions, removing sediments, nutrients, and toxins from surface water. For a summary of all wetland functions and values within the BBNPP property boundary see the "Wetland Functions and Values Report" (LandStudies, 2011). The water quality functions of permanently and temporarily impacted wetlands are discussed below.

Wetland 5 does not provide water quality improvement functions. The wetland is small (0.12 acres) and isolated. It is located on a steep hillside in the upper region of the watershed. Forest and shrub areas comprise the upstream watershed; therefore pollutants entering the watershed are minimal.

Wetland 11 does not perform water quality improvement functions because a significant source of pollutants does not exist in the upslope watershed. The stable upper reach of Tributary 2 has low vegetated banks that can slow and filter water. This wetland also contains a flat valley bottom with a high density of vegetation throughout the wetland and some vegetation and water interspersion in the upper, stable portion of the channel. Below the headcut, water in the channel is not slowed by vegetation or a low easy accessible floodplain. Filtering of sediments in this portion of the wetland would only occur during high flows. Minimal sources of sediment (except stream bank erosion) and no sources of nutrients were identified in this wetland's watershed.

Wetland 12 provides water quality improvement functions. Wetland characteristics including flat topography and depressions, and backwater from undersized culverts and the weir structure promote water retention, sediment detention, and nutrient uptake. Normandeau's water quality testing revealed high conductivity levels within the unnamed tributary. This could indicate groundwater discharge into the steam.

Wetland 10 could provide water quality improvement functions due to its flat topography with dense emergent vegetation that slows and detains water. However, there is a lack of upslope nutrients and sediment pollution within the watershed.

Wetland 18 performs water quality improvement functions such as nutrient and sediment retention. This wetland is an isolated depression consisting of PFO, PSS, PEM, and Palustrine Open Water. The majority of the wetland was saturated or inundated with very mucky soils. A wide diversity and high density of vegetation was also present. Poorly drained soils allow the wetland to retain water for long periods of time. This wetland likely traps nutrients and sediments from the adjacent crop ground upslope.

Wetland 19 does not provide water quality improvement functions. If sources of sediment or nutrients were present in the upslope watershed this wetland could serve as a sediment and/or nutrient trap due dense woody vegetation and relatively flat topography which causes water to move slowly (diffusely) within the wetland. There is no defined outlet and surface water is retained for long periods of time, especially outside of the growing season. There is not a substantial source of pollutants in wetland's watershed which reduces the wetlands ability improve water quality.

Wetland 49 includes three wetland pockets; A, B, and C. Of the three small wetland pockets, wetland 49C (a stormwater basin) is the most likely to have a positive effect on water quality based on its size and design.

Wetlands 37, 38 and 39 are not suited to improve the water quality of adjacent water bodies. The restricting factor is the lack of a source of pollutants due to the small watershed. If a source existed this wetland would provide this valuable function due to areas of saturation and ponded water, and dense vegetation for nutrient uptake.

Wetland 44 is not suited to improve water quality. Although this wetland has flat topography and detains water it lacks a source of pollutants due to the small watershed size.

7. Recreation

Part of the Susquehanna Riverlands Environmental Preserve is located within the BBNPP project boundary, east of US 11. The Preserve provides refuge for a wide variety of flora and fauna and gives visitors the chance to observe these species in their

natural surroundings. Riverlands property is also part of a Pennsylvania Audubon Important Bird Area.

PPL provides educational programs at this facility. The historical NBC system is located on the PPL Riverlands property. Many walking trails are accessible for exercise and wildlife observation. Walking trails pass through a variety of upland and wetland habitats and follow the canal. Lake Took-A-While is also part of the PPL Riverlands. Fisherman can utilize this Lake. Commonly caught fish include sunfish, bass, cyprinids (minnows), and catfish (Ecology III, 2000). The fish community in the Lake is typical of other warmwater lentic waterbodies in Pennsylvania. Boats are allowed on the lake, however gasoline engines are not permitted.

Common recreational activities along the Susquehanna River include swimming, fishing, and boating. The NBSR sustains recreational fisheries for several fish species including smallmouth bass, muskellunge, northern pike, channel catfish, walleye, yellow perch, bluegill, and redbreast sunfish. Creel surveys performed during 1986 near BBNPP indicated that the majority of anglers fished for walleye, muskellunge, and smallmouth bass and that walleye, smallmouth bass, and channel catfish were the species most often caught (PPL, 2006).

The normal flow of the Susquehanna River within this river reach accommodates private recreational boats that are generally less than 24 feet in length, have shallow drafts, are both powered and non-powered, and launch from nearby ramps. Within a 10 mile radius from the BNNPP, three boat ramps area available to the public on the Susquehanna River. The Pennsylvania Fish and Boat Commission operates a recreational boat ramp about 5 mi upstream of BBNPP; a private club operates the Wapwallopen boat ramp approximately 1.5 miles downstream of BBNPP and the Borough of Berwick operates the Berwick Test Track boat ramp approximately 8 miles downstream of BBNPP. A fourth boat ramp is located in Hunlock Township approximately 10 miles upstream of BBNPP. In addition, several small private boat ramps exist along this segment of the Susquehanna including one commercial ramp owned by PPL, located approximately 2,100 feet north of the proposed BNPP cooling water intake. This ramp will be used to support BBNPP and SSES needs for river access. The proposed project will not affect recreational river access from these facilities. The NBSR is not used for commercial

navigation within the project vicinity. No navigation or swimming is permitted in the vicinity of the BNNPP.

Game and non-game fish species exist in Walker Run, Beaver Pond, Johnson's Pond and the Susquehanna River. Small fish populations also exist in the unnamed tributaries.

All property located west of US 11 within the BBNPP Project Boundary is closed to the public. Recreation activities, including fishing and hiking, are prohibited within this area.

8. Upstream and Downstream Property

Land use within a 6 mile radius of the BBNPP is primarily forested (66%). Agriculture is the second largest land use at 20%. Urban or built up land represents 9% and the remaining 5 percent represents water, wetlands and barren land.

PPL owns the property directly upstream and downstream of the BBNPP intake structure along the NBSR. Characteristics of the NBSR are similar both upstream and downstream of the BBNPP intake structure and consist mostly of forested and agricultural land.

Downstream of the BBNPP Project Boundary to Denns Road Walker Run passes behind a number of residential homes and agricultural areas. Within this reach the channel appears to have been straightened. Throughout this reach an earthen berm prevents floodflows from reaching the floodplain. The bottom substrate is composed of mostly silts and sands (Walker Run Geomorphic Assessment, LandStudies, 2009).

Upstream of the project boundary Walker Run's channel grade increases and the valley narrows. This reach is characteristic of a mountain headwater stream. The land use is primarily forested with some residences located upslope from the stream. Walker Run appears to be in a more stable condition and the stream has access to the floodplain (Walker Run Geomorphic Assessment, LandStudies, 2009).

A map of contiguous property owners is included within this JPA section.

9. Other Environmental Factors Determined by Site Investigation

9.1 Summary of Relevant Studies

Aquatic habitat characteristics and other biological resources within the BBNPP project boundary were evaluated in the following studies that will be referenced frequently throughout the Environmental Assessment and are provided in Appendix B of the JPA.

1. "Wild Trout Habitat Assessment" dated May 2009, documents fish and macroinvertebrate populations, general habitat conditions, substrate composition and embeddedness measurements, and spawning gravel surveys within Walker Run.

2. "Bell Bend Project Site: Supplemental Field Assessments for the Walker Run Watershed" dated September 2010, documents the macroinvertebrate community and substrate embeddedness measurements of Tributary 1 to Walker Run and Tributary 2 to Walker Run. Water quality testing results and pressure transducer trends for Walker Run is also published in this report.

3. "Bell Bend Project Site: Supplemental Field Assessments for PPL Riverlands" dated January 2010, describes macroinvertebrate community and substrate embeddedness measurement results of the NBC outfall channel.

4. "Walker Run Trout Enhancement Plan" dated October 2010, summarizes habitat needed by brown trout at various life stages and evaluates Walker Run in terms of brown trout habitat suitability. The report recommends strategies to enhance trout habitat during the stream and floodplain restoration project as well as outlines a plan for repopulating restored reaches of Walker Run with brown trout post-restoration.

5. "A Field Survey of Fish and Aquatic Macroinvertebrates at the Proposed Bell Bend Nuclear Power Plant Site" dated September 2011 documents fish and macroinvertebrate surveys performed within Walker Run, unnamed tributaries to Walker Run, NBSR, the NBC, NBC outfall channel, and ponds within the BBNPP project boundary. Habitat assessments and some water quality data are also provided in this report.

6. "Impingement and Entrainment Sampling for the Proposed Bell Bend Nuclear Power Plant at the SSES Circulating Water Supply System Intake Structure" dated June

2010, documents the species composition and number of organisms that may possibly be impinged and entrained at the future intake of the proposed BBNPP.

7. "Mussel Survey in the Susquehanna River in the Vicinity of the Proposed Bell Bend Nuclear Power Plant Site" dated July 2010 provides the results of a mussel study.

8. "Walker Run Stream Survey Report" dated August 2009 and written by the PA Fish and Boat Commission, documents their electrofishing results regarding the presence of reproducing brown trout populations.

9. The "Sediment Characterization Report, Bell Bend Nuclear Power Plant, Susquehanna River, Berwick, PA" dated March 2011, documents the NBSR river substrate composition and analyzes sediment for the presence of hazardous pollutants.

10. "Wetlands Functions and Values Assessment" dated April 2011 characterizes the functions and values of wetlands within the BBNPP site boundary based on a set list of criteria through field visits and analysis of existing information.

11. "A Field Survey of Plant Communities at the Proposed Bell Bend Nuclear Power Plant Site" dated September 2011 documents wetland and upland plant communities as well as invasive plant species.

12. "A Field Survey of Terrestrial Flora and Fauna at the Proposed Bell Bend Nuclear Power Plant Site" dated September 2011 documents the results of surveys of birds, mammals, reptiles, amphibians, bats, and butterflies.

13. "Indiana Bat Roost Tree Survey Report for the Proposed Bell Bend NPP Site Luzerne County Pennsylvania" dated October 2011 describes the amount, type, and quality of Indiana Bat habitat within forested areas designated for clearing.

14. The "Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users, Proposed Bell Bend Nuclear Power Plant Site" dated June 2011 documents the results of various water quality studies on the NBSR related to BBNPP consumptive use and blowdown discharge.

9.2 Upland Land Use Summary

The BBNPP project site is located along the NBSR in an area of open deciduous woodlands interspersed with grasslands, previously cultivated fields, and orchards. The areas devoted to major uses of the land within the Project Boundary are summarized in Table 1.

Table 1. Existing Land Use within the Bell Bend Nuclear Power Plant Site

Land Use Type	Pre-Construction Area (acres)	Percent of Total
Urban or Built-Up	220.8	10.7
Forest	1141.7	55.6
Barren	21.5	1.0
Wetlands	159.0	7.7
Water	71.9	3.5
Agricultural	440.0	21.4
Total Site Boundary	2054.9	100.0

"A Field Survey of Plant Communities at the Proposed Bell Bend Nuclear Power Plant Site" characterizes upland vegetative communities within the Project Boundary. Upland habitat within the project boundary includes old field/former agricultural, upland scrub/shrub and upland deciduous forest. Old-field vegetation is composed of a largely upland-preferring assemblage of grasses and herbaceous plants. This habitat type extends over much of the fallow farmland in the western section of the project boundary. Dominant species include daisy fleabane, Canada thistle, wrinkled goldenrod (*Solidago rugosa*), flat-top fragrant goldenrod (*Euthamia graminifolia*), Canada goldenrod (*Solidago canadensis*), giant foxtail grass, white heath aster (*Aster pilosus*), lamb's quarters, red clover, and common ragweed.

Upland scrub shrub is found along transmission line corridors and in several abandoned farm fields within the Project Boundary that are undergoing secondary succession. The plant community consisted primarily of bush honeysuckle, multiflora rose, Allegheny blackberry, and Russian olive.

Upland Deciduous forest covers a large portion of the project boundary to the west of US 11. Common overstory species include northern red oak, white oak, black cherry, white ash, shagbark hickory, bitternut hickory, sweet birch, black walnut, black locust, yellow poplar and red maple. Upland forest understories are composed predominantly of spicebush, round-leaved greenbrier, Virginia creeper, and saplings of overstory species. The groundcover includes may-apple, garlic mustard, hayscented fern, tree clubmoss, partridge berry, ground cedar, and stilt grass (Normandeau, 2011).

No significant mineral resources have been identified within the Project Boundary. The only mineral resources occurring within the Project Boundary are siltstone and sand and gravel (PPL, 1972). The siltstone cannot be mined economically due to its depth. Deposits of sand and gravel underlie most portions of the Susquehanna River Valley. A very small portion of these deposits are under the Susquehanna River floodplain within the Project Boundary.

Project Boundary landscape has been substantially altered to support agriculture, electric power generation, recreation, and canal transportation uses. Much of the original forest cover was cleared and the remainder became highly fragmented as a result of these activities. No active timber cutting for these purposes has recently occurred within the Project Boundary.

9.3 Hydrogeology

Geologic conditions beneath the site consist of sand and gravel deposits underlain by shale bedrock. The overburden soils range from 0 to 100 feet of depth. Overburden is thinner on ridges and hills. Generally, borings southwest of the North Market Street and Beach Grove Road intersection did not encounter groundwater in the overburden soils. In this upland area vertical groundwater flow is typically downward. North of Tributary 1 to Walker Run and Wetland 12, groundwater in the overburden layer typically ranged from 30 to 55 feet deep and moves from the northeast to the southwest. Vertical groundwater flow is typically upward in this area of lower topography (Sargent and Lundy, 2010).

9.4 Special Designations within the Project Boundary

The following special designations are not present within the BBNPP Project Boundary:

- Native American or military reservations
- State or national, parks, forest or recreation areas
- Natural, wild, or wilderness areas
- National natural landmark
- National wildlife refuge
- State Gamelands

State and local historical resources and artifacts have been located within the project boundary. The NBC was historically used within the region for transportation from 1830 to 1900. Additionally, eel walls (or eel weirs) are still visible today along the NBSR during low flows both upstream and downstream of BBNPP. These structures are considered a historical resource and will not be affected by project implementation. During the early part of the 20th century these structures were built in shallow parts of the NBSR to trap out-migrating eel and other fish which were important food sources during that time period. The installation of these structures became illegal due largely to increased mortality of juvenile American shad populations. Many of these structures were destroyed by fish wardens. Additional terrestrial historical sites and artifacts have been identified within the project boundary. Required supplemental cultural resources information can be found in Section D of the JPA, Appendix A Item 2 (summary of findings) and Appendix C (full text of cultural resource studies).

There is one environmental study area and wildlife sanctuary that is adjacent to and within a small portion of the Project Boundary. A portion of Susquehanna Riverlands property, which includes a Wetlands Nature Area, lies within the Project Boundary. The Wetlands Nature Area provides an area for nature study and educational programs and was designated an Urban Wildlife Sanctuary in 1988. The Susquehanna Riverlands property is also a recreational area for public use and environmental education. Portions of the PPL Susquehanna Riverlands, PPL SSES and BBNPP properties have also been identified by the Pennsylvania Audubon Society as an Important Bird Area (IBA).

The BBNPP site boundary contains 3 soil types designated as prime farmland by the Natural Resources Conservation Service (USDA, 2004). Most of the lands making up BBNPP were zoned agricultural district with a much smaller portion zoned as a

conservation district. Small areas of the Project Boundary associated with SSES facility are zoned heavy industrial (Salem, 2008). In February 2011 Salem Township rezoned the area involving BBNPP and SSES as a new Heavy Industrial, I-3, classification that allows power plants.

10. References

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