6.3 HYDROLOGICAL MONITORING

This section describes the hydrological monitoring program that will be implemented to monitor the effects of the BBNPP. Elements of the hydrological program relating to thermal, radiological, and chemical monitoring are described separately in Section 6.1, Section 6.2, and Section 6.6, respectively.

This section includes the pre-application monitoring program that discusses the existing hydrological monitoring program at the SSES site as well as the BBNPP site, and the programs to monitor BBNPP during the construction/pre-operational and operational phases.

Section 2.3.1 describes the vicinity watershed and stream flow data collected by the U.S. Geological Survey and the Pennsylvania Geological Survey. Groundwater velocities are discussed in Section 2.3.1.2. Flow rates are discussed in Section 2.3.1.1 and Table 2.3-2 and Table 2.3-7. Stream bank erosion is discussed in Sections 2.4.2, 4.2.1, 4.2.2, 4.3.1, and 4.3.2. Section 2.3.2 describes surface and groundwater uses. Features of the BBNPP site, including boundaries and bathymetry of all surface water bodies adjacent to the site are provided in Section 2.3.1. The locations of groundwater monitoring wells are provided in Figure 2.3-32. The surface water monitoring locations are shown on Figure 2.3-33. The existing thermal and ecological monitoring stations are discussed in Section 6.1 and Section 6.5 for surface water. No thermal or ecological monitoring stations exist for groundwater and none are planned. Figures showing major geomorphic features and regional geology are shown in Section 2.3.1 and Section 2.6.

Preapplication monitoring programs will be extended as needed to Construction, Preoperation and into Operational phases with adjustments made to the scope and frequency of monitoring to address changing site conditions and the potential impacts associated with each phase. Monitoring data will be maintained and stored as part of BBNPP environmental programs. Procedural requirements will dictate specific Data Quality Objectives for BBNPP monitoring data.

6.3.1 Preapplication Monitoring

Hydrological monitoring at the BBNPP site includes both surface water and groundwater. Both monitoring programs comply with and are controlled by regulatory permit requirements and conditions. Additional information on bathymetric characteristics of surface water, soil and groundwater characteristics, and transient hydrological parameters in the site vicinity are discussed in Section 2.3.1.

6.3.1.1 Surface Water

SSES conducts hydrological monitoring of surface water in accordance with the National Pollutant Discharge Elimination System (NPDES) program. Flows from storm water, plant-associated activities such as equipment blowdown, and various system effluents are measured at different monitoring locations. Table 6.3-1 lists the monitoring locations and the permit flow requirements. Refer to Section 6.6 for a description of the monitoring locations as well as the NPDES monitoring program data analysis and quality control procedures. Flow is monitored as described in Table 6.3-1 and reported to the Pennsylvania Department of Environmental Protection (PADEP) monthly.

In addition, water withdrawn from the Susquehanna River that is used for SSES plant system cooling is monitored as part of the Susquehanna River Basin Commission (SRBC) Regulation 806.30. Withdrawal is monitored daily and reported to SRBC quarterly and to PADEP annually.

Susquehanna River water flow and quality is monitored by Ecology III, Inc. on behalf of the SSES Environmental Laboratory. Water flow is measured daily upstream of the SSES intake structure. Water quality samples are taken on a quarterly basis upstream and downstream of the SSES discharge. Results from the monitoring program are reported on a yearly basis (Ecology III, 2007).

Additional preapplication monitoring is described in Section 2.3.3.

6.3.1.2 Groundwater

As described in Section 2.3.2.2, the SSES site has five groundwater wells that supply water for domestic and miscellaneous process water uses on either a regular or emergency basis. Section 2.3.2.2 describes the well locations, permit limits, and withdrawal volumes.

Groundwater observation wells were installed across the BBNPP site as discussed in Section 2.3.1. The wells were located in order to provide adequate distribution with which to determine site groundwater levels, subsurface flow directions, hydraulic gradients, and vertical gradients beneath the site. To evaluate vertical hydraulic gradients, several observation wells were installed as well clusters as discussed in Section 2.3.1. Well clusters are a series of wells placed at the same location, with each well monitoring a distinct water bearing unit.

Water levels in the observation wells were measured to characterize seasonal trends in groundwater levels and flow directions for the BBNPP site. Results are discussed and shown in Section 2.3.1.

6.3.2 Construction and pre-Operational Monitoring

Hydrological monitoring at the BBNPP site during construction will include both surface water and groundwater. Both monitoring programs will comply with regulatory permit requirements and conditions described below. The objective of each program will be to establish a baseline for evaluating potential hydrologic changes, monitor anticipated impacts from site preparation and construction, and detect unexpected impacts

6.3.2.1 Surface Water

Surface water onsite will be monitored as part of the NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities as described in Section 1.3. Conditions of the permit will include compliance with erosion/sediment control and storm water management plans. Both plans, as part of the permit, will require inspections as well as monitoring and recordkeeping to insure stormwater controls are installed properly and working effectively as the various stages of construction are performed.

In addition, Susquehanna River surface water will be monitored during construction of both the BBNPP intake and discharge structures. Monitoring will be part of the U.S. Corps of Engineers, Clean Water Act 404 permit and PADEP 401 Water Quality Certification as described in Section 1.3 to ensure compliance with applicable water quality (e.g., turbidity) and sediment transport requirements.

6.3.2.2 Groundwater

Groundwater monitoring during BBNPP construction will include, as needed, data from groundwater observation wells installed across the BBNPP site as part of COL preapplication

studies described in Section 2.3.1.2. The purpose will be to monitor the potential effects of dewatering on perched water levels.

Some of the existing BBNPP area observation wells may be taken out of service prior to construction activities due to earth moving and construction requirements. Prior to construction activities, the observation well monitoring network will be evaluated in order to determine groundwater data gaps and needs created by the abandonment of existing wells. These data needs will be met by the installation of additional observation wells, if required. Additionally, the hydrologic properties and groundwater flow regimes of the shallow water bearing units will be impacted by the proposed earthmoving, regrading, and construction of infrastructure (buildings, parking lots, etc.). Revisions to the observation well network will be implemented to ensure that the resulting changes in the local groundwater regime from construction activities will be identified.

No groundwater wells are anticipated for consumptive use during construction.

Disturbances to existing drainage systems will be avoided, if possible. Environmental controls (i.e., silt screens, dams, settling basins, and spill containment measures), will be implemented to reduce potential pollutants in storm water runoff and to minimize construction impacts to aquatic habitats. Prior to the start of construction, approval of the post-construction storm water management and the erosion and sedimentation control plans will be obtained in accordance with the NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities as described in Section 1.3.

6.3.3 Operational Monitoring

Hydrological monitoring during BBNPP operation will be designed, as needed, to monitor the potential impacts from plant operation as well as detect unanticipated operational impacts.

During BBNPP operation, plant water supply will be from the Susquehanna River at a BBNPP intake structure to be located on the Susquehanna River downstream of the existing SSES intake. The principle potable (fresh water) source will be from the Pennsylvania American Water Company. Operation of the BBNPP intake structure will require surface water monitoring and reporting as part of the SRBC Regulation 806.30 and the PA Water Resources Planning Act. In addition, discharge effluents to the Susquehanna River from BBNPP during operation will require monitoring as discussed in Section 6.6.

As discussed in more detail in Section 3.6.2, sanitary sewage effluent will be directed to a sewer main for off-site treatment at a Publicly Owned Treatment Works (POTW) and monitored as required in accordance with any local sewer use ordinances.

Non-radioactive liquid effluents that could potentially drain to the Susquehanna River will be limited under a NPDES permit with the PADEP. An anticipated list of permitted outfalls is included in Section 3.6.3.2. Non-radioactive liquid waste effluents from various sources are listed in Table 3.6-2 and Table 3.6-4. Table 3.6-1 provides information on the various chemicals anticipated to be used for the various plant water treatment systems. Chemical additives will have limiting discharge concentrations specified in the NPDES permit.

Chemical monitoring will be performed at the BBNPP to assess the effectiveness of retention methods and effluent treatment systems, as well as to detect changes in water quality associated with plant operations. BBNPP chemical monitoring will also be performed at stormwater runoff outfalls and at internal monitoring points (i.e., sanitary waste effluents,

Combined Waste Water Retention Pond influent and/or effluent). Effluent water chemistry will meet applicable Federal and State environmental regulatory requirements.

NRC has published new regulation 10 CFR 20.1406(c) which becomes effective December 17, 2012 (Federal Register, 2011). This regulation requires licensees, to the extent practical, to conduct operations to minimize the introduction of residual radioactivity into the site, including the site's subsurface soil and groundwater. As noted in the final rule for 10 CFR 20.1406(c), if there are pathways that would allow the contamination to migrate, the licensee may need to monitor the groundwater on-site for contamination based on site-specific conditions (Federal Register, 2011). Additionally, this final rule amends 10 CFR 20.1501(a) to require surveys of subsurface residual radioactivity identified at the site. Radiological Effluent Monitoring Program (REMP) details for meeting these requirements and objectives of the NEI Groundwater Protection Initiative (NEI, 2007) are discussed in Section 6.2.

6.3.4 References

Ecology III, 2007. Environmental Studies in the vicinity of the Susquehanna Steam Electric Station, 2006 water quality and fishes. Prepared for PPL Susquehanna, LLC.

NEI, 2007. Industry Ground Water Protection Initiative - Final Guidance Document, Nuclear Energy Institute, ML072600295, August 2007.

Federal Register, 2011. Federal Register Notice, 76FR33512, Decommissioning Planning, June 2011.

Table 6.3-1— SSES Units 1 and 2 NPDES Hydrological Monitoring Program

Monitoring Station	Description	Parameter	Frequency	Sample Type
Outfall 070	Stormwater From S-2 Pond	Note (a)	NA	NA
Outfall 071	Cooling Tower Blowdown	Flow	Daily	Recorded
Outfall 072	Service and Admin. Building Low Volume Waste Sump	Flow	Daily When Discharging	Estimate
Outfall 073	Unit #1 Turbine Bldg Low Volume Waste Sump	Flow	Daily When Discharging	Estimate
Outfall 074	Unit #2 Turbine Bldg Low Volume Waste Sump	Flow	Daily When Discharging	Estimate
Outfall 075	Stormwater From Peach Stand Pond	Note (a)	NA	NA
Outfall 079	Sewage Treatment Plant	Flow	Daily	Pump rate or Weir
Outfall 080	Stormwater From C-1 Pond	Note (a)	NA	NA
Outfall 171	Radwaste Treatment Bldg	Flow	Daily When Discharging	Estimate
Outfall 371	Neutralization Basin	Flow	Daily When Discharging	Estimate

Note:
(a) No flow requirement

6.4 METEOROLOGICAL MONITORING

This section describes the meteorological monitoring program that will be implemented for BBNPP. It includes the pre-application and pre-operational meteorological monitoring program consisting of the existing meteorological monitoring program for SSES Units 1 and 2 and the operational meteorological monitoring program utilizing the BBNPP meteorological tower. There are no unusual circumstances anticipated during site preparation and construction that require additional meteorological monitoring.

6.4.1 Pre-Application and pre-Operational Meteorological Measurement program

The pre-application and pre-operational meteorological monitoring program for BBNPP is the operational program for SSES Units 1 and 2. The SSES program was designed in accordance with the guidance provided in Regulatory Guide 1.23 (Safety Guide 23) (NRC, 1972) and complies with the requirements of the second proposed Revision 1 of Regulatory Guide 1.23 (NRC, 1986). There are currently three monitoring locations at SSES: a primary meteorological tower, a backup tower and a supplemental (downriver) tower. The pre-application and pre-operational meteorological monitoring program for BBNPP only includes data from the primary SSES meteorological tower.

6.4.1.1 Tower Location

The site is about 5 mi (8 km) ENE of Berwick, Pennsylvania. The primary meteorological tower for the SSES is located on-site (650 ft (198 m) msl) approximately 1115 ft (340 m) to the southeast of the cooling towers. The area is generally level, increasing slightly in elevation to the north and west. South and east of the tower the topography slopes down towards the Susquehanna River. Vegetation in the immediate vicinity consists of low weeds with some deciduous trees in a gully to the south. The deciduous trees are approximately 40 ft (12 m) in height and are approximately 100 ft (30 m) from the tower. An ash facility exists approximately 185 ft (56 m) north of the tower. The maximum height of this structure is approximately 30 ft (9 m).

Figure 6.4-1, Site Map with Meteorological Tower Location, presents the location of the SSES and BBNPP meteorological towers as well as the topography within a 1 mi (1.6 km) radius of the BBNPP site. Figure 6.4-2, Detailed Topography Within 5 mi (8 km), also presents the general topographic features of the region.

6.4.1.2 Tower Design

The SSES meteorological tower is a 200 ft (61 m) open-lattice steel framed tower.

The primary data recording system used for the SSES meteorological tower is a digital data acquisition system. All telemetry transmitters, translators and a data logger are housed in a weatherproof cinderblock building. This building has thermostatically controlled heating and air conditioning. The secondary recording system is the SSES Control Room recorders.

6.4.1.3 Instrumentation

Instruments at the SSES meteorological tower monitor temperature, delta temperatures, wind speed and direction, dew point and precipitation. SSES meteorological tower instrument types, specifications, and accuracies are presented in Table 6.4-1.

The temperature measuring system consists of multiple thermistor composite sensors. Two sensors are mounted in motor aspirated shields at each of the 33 ft (10 m) and 197 ft (60 m)

levels (above ground level). Vertical dispersion coefficients are computed from the vertical temperature differences.

Wind speed and direction are monitored at the 33 ft (10 m) and 197 ft (60 m) levels using a 3-cup anemometer and a counterbalanced lightweight vane. The standard deviation of the wind direction (sigma theta) is measured at 33 ft (10 m) and 197 ft (60 m) and is used to compute horizontal dispersion coefficients. Sigma theta calculations based on wind direction measurements are used as a backup to temperature difference readings to monitor atmospheric stability.

The dew point temperature is measured at the 33 ft (10 m) level using a sensor consisting of bifilar gold electrodes wound on a lithium chloride impregnated wick.

Precipitation is measured at the base of the tower using a heated tipping bucket rain gauge. This is a remote reading rain gauge which produces a signal proportional to total rainfall.

The wind sensors are mounted on a boom that is at least twice the length of the tower side. The boom is not mounted on the tower such that the instruments are approximately perpendicular to the primary two wind directions. However, this tower was installed before RG 1.23, Revision 1, was published and will only be used for the pre-operational phase of BBNPP.

6.4.1.4 Instrument Maintenance and Surveillance Schedules

Calibration schedules are specified to comply with Regulatory Guide 1.23 recommendations (SSES, 2005). Equipment checks are performed at least weekly. Charts are changed as required. Component checks and adjustments are performed when required. All meters and other equipment used in calibration are, in turn, calibrated at scheduled intervals.

Inspection and maintenance of all equipment is accomplished in accordance with procedures. Inspection is implemented by qualified technicians that are capable of performing the maintenance, if required. The results of the inspections and maintenance performed are recorded.

6.4.1.5 Data Reduction and Compilation

The primary data recording system is a digital data acquisition system. Both 15-minute and hourly average data values are produced. An analog recording system provides a backup in case of digital system failure, so that a high data recovery rate can be maintained. Data recovery rates for the SSES meteorological monitoring program have consistently been greater than 95%.

Section 2.3.3.6 of the SSES FSAR, Rev. 60 (SSES, 2005) describes the analytical data reduction procedures used to produce hourly averages and other specified meteorological compilations. In summary, Section 2.3.3.6 of the SSES Units 1 and 2 FSAR provides procedures for the following:

- For temperature and dew point, computing hourly averages from five second sample data
- Treatment of calm wind conditions
- Computing hourly averages for wind speed and wind direction
- Replacement of invalid or missing digital data with analog data

- Substituting data from the secondary (197 ft (60 m)) tower level for unavailable data from the primary (33 ft (10 m)) tower level
- Reducing the 197 ft (60 m) wind speed to the equivalent 10-meter value utilizing the wind power law.

The hourly values of the meteorological parameters are then processed to obtain the following compilations:

- Joint frequency distributions of wind speed and stability for lower and upper levels
- Wind direction persistence summaries by stability class
- Maximum, minimum and diurnal variation of temperature and humidity
- Annual average values of relative concentration with direction and distance
- Frequency distribution of concentrations for the 0-2 hour, 0-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods.

The 15-minute averaged data are available for use in the determination of magnitude and continuous assessment of the impact of releases of radioactive materials to the environment during a radiological emergency (as required in 10 CFR Part 50, Paragraphs 50.47(b)(4), 50.47(b)(8), and 50.47(b)(9) as well as Section IV.E.2 of Appendix E). The hourly averaged data are available for use to:

- Determine radiological effluent release limits associated with normal operations can be met for any individual located off site (as required in 10 CFR 100.20(c)(2)).
- Determine radiological dose consequences of postulated accidents meet prescribed dose limits at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) (as required in 10 CFR 100.20(c)(2)).
- Evaluate personnel exposures in the control room during radiological and airborne hazardous material accident conditions (as required in 10 CFR Part 50, Appendix A).
- Determine compliance with numerical guides for design objectives and limiting conditions for operation to meet the requirement that radioactive material in effluents released to unrestricted areas be kept as low as is reasonably achievable (as required in 10 CFR Part 50, Appendix I).
- Determine compliance with dose limits for individual members of the public (as required in 10 CFR Part 20, Subpart D).

Annual summaries of meteorological data in the form of joint frequency distributions of wind speed and wind direction by atmospheric stability class are kept onsite and are available to the Nuclear Regulatory Commission upon request. The annual summaries used for licensing are presented in FSAR Section 2.3.2.

ER Section 2.7 indicates that the SSES meteorological data represent long-term conditions at the site by comparing site meteorological statistics with similar statistics from surrounding National Weather Service (NWS) stations (Wilkes-Barre/Scranton, Allentown, and Williamsport, PA). The comparison noted:

- Wilkes-Barre/Scranton is located in the same climatic division as the BBNPP and the SSES site. (A climate division represents a region within a state that is as climatically homogeneous as possible, as determined by the U.S. National Climatic Data Center.)

- The monthly mean temperatures at the SSES site are within 0.6 degree Fahrenheit (0.3 degree Celsius) of the three NWS sites on the average. The annual mean temperature at the BBNPP site is within 0.1 degree Fahrenheit (0.06 degree Celsius) of the Allentown value.

- The annual average precipitation at the SSES site is within 1.5 inches (38.1 mm) of the Wilkes- Barre/Scranton value.

Winds are from the SW approximately 11% of the time at the SSES site and are from the SW approximately 13% of the time at Wilkes-Barre/Scranton.

6.4.1.6 Nearby Obstructions to Air Flow

Downwind distances from the SSES meteorological tower to nearby (within 0.5 mi (0.8 km)) obstructions to air flow were determined using U.S. Geological Survey topographical maps. Highest terrain is to the west and north. Lowest terrain is to the northeast through southeast (river valley).

Table 6.4-6 presents information on potential man-made obstructions to air flow for the SSES meteorological tower.

A study performed to determine the effect of the SSES Unit 1 and 2 cooling towers on meteorological measurements at SSES concluded that the impact of the cooling towers on wind speed measurements is minimal and the effect on wind direction measurements is nearly non-existent.

6.4.1.7 Deviations to Guidance from Regulatory Guide 1.23

The pre-operational meteorological monitoring program for BBNPP deviates from the guidance provided in Regulatory Guide 1.23, Revision 1 (NRC, 2007) The SSES meteorological tower is not at a distance at least 10 times the height of any nearby obstruction that exceeds one-half the height of the wind measurement. Further discussion is provided in Section 6.4.1.1. The SSES meteorological tower is not at the same elevation as the finished BBNPP grade. The SSES tower location was selected to assure the meteorological tower was located on level, open terrain at a suitable distance from any nearby obstructions and complies with the guidance of the second proposed revision to Reguatory Guide 1.23, Revision 1 (NRC, 1986).

The tower, guyed wire, and anchor inspections are performed once every 5 years instead of an annual inspection for tower and guyed wire and an anchor inspection of once every 3 years as provided in Regulatory Guide 1.23, Revision 1.

The wind instruments are not mounted on the tower such that the instruments are approximately perpendicular to the primary two wind directions. Further discussion is provided in Section 6.4.1.3.

6.4.2 Operational Meteorological Measurement program

The operational meteorological monitoring program for BBNPP utilizes the BBNPP meteorological tower and its instrumentation, telemetry and data recording system. This

program is designed according to the guidance provided in Regulatory Guide 1.23, Revision 1 (NRC, 2007).

Information relating to the BBNPP meteorological tower location and support facilities for the operational meteorological monitoring program is contained in Section 6.4.2.1 and Section 6.4.2.2. Likewise, Section 6.4.2.3 contains general instrument information.

Table 6.4-2 presents detailed information on the BBNPP meteorological tower instrument types and specifications and compares them with regulatory requirements from Regulatory Guide 1.23, Revision 1 (NRC, 2007). Information relating to operational instrument maintenance and surveillance scheduling is contained in Section 6.4.2.4. Data reduction and compilation is contained in Section 6.4.2.5.

Pertinent meteorological data are submitted to the NRC's ERDS as required in Section VI of Appendix E to 10 CFR Part 50.

6.4.2.1 Tower Location

The BBNPP meteorological tower and support facilities for the operational meteorological monitoring program are located approximately 4,368 ft (1,331 m) ESE of the BBNPP Reactor Building. Grade at the tower is approximately 670 ft (204 m) msl. While tower grade is not the same as plant grade, it is nonetheless acceptable, as discussed in Section 6.4.2.7. Figure 6.4-1, Topography within a 1-Mile (1.6 km) Radius of the Site, presents the location of the BBNPP meteorological tower as well as the topography within a 1 mi (1.6 km) radius of the BBNPP site. Figure 6.4-2, Topography within a 5-Mile (8 km) Radius of the Site, presents the general topographic features of the region.

6.4.2.2 Tower Design

The BBNPP meteorological tower is an open-lattice steel tower approximately 197 ft (60 m) in height.

6.4.2.3 Instrumentation

Equipment includes sensors to measure wind speed, wind direction, ambient temperature, delta temperature, dew point or wet bulb temperature, and precipitation.

Sensor accuracies and resolutions will meet those presented in Table 2 of Regulatory Guide 1.23, Revision 1 (NRC, 2007). The wind sensors are mounted at a distance equal to at least twice the horizontal dimension of the tower (e.g., the side of a triangular tower). The wind sensors are mounted in a direction perpendicular to the primary two primary wind directions (up- and down-valley). Wind measurements are made at 33 ft (10 m) and 197 ft (60 m). Ambient temperature and dew point or wet bulb temperature are measured at 33-ft (10- m). The temperature sensors will be mounted in downward-pointing fan-aspirated shields. The fan-aspirated shields will be at least one and one half times the tower horizontal width away from the nearest point on the tower. Delta temperature is measured between the 197 ft (60 m) and 33 ft (10 m) levels of the tower. Precipitation is measured at or near the base of the tower and will be equipped with a wind shield. BBNPP meteorological tower instrument types, specifications and accuracies are presented in Table 6.4-2.

6.4.2.4 Instrument Maintenance and Surveillance Schedules

Information relating to the operational meteorological tower instrument maintenance and surveillance schedules is provided in ER Section 6.4.1.4.

6.4.2.5 Data Reduction and Compilation

The BBNPP meteorological tower data collection uses electronic digital data acquisition systems as the primary data recording system and conforms to the guidance in Regulatory Guide 1.23, Revision 1 (NRC, 2007).

The 15-minute averaged data are available for use in the determination of magnitude and continuous assessment of the impact of releases of radioactive materials to the environment during a radiological emergency (as required in 10 CFR Part 50, Paragraphs 50.47 (b)(4), 50.47(b)(8), and 50.47 (b)(9) as well as Section IV.E.2 of 10 CFR 50 Appendix E). The hourly averaged data are available for use to:

1. Determine radiological effluent release limits associated with normal operations can be met for any individual located off site (as required in 10 CFR 100.21 (c)(1).

2. Determine radiological dose consequences of postulated accidents meet prescribed dose limits at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) (as required in 10 CFR 52.79 (a)(1)(vi)).

3. Evaluate personnel exposures in the control room during radiological and airborne hazardous material accident conditions (as required in 10 CFR Part 50, Appendix A).

4. Determine compliance with numerical guides for design objectives and limiting conditions for operation to meet the requirement that radioactive material in effluents released to unrestricted areas be kept as low as is reasonably achievable (as required in 10 CFR Part 50, Appendix I).

5. Determine compliance with dose limits for individual members of the public (as required in 10 CFR Part 20, Subpart D).

6.4.2.6 Nearby Obstructions to Air Flow

Downwind distances from the BBNPP meteorological tower to nearby (within 0.5 mile or 0.8 km) obstructions to air flow were determined using U.S. Geological Survey topographical maps. Highest terrain is to the west and north. Lowest terrain is to the northeast through southeast (river valley). Table 6.4-4 presents the distances to nearby obstructions to air flow in each downwind sector.

Table 6.4-3 presents building heights and distances from various structures to the BBNPP meteorological tower. The BBNPP cooling towers are 475 ft (145 m) tall and the SSES cooling towers are 540 ft (165 m) tall (SSES, 2006). The two tallest EPR buildings are the Reactor Building 204 ft (62 m) and the Turbine Building 160 ft (49 m). The Turbine Building is also the closest major building to the BBNPP meteorological tower. Both buildings will have a finish floor grade of approximately 720 ft (219 m) msl. Grade at the BBNPP meteorological tower is approximately 670 ft (204 m) msl (USGS, 1978). This difference between finished floor grade and the meteorological tower grade is acceptable for the following reasons:

- It is assumed in atmospheric dispersion modeling that the plume follows the terrain, therefore, the meteorological measurements would be applicable for their primary purpose, atmospheric dispersion modeling to protect the health and safety of members of the public.

- The selected location is suitably far from man-made obstructions to air flow.

- Any potential locations closer to finished floor grade have significant obstructions to air flow.

All EPR buildings are greater than a factor of ten times their respective heights away from the meteorological tower, and as such are not expected to impact the meteorological measurements. The BBNPP and SSES cooling towers are closer than a factor of ten times their respective heights away from the BBNPP meteorological tower. This deviation from Regulatory Guide 1.23, Revision 1 has a minimal influence on the BBNPP meteorological tower instruments as discussed in the study described below.

A study performed to determine the effect of the SSES Unit 1 and 2 cooling towers on meteorological measurements at SSES (refer to Section 6.4.1.6) concluded that the impact of the cooling towers on wind speed measurements is minimal and the effect on wind direction measurements is nearly non-existent. Since the BBNPP meteorological tower is further away from the SSES cooling towers than the SSES meteorological tower, it is concluded that there will be little to no impact on wind measurements made at the BBNPP meteorological tower due to the SSES cooling towers. Similarly, since the BBNPP meteorological tower is further away from the BBNPP cooling towers than the SSES meteorological tower is to the SSES cooling towers, it is concluded that there will be little to no impact on wind measurements made at the BBNPP meteorological tower due to the BBNPP cooling towers. In addition, the predominant wind direction for the site has been from the east-northeast at the 10 m level and from the north-northeast at the 60 m level with secondary peaks at both levels from the southwest. Due to the orientation of the BBNPP meteorological tower with respect to the BBNPP and SSES cooling towers, the influence of the local meteorology will act also to minimize the impact of the cooling towers on meteorological measurements.

6.4.2.7 Deviations to Guidance from Regulatory Guide 1.23

The BBNPP and SSES cooling towers do not meet the distance criterion of any nearby obstructions to airflow being at least 10 times the height of the structure that exceeds one-half of the height of the wind measurement away from the meteorological tower. This deviation from Regulatory Guide 1.23, Revision 1 (NRC, 2007) has minimal influence on the BBNPP meteorological tower instruments as discussed in the study described in Section 6.4.2.6.

The BBNPP meteorological tower is not at the same elevation as the finished floor grade of the Reactor Building. The difference between finished floor grade and meteorological tower grade is acceptable for the following reasons: 1) it is assumed in atmospheric dispersion modeling that the plume follows the terrain; therefore, the meteorological measurements would be applicable for their primary purpose, atmospheric dispersion modeling to protect the health and safety of members of the public, 2) the selected location is suitably far from man-made obstructions to air flow, and 3) any potential locations closer to finished floor grade have significant obstructions to air flow.

6.4.3 References

NRC, 1972. Onsite Meteorological Programs, Safety Guide 23 (Regulatory Guide 1.23 Revision 0), U.S. Nuclear Regulatory Commission, February 1972.

NRC, 1986. Meteorological Measurement Program For Nuclear Power Plants, Regulatory Guide 1.23, Second Proposed Revision 1, U.S. Nuclear Regulatory Commission, April 1986.

NRC, 2007. Meteorological Monitoring Programs for Nuclear Power Plants, Regulatory Guide 1.23, Revision 1, U.S. Nuclear Regulatory Commission, March 2007.

SSES, 2005. Susquehanna Steam Electric Station, Final Safety Analysis Report, Rev. 60, pp. 2.3-12 through 2.3-18, June 2005.

SSES, 2006. Susquehanna Steam Electric Station Units 1 and 3 License Renewal Application, Appendix E, Environmental Report, p 3.1-4, September 2006.

USGS, 1978. U.S. Geological Survey Berwick Triangle Topographical Map

Table 6.4-1— SSES Meteorological Tower Instrument Types, Specifications and Accuracies for Pre-Application and Pre-Operational Programs

Characteristics	Requirements*	Specifications
Wind Speed Sensor		
Make		Climatronics
Model		100075
Starting Threshold	< 1 mph (0.45 m/s)	0.5 mph
Range		0-145 mph
Accuracy	+/- 0.2 m/s (+/- 0.45 mph) or 5% of observed wind speed	+/- 1.0% or +/- 0.15 mph, whichever is greater
Resolution	0.1 m/s (0.1 mph)	0.1 m/s (0.1 mph)
Wind Direction Sensor		
Make		Climatronics
Model		100076
Starting Threshold	< 1 mph (0.45 m/s)	0.5 mph
Range		0-360 degrees
Accuracy	+/- 5 degrees	+/- 2 degrees
Resolution	1.0 degree	1.0 degree
Temperature Sensors		
Make		Climatronics
Model		100093
Range (ambient)		-20°F to +100°F
Range (vertical temperature diference)		-5°F to +5°F
Accuracy (ambient)	+/- 0.5°C (+/- 0.9°F)	+/- 0.15°C
Resolution (ambient)	0.1°C (0.1°F)	0.1°C (0.1°F)
Accuracy (vertical temperature difference)	+/- 0.1°C (+/- 0.18°F)	+/- 0.1°C
Resolution (vertical temperature difference)	0.01°C (0.01°F)	0.01°C (0.01°F)
Dew Point Sensor		
Make		Climatronics
Model		101197
Range		-40°F to +100°F
Accuracy	+/- 1.5°C (+/- 2.7°F)	+/- 0.5°C
Resolution	0.1°C (0.1°F)	0.1°C (0.1°F)
Precipitation Sensor		
Make		Climatronics
Model		100097-1
Accuracy	+/- 10% for a volume equivalent to 2.54 mm (0.1 in.) of precipitation at a rate of 50 mm/h (< 2 in./h)	+/- 1.0% at 3 inches per hour
Resolution	0.25 m (0.01 in)	0.25 m (0.01 in)
* Accuracy requirements from Regulatory Guide 1.23, Revision 1, March 2007		

Table 6.4-2— BBNPP Meteorological Tower Instrument Types, Specifications and Accuracies for Operation Program

Measurement	System Accuracy*	Measurement Resolution*
Wind Speed	+/- 0.2 m/s (+/-0.45 mph) or 5% of observed wind speed starting threshold <0.45 m/s (1 mph)	0.1 m/s or 0.1 mph
Wind Direction	+/- 5 degree starting threshold <0.45 m/s (1 mph)	1.0 degree
Ambient Temperature	+/-0.5°C (+/-0.9°F)	0.1°C or 0.1°F
Vertical Temperature Difference	+/-0.1°C (+/-0.18°F)	0.01°C or 0.01°F
Dew Point Temperature	+/-°1.5°C (+/-2.7°F)	0.1°C or 0.1°F
Wet-Bulb Temperature	+/-0.5°C (+/-0.9°F)	0.1°C or 0.1°F
Relative Humidity	+/-4%	0.1%
Precipitation (water equivalent)	+/-10% for a volume equivalent to 2.54 mm (0.1 in) of precipitation at a rate <50 mm/h (<2 in/h)	0.25 mm or 0.01 in
Time	+/- 5 min	1 min
*Resolution and Accuracy requirements consistent with Regulatory Guide 1.23, Revision 1 March 2007		

Table 6.4-3— Potential Man-Made Obstructions to Air Flow for the BBNPP Meteorological Tower
(Page 1 of 2)

Obstruction	Wind Direction and Sector	Distance (ft)/(m)	Grade / Finished Floor Elevation (ft)/(m)	Height (ft)/(m)	Largest Bottom Dimension (ft)/(m)	Largest Top Dimension (ft)/(m)
SSES Met. Tower	45 NE	4171/1271	650/198	N/A	N/A	N/A
SSES CWS Cooling South Unit 2 (centerline)	19 NNE	3139/957	690/210	540/165	419/128	301/92
SSES CWS Cooling North Unit 1 (centerline)	15 NNE	3823/1165	710/216	540/165	419/128	301/92
BBNPP CWS Cooling East (centerline)	316 NW	4520/1378	700/213	475/145	360/110	202/62
BBNPP CWS Cooling West (centerline)	310 NW	4985/1519	700/213	475/145	360/110	202/62
Treeline (to North)	357 N	260/79	668/204	79/24	N/A	N/A
Treeline (to South)	177 S	300/91	668/204	94/29	N/A	N/A
BBNPP Reactor Building (centerline)	300 WNW	4368/1331	720/219	204.4/62.3	182.87/56	N/A
BBNPP Turbine Building (centerline)	303 WNW	4043/1232	720/219	160/49	384.5/117	N/A
SSES Reactor Building Unit 2 (centerline)	28 NNE	3669/1118	670/204	203.125/61.913	323/98	N/A
SSES Turbine Building Unit 2 (centerline)	26 NNE	3585/1093	676/206	112.21/34.20	630/192	N/A
BBNPP Emergency Diesel Generator South	298 WNW	4141/1262	720/219	68/21	178/54	N/A
BBNPP Emergency Diesel Generator North	304 NW	4464/1361	720/219	68/21	178/54	N/A
BBNPP Service and Administration Building (Access Building)	299 WNW	4214/1284	720/219	62.67/19.10	119.94/37	N/A

Table 6.4-3— Potential Man-Made Obstructions to Air Flow for the BBNPP Meteorological Tower
(Page 2 of 2)

Obstruction	Wind Direction and Sector	Distance (ft)/(m)	Grade / Finished Floor Elevation (ft)/(m)	Height (ft)/(m)	Largest Bottom Dimension (ft)/(m)	Largest Top Dimension (ft)/(m)
SSES Emergency Diesel Generator (E)	30 NNE	4092/1247	656/200	85.5/26.1	80/24	N/A
SSES Emergency Diesel Generator (AN/AD)	27 NNE	3952/1205	660/201	75.5/23.0	120/37	N/A
SSES Service and Administration Building	26 NNE	4123/1257	676/206	66/20	150.5/46	N/A
SSES Salt Dome Storage	43 NE	4045/1233	655/200	60/18	60/18	N/A
SSES Domestic Water Storage Tank	40 NE	4234/1291	660/201	46/14	46/14	N/A
N/A stands for not applicable						

Table 6.4-4— Distances from BBNPP Met Tower to Nearby Obstructions to Air Flow

Downwind Sector*	Approximate Distance miles (meters)
N	0.45 (724)
NNE	0.45 (724)
NE	N/A**
ENE	N/A**
E	N/A**
ESE	N/A**
SE	N/A**
SSE	N/A**
S	N/A**
SSW	N/A**
SW	0.25 (402)
WSW	0.40 (644)
W	0.30 (483)
WNW	0.45 (724)
NW	0.5 (805)
NNW	0.5 (805)

* With respect to True North
** Lower than base elevation and therefore no possible obstructions

Table 6.4-5— {Existing Man-Made Potential Obstructions to Air Flow for the SSES Meteorological Tower}

Obstruction	Wind Direction and Sector	Distance ft (m)	Grade ft (m)	Height ft (m)	Largest Bottom Dimension ft (m)	Largest Top Dimension ft (m)
SSES CWS Cooling Tower South Unit 2 (centerline)	271 W	1958 (597)	690 (210)	540 (165)	419 (128)	301 (92)
SSES CWS Cooling Tower North Unit 1 (centerline)	291 WNW	2108 (643)	710 (216)	540 (165)	419 (128)	301 (92)
SSES Reactor Building Unit 2 (centerline) (note 1)	284 WNW	1219 (372)	670 (204)	203.125 (62)	323 (98)	N/A
SSES Turbine Building Unit 2 (centerline) (note 1)	280 W	1409 (429)	676 (206)	112.21 (34)	630 (192)	N/A
SSES Emergency Diesel Generator (E)	301 WNW	1100 (335)	656 (200)	85.5 (26)	80 (24)	N/A
SSES Emergency Diesel Generator (A-D)	297 WNW	1336 (407)	660 (201)	75.5 (23)	120 (37)	N/A
SSES Service and Administration Building	302 WNW	1430 (436)	676 (206)	66 (20)	150.5 (46)	N/A
SSES Salt Dome Storage	277 W	209 (64)	655 (200)	60 (18)	60 (18)	N/A
SSES Domestic Water Storage Tank	321 NW	432/132	660 (201)	46 (14)	46 (14)	N/A
-Note 1: SSES Unit 2 reactor Building and Turbine Building are closer to the SSES Meterological Tower than the Unit 1 structures.						

Table 6.4-6— Potential Man-Made Obstructions to Air Flow for the SSES Meteorological Tower
(Page 1 of 2)

Obstruction	Wind Direction and Sector	Distance ft (m)	Grade/ Finished Floor Elevation ft (m)	Height ft (m)	Largest Bottom Dimension ft (m)	Largest Top Dimension ft (m)
BBNPP Met. Tower	225 SW	4171/1271	675/206	N/A	N/A	N/A
SSES CWS Cooling Tower South Unit 2 (centerline)	271 W	1958/597	690/210	540/165	419/128	301/92
SSES CWS Cooling Tower North Unit 1 (centerline)	291 WNW	2108/643	710/216	540/165	419/128	301/92
BBNPP CWS Cooling East (centerline)	273 W	6100/1859	700/213	475/145	360/110	202/62
BBNPP CWS Cooling West (centerline)	272 W	6794/2071	700/213	475/145	360/110	202/62
BBNPP Reactor Building (centerline)	264 W	6789/2069	720/219	204.4/62.3	182.87/56	N/A
BBNPP Turbine Building (centerline)	264 W	6385/1946	720/219	160/49	384.5/117	N/A
SSES Reactor Building Unit 2 (centerline)	284 WNW	1219/372	670/204	203.125/ 61.913	323/98	N/A
SSES Turbine Building Unit 2 (centerline)	280 W	1409/429	676/206	112.21/34.20	630/192	N/A
BBNPP Emergency Diesel Generator South	261 W	6712/2046	720/219	68/21	178/54	N/A
BBNPP Emergency Diesel Generator North	266 W	6703/2043	720/219	68/21	178/54	N/A
BBNPP Service and Administration Building (Access Building)	263 W	6697/2041	720/219	62.67/19.10	119.94/37	N/A
SSES Emergency Diesel Generator (E)	301 WNW	1100/335	656/200	85.5/26.1	80/24	N/A

Table 6.4-6— Potential Man-Made Obstructions to Air Flow for the SSES Meteorological Tower
(Page 2 of 2)

Obstruction	Wind Direction and Sector	Distance ft (m)	Grade/ Finished Floor Elevation ft (m)	Height ft (m)	Largest Bottom Dimension ft (m)	Largest Top Dimension ft (m)
SSES Emergency Diesel Generator (AN/ AD)	297 WNW	1336/407	660/201	75.5/23	120/37	N/A
SSES Service and Administration Building	302 WNW	1430/436	676/206	66/20	150.5/46	N/A
SSES Salt Dome Storage	277 W	209/64	655/200	60/18	60/18	N/A
SSES Domestic Water Storage Tank	321 NW	432/132	660/201	46/14	46/14	N/A
N/A stands for not applicable						

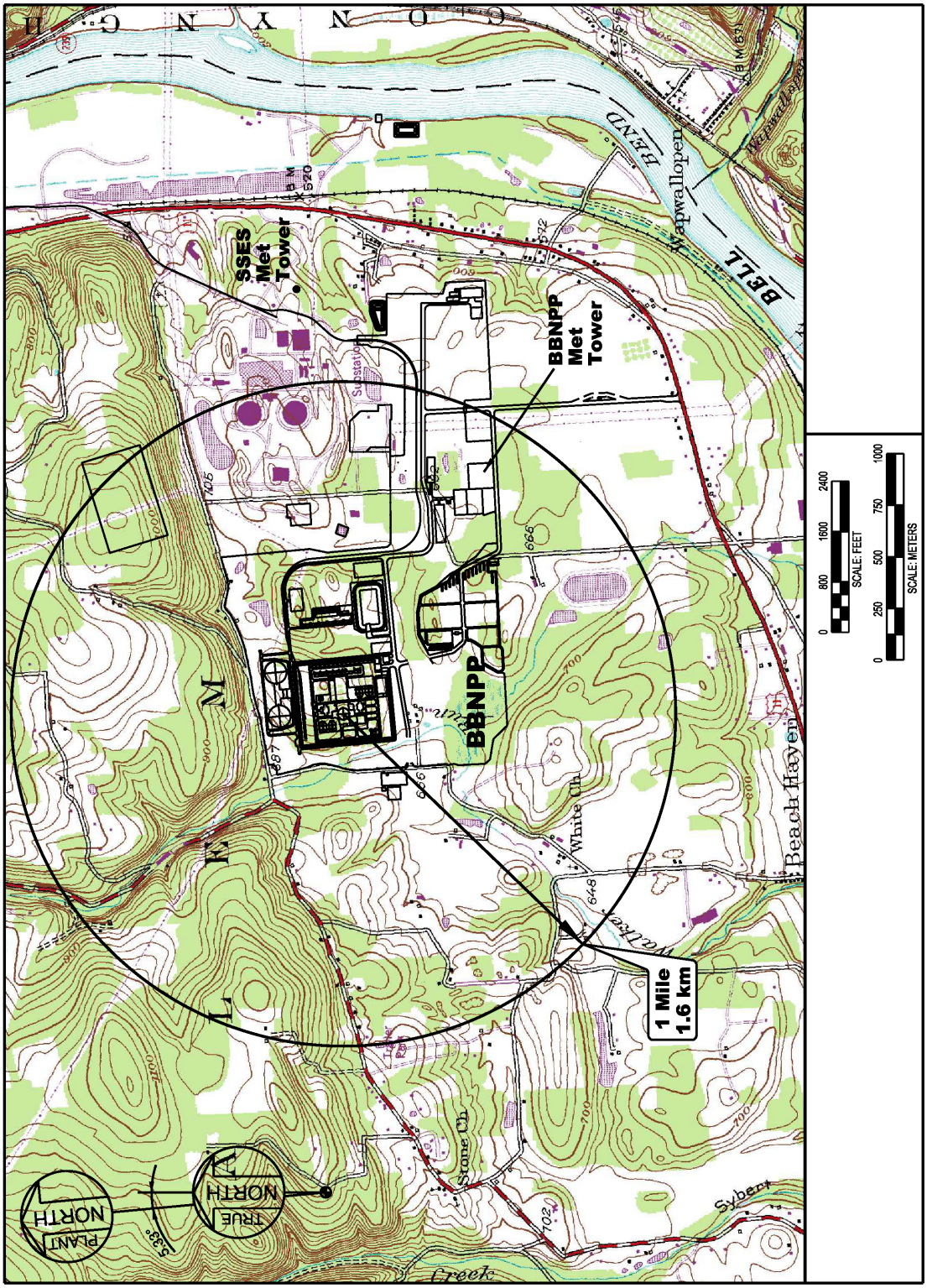
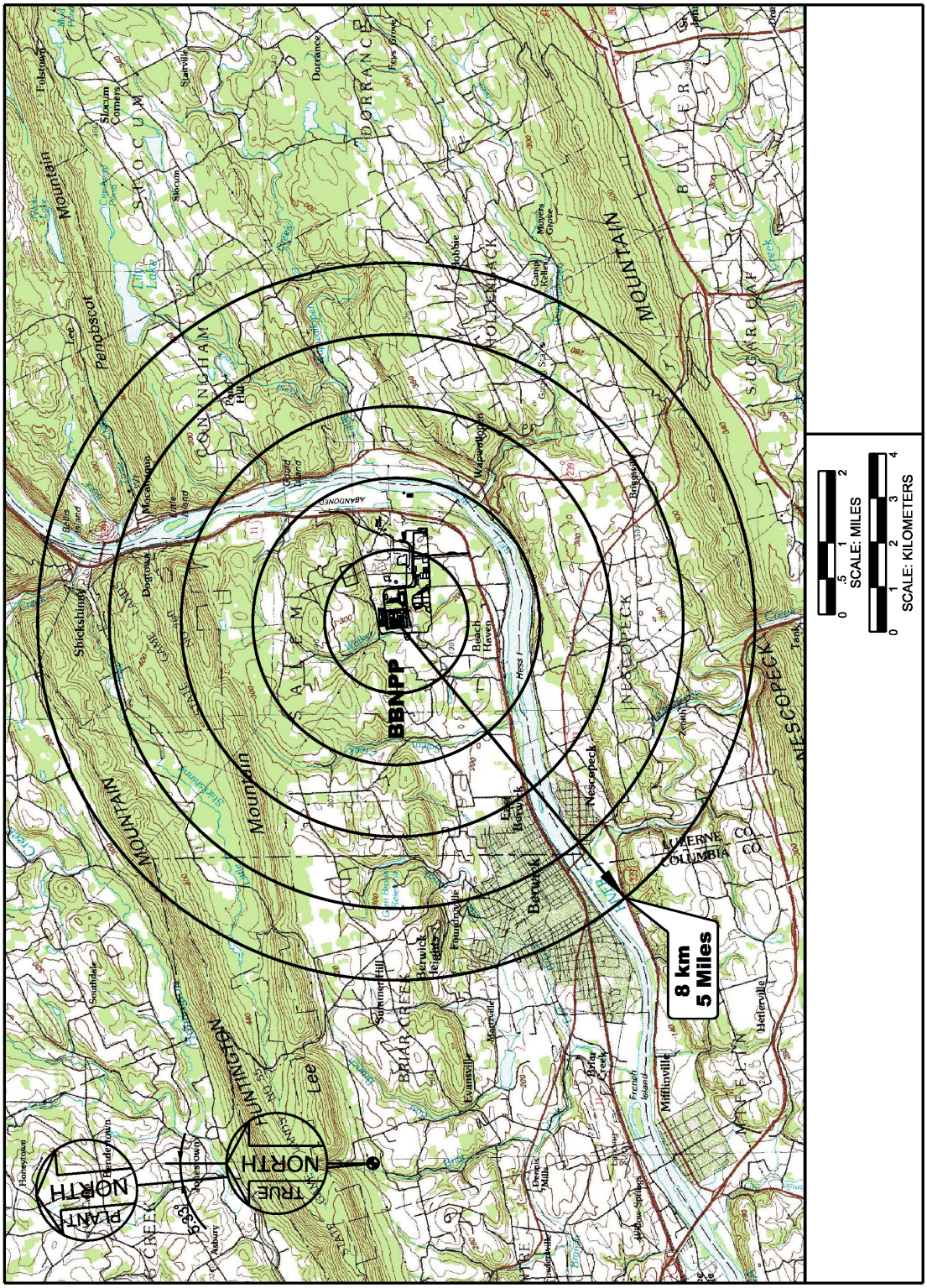


Figure 6.4-1— Topography within a 1-Mile (1.6 km) Radius of the Site

Figure 6.4-2— Topography within a 5-Mile (8 km) Radius of the Site



6.5 ECOLOGICAL MONITORING

The following sections present information regarding ecological monitoring for terrestrial ecology, land use, and aquatic ecology of the Bell Bend Nuclear Power Plant (BBNPP) site areas likely to be affected by site preparation, construction, and operation and maintenance of BBNPP. The monitoring programs are designed based on anticipated environmental impacts through the various stages of BBNPP project implementation. This section complies with NRC Regulatory Guide Sections 4.7 and 4.11 regarding general site suitability studies and terrestrial environmental studies to allow reasonably certain predictions that there are no significant impacts to the terrestrial ecology associated with the construction or operation of BBNPP.

Monitoring programs to detect changes in the ecology begin before application submittal and continue during site preparation and construction and throughout station operation and maintenance. The monitoring programs cover elements of the ecosystem where a causal relationship between station construction and operation and adverse changes are established or strongly suspected. An evaluation of the standardization, adequacy and accuracy of data collection and analytical methods used in the monitoring programs is included.

6.5.1 Terrestrial Ecology and Land Use

The following sections present information on monitoring programs for terrestrial ecology and land use likely to be affected by site preparation, construction, or operation and maintenance of the facility. The monitoring programs are designed based on anticipated environmental impacts through the various stages of project implementation.

6.5.1.1 Preapplication Monitoring

Section 2.2.1 describes the site features and land use including a map showing these features. Section 2.2.2 describes the existing and proposed transmission line corridors and Section 2.4.1 describes the field studies performed to determine the major plant communities and important species and habitats. Note that the details of the type, frequency and duration of observations or samples taken at each location are contained in the individual reports for the field studies discussed in Section 2.4.1. The field studies and Section 2.4.1 discuss the distribution and abundance of important species and habitats. Critical life history information including parameters such as feeding areas, wintering areas and migration routes are also discussed in Section 2.4.1. Descriptions of modifications that may affect existing patterns of plant and animal communities including the development of cooling ponds and reservoirs, cooling towers, transmission line corridors and access routes is discussed in Section 4.3.1.

Mitigation requirements for unavoidable impacts to wetlands will be guided by conditions established in permits issued by the U.S. Army Corps of Engineers (USACE) under Section 404 of the Federal Water Pollution Control Act (EPA, 1977) and by the Pennsylvania Department of Environmental Protection (PADEP) under its Chapter 105 Dam Safety and Waterway Management Regulations (PA, 1991). Section 1.3 contains a list of the permits required for this project as well as the applicable Federal and State regulations. Monitoring of mitigation success will be defined and executed with reference to these regulations. Additional guidance will be provided by "Design Criteria for Wetland Replacement" (PADEP, 1997), and "Mitigation and Monitoring Guidelines" (USACE, 2004).

As part of the mitigation design process, all wetlands likely to be affected by BBNPP site preparation and construction will be evaluated to determine their functions and values by a methodology accepted by USACE and PADEP. Functions identified will be used as the basis of mitigating loss of wetlands during site development.

As an essential record of overall project area baseline conditions, field surveys and aerial photography of the proposed site and transmission line system were obtained prior to construction. The resulting map of vegetation types by structure (e.g., herbaceous, shrub-scrub, sapling/small trees) and moisture regime (e.g., emergent wetland, droughty outcrops) serve as a guide to identify suitable habitats of Federal and State-listed species of plants and animals. Following the results of a listed-species field survey, access roads and staging areas within the proposed site were located so as to avoid such habitats to the extent possible. Management plans will be prepared that aim to enhance or at least perpetuate the habitat for target species. Repeated aerial photography every five years including some field observations to verify the information gathered from photo interpretation will serve as a record of forest regrowth in restored areas after completion of construction as proposed in Section 4.3.1.4. It would also provide evidence of any erosion around construction and other work areas, and indicate changes in vegetation that may call for corrective action (e.g., wind throws) or aid in the scheduling of routine transmission corridor right-of-way management.

Wildlife surveys of mammals, birds, reptiles, amphibians, and terrestrial invertebrates were conducted at the BBNPP site during 2007 and 2008. Additional terrestrial surveys were completed during May and June 2010. In addition, plant species were inventoried as part of the wetlands delineation and plant community mapping field studies conducted during 2007 and 2008 and in Spring 2010. Table 2.4-1 identifies the important terrestrial species at the BBNPP Site. The Northern myotis, peregrine falcon, long dash butterfly, and black dash butterfly have been observed on the site. In addition, recreationally important fauna (white-tailed deer, black bear, wild turkey) and ecologically important fauna (meadow vole, deer mouse, white-footed mouse, scarlet tanager) were observed but are also known to commonly occur in surrounding areas. Plants that are commercially important (black cherry) and ecologically important (red maple, river birch, spicebush, skunk cabbage, Canada goldenrod) were also observed onsite. Similarly, these plant species are very common both locally and regionally.

There are no continuous monitoring programs required for terrestrial ecology and land use in this phase of the project.

6.5.1.2 Site Preparation, Construction and Pre-Operational Monitoring

A description of site preparation and construction impacts on terrestrial resources, including wetlands, is discussed in Section 4.1.

Mitigating wetlands lost to BBNPP site development will commence according to mitigation plans developed for USACE and PADEP approval. Any monitoring required during site preparation, construction and pre-operation will follow guidelines developed by the USACE and the Commonwealth of Pennsylvania in accordance with conditions specified in required permits listed in Table 1.3-1. Additional monitoring including program elements, actions and reporting levels will be specified as required by the PA Department of Environmental Protection; Pennsylvania Stormwater Best Management Practices Manual (PADEP, 2008); Best Management Practices (BMPs) for erosion and sediment control as provided in Title 25 PA Code, Chapter 102 (PA, 2000); the NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities; and other applicable permits obtained for construction. This plan and program will be implemented during this phase in order to minimize impacts to wetlands, groundwater and aquatic ecology.

In accordance with the baseline studies performed during the preapplication timeframe and existing plant experience at the nearby SSES site, no additional monitoring programs are proposed for:

- Bird collisions with plant structures, transmission lines and towers, and cooling towers; and
- Impacts to important species and habitats.

These parameters have all been determined to have a small impact on terrestrial ecology as discussed in Section 4.3.1, and Section 4.3.2. In addition, there is a commitment to place flashing lights or reduce lighting on the large cooling towers to minimize bird collisions once these structures are built.

There are no continuous monitoring programs required for terrestrial ecology and land use in this phase of the project.

6.5.1.3 Operational Monitoring

Operation and maintenance impacts of the proposed transmission system are addressed in Section 5.6.1. There are no continuous monitoring programs required for terrestrial ecology and land use in this phase of the project

6.5.2 Aquatic Ecology

The following sections present information regarding ecological monitoring for aquatic ecosystems likely to be affected by site preparation, construction, or operation and maintenance of the facility. The monitoring programs are designed based on anticipated environmental impacts through the various stages of project implementation.

Section 2.3.3 documents the pre-existing water quality characteristics of the freshwater bodies in the vicinity of the plant and the Susquehanna River. The principal aquatic ecological features of the BBNPP site and vicinity are described in Section 2.4.2, including freshwater systems on the BBNPP site and the intake and discharge areas of the Susquehanna River. Impacts to aquatic systems from construction of the facilities are described in Section 4.3.2. Impacts to aquatic systems from operation of the cooling system are described in Section 5.3.1.2. Impacts from waste discharges are described in Section 5.5.

6.5.2.1 Preapplication Monitoring

Long-term monitoring of the Susquehanna River has occurred in relation to operation of SSES. This long-term monitoring program included water quality, algae, periphyton, benthic macroinvertebrates, and fish. Currently, the program samples river water quality on a quarterly basis, and the fish assemblage is sampled from spring to fall. In addition to the ongoing water quality and fish data collections, benthic macroinvertebrates were collected in the summer of 2007 and 2008. A mussel survey was completed during October 2007 in the vicinity of the proposed BBNPP intake/discharge structures. Other preapplication monitoring has been conducted on the BBNPP site, including sampling for fish in the ponds, the Canal and adjacent waters, Walker Run, and Unnamed Tributary 1 and benthic macroinvertebrate collections in Walker Run and Unnamed Tributary 5. This recent data collection effort is reported in Section 2.4.2. An impingement and entrainment study was performed from April 2008 through March 2009 at the SSES intake structure to provide data on potential impingement and entrainment at the proposed BBNPP Intake Structure. Some historical impingement data have also been collected but is limited to the fall outmigration period in years where American shad were

stocked up-river from SSES. A macroinvertebrate collection was completed during the summer of 2008, and fish sampling was conducted in the North Branch Canal, Canal Outlet, and a Marshland adjacent to the Canal in the spring of 2010. The aforementioned data collection efforts provide a sufficient basis for describing the ecological resources existing on and in the vicinity of the BBNPP site. Sampling locations, sampling methods and quality control are discussed in Section 2.4.2.

No rare or unique aquatic species were identified in the on-site ponds or Walker Run. The aquatic species that occur on site are ubiquitous, common, and easily located in nearby waters. Typical fish species found in the ponds included bluegill, largemouth bass, and brown bullhead. The Walker Run fish community was predominantly comprised of creek chub, white sucker, and blacknose dace. The composition of the fish assemblage in the Canal and adjacent waters was found to be similar to the fish assemblage in Lake Took-a-while, a lake that is hydrologically connected to the Canal. The fish assemblage in the Canal and adjacent waters is dominated by bluegill, green sunfish, and golden shiner. However, as discussed in detail in Section 2.4.2, a single specimen of brook stickleback, a candidate species of concern in Pennsylvania, was collected in the Canal Outlet. The most important aquatic macroinvertibrate species in the on-site water bodies are the juvenile stages of aquatic insects. No mussels were observed in the ponds, Canal and adjacent waters of Walker Run. Figure 2.4-3 through Figure 2.4-6 show the collection locations in the River and on site in the ponds, Walker Run, and the Canal.

No rare fish species were collected in the Susquehanna River. All of the collected species are common inhabitants of large rivers in Pennsylvania and include several game fishes including smallmouth bass, walleye, and muskellunge.

Two important species of mussels, green floater and yellow lampmussel, were collected from the river. The yellow lampmussel was collected during the mussel survey completed in October 2007. This survey was performed both upstream and downstream of the proposed BBNPP intake/discharge structures. The green floater was collected in the benthic macroinvertebrate samples taken during August 2007. Both species are listed as rare by the Pennsylvania Fish and Boat Commission (PFBC, 2011). Construction activities will likely have minimal impact to mussels in the Susquehanna River. However, surveys may be required prior to intake/discharge structure construction to determine if mussels are present in the vicinity of these areas and, if so, these mussels may need to be relocated. This determination is coordinated with the Pennsylvania Fish and Boat Commission as construction plans for BBNPP become more definite. A description of both species is included in Section 2.4.2.

Descriptions of modifications that may affect existing patterns of plant and animal communities such as dams, impoundments, dredging, filling of wetlands, and clearing of stream banks are discussed in Section 4.3.2.

There are no continuous monitoring programs required for aquatic ecology in this phase of the project. The surveys performed to establish baseline conditions were sufficient to document the composition and abundance of aquatic organisms on site and in the river.

6.5.2.2 Construction and Pre-Operational Monitoring

Construction and preoperational monitoring programs are proposed for resources that may affect aquatic ecology, including thermal monitoring (as discussed in Section 6.1), hydrological monitoring (as discussed in Section 6.3) and chemical monitoring (as discussed in Section 6.6).

Construction monitoring mainly consists of drainage from excavations which are pumped to a storm water discharge point. Approval of storm water management and erosion/sediment control plans will be obtained in accordance with the National Pollution Discharge Elimination System (NPDES) Individual Permit for Discharge of Stormwater Associated with Construction Activities (PA, 2000). The Pennsylvania Department of Environmental Protection will issue a permit to include pollutants typically found at a construction site such as sediments and petroleum hydrocarbons.

Storm water discharges from impervious surfaces at the new facility will be controlled and minimized by following guidelines established in Pennsylvania's Stormwater Best Management Practices Manual. This plan calls for periodic monitoring and record keeping of the engineered controls to ensure they are effective in minimizing silt runoff and evaluating the need to repair or replace the installed controls such as silt fences, hay bales, berms and settling ponds (PADEP, 2006). The U.S. Army Corps of Engineers 404 Permit may contain requirements for aquatic monitoring as it relates to chemical spills or control of silt discharging into water bodies. Implementation of the Preparedness, Prevention, and Contingency Plan requires periodic monitoring and record keeping to ensure spill controls are established and maintained to minimize impacts to the aquatic environment.

Details as to monitoring program elements, sampling procedures and equipment, data analysis, quality control and reporting will be contained in the various permits and approvals required for construction.

BBNPP will be designed to meet the Phase I, New Facility requirements published at 40 CFR 125.80 to 89, under Track I (CFR, 2008). The cited EPA requirements meet the Clean Water Act 316(b) rules to verify there will be minimal adverse environmental impact to fish and other aquatic organisms due to impingement and entrainment for the new intake structure.

6.5.2.3 Operational Monitoring

Operational aquatic ecology monitoring may be required as a condition of a new NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities; and for compliance with the Clean Water Act 316(b) Rule (CFR 2008). The permit will require flow and water quality monitoring, such as monitoring of certain chemical constituents in the discharge and temperature.

Aquatic biological monitoring may be required in the river, Walker Run, and in several unnamed tributaries after completion of construction and after initiation of plant operation. This monitoring would most likely entail additional aquatic collections at the same locations as the preapplication monitoring.

The River biota monitoring program should consist of summer benthic macroinvertebrate collections, monthly fish collections from spring through fall, and quarterly water quality monitoring. The sample locations would be upstream and downstream of the BBNPP diffuser bar, similar to the monitoring program currently in place for SSES. Data has been collected in the Susquehanna River for over 24 years in support of SSES operations. The monitoring originally included sampling of macroinvertebrates, fish, algae, periphyton, and water quality in the river. The current program samples water quality on a quarterly basis and fish on a monthly basis from spring through fall.

Monitoring within Walker Run and unnamed tributaries to Walker Run may also be necessary. This monitoring should include both benthic macroinvertebrate and fish surveys at the same

locations as those completed in the pre-application monitoring (Figure 2.4-3). Spring and fall collections for both groups should be sufficient to document changes in the community associated with operation of BBNPP. Additionally, water quality and habitat monitoring may also be necessary.

Several unnamed tributaries (Unnamed Tributaries 3, 4, and 5) may be impacted by construction and operation of BBNPP (Figure 2.4-3). Monitoring of these tributaries may include benthic macroinvertebrate collections during the spring and fall. Benthic macroinvertebrate surveys were completed in Unnamed Tributaries 3 and 5 during pre-application monitoring. Unnamed Tributary 3 was dry during the sampling effort. In all three streams operational monitoring should include benthic macroinvertebrate collections at the same locations as pre-application monitoring and possibly habitat assessments to document changes in the stream channel associated with runoff from the BBNPP site.

The Clean Water Act Section 316(b) (CFR 2008) requires that the location, design, construction and capacity of a cooling water intake structure reflect the best technology available (BTA) for minimizing adverse environmental impacts. The Phase I Rule, 40 CFR 125 (CFR 2008), addresses new sources of cooling water intake at steam electric plants. The BBNPP cooling water intake structure is designed to meet the Clean Water Act Section 316(b) (CFR 2008) Phase I requirements for new facilities under Track 1 (closed cycle cooling and intake screen velocity less than or equal to 0.5 fps (0.15 mps)).

As noted in Section 5.5.1.1, the discharges to surface waters from plant operations will include cooling water blowdown and storm water runoff. Concentrations of chemicals in the cooling water discharge will be controlled by the NPDES permit. Sanitary wastewater lines will be tied into a publicly owned treatment works operated by the Berwick Area Joint Sewer Authority.

Storm water discharges from impervious surfaces at the BBNPP will be controlled and minimized by provisions of Pennsylvania's Stormwater Best Management Practices Manual. An Erosion and Sediment Control Plan is required to be implemented at a construction site in which best management practices are utilized to control erosion and sediment. The plan provides detailed descriptions of various best management practices that can be implemented on site to reduce stream channel erosion, pollution, siltation and sedimentation and local flooding. A Preparedness, Prevention, and Contingency Plan is required by Pennsylvania (Pa Code Section 91.33 and 91.34). The plan shall identify areas in which toxic or hazardous substances are stored or handled that may have the potential to cause non-compliance. BMP's shall be developed for each identified area. A Post-Construction Stormwater Management Plan must be prepared and implemented to identify the BMP's to be installed to manage and treat the stormwater discharge so that water quality is protected after construction activities are terminated.

In addition, water withdrawn from the Susquehanna River is regulated as part of the Susquehanna River Basin Commission (SRBC, 2008). The Susquehanna River Basin Commission oversees the consumptive use permitting process under Article 3, Section 3.10.2(ii) of the Commission. The withdrawn water will be used for makeup water in the plant cooling system.

Operation of the BBNPP will not require use of groundwater.

A recent nuclear industry initiative by the Nuclear Energy Institute and NRC assessment (NRC, 2006) of existing nuclear reactors indicates that requirements related to groundwater monitoring during plant operation may change for present and future nuclear reactors.

Therefore, this developing issue will continued to be followed and future requirements will be addressed, as applicable.

6.5.3 References

CFR, 2008. Title 40, Code of Federal Regulations, Sections 125.80-89, Track 1, Requirements Applicable to Cooling Water Intake Structures for New Facilities Under Section 316(b) of the Act, 2008.

EPA, 1977. Environmental Protection Agency, Section 404 of the Federal Water Pollution Control Act, Clean Water Act, Amended 1977, Website: http://www.epa.gov/npdes/pubs/cwatxt.txt, Date accessed: June 4, 2008.

NRC, 1999. Standard Review Plans for Environmental Reviews for Nuclear Power Plants, NUREG-1555, Nuclear Regulatory Commission, October 1999.

NRC, 2006. Liquid Radioactive Release, Lessons Learned Task Force - Final Report, Nuclear Regulatory Commission, September 1, 2006.

PA, 1991. Title 25 PA Code, Chapter 105, Dam Safety and Waterway Management, Amended October, 1991, Website: http://www.pacode.com/secure/data/025/chapter105/s105.20a.html, Date accessed: June 4, 2008.

PA, 2000. Title 25 PA Code, Chapter 102, Erosion and Sediment Control, January 2000.

PADEP, 1997. Design Criteria – Wetlands Replacement/Monitoring. Pennsylvania Department of Environmental Protection, February 1997.

PADEP, 2006. PA Department of Environmental Protection, Bureau of Watershed Management, Pennsylvania Stormwater Best Management Practices Manual, Document Number 363-0300-002, December 30, 2006.

PFBC, 2011. Pennsylvania Fish and Boat Commission, Letter from Christopher A. Urban to Bradley Wise (PPL), Re: Species Impact Review (SIR)- #35087, Bell Bend Nuclear Plant, Salem Township, Luzerne County, Pennsylvania.

SRBC, 2008. Susquehanna River Basin Commission, Policies, Guidances, and Regulations, Website: http://www.srbc.net/policies/policies.htm#Policies, Date accessed: May 28, 2008.

USACE, 2004. Mitigation and Monitoring Guidelines, Baltimore District Regulatory Program, U. S. Army Corps of Engineers, November 2004.

6.6 CHEMICAL MONITORING

Chemical monitoring of surface water and groundwater is performed to control and minimize adverse impacts to the Susquehanna River and on-site water bodies and will be implemented in three phases: preapplication, construction and preoperational, and operational monitoring. The scope for each monitoring phase will be predicated by the findings for the preceding phase.

Section 6.1 discusses discharged wastewater temperature requirements and Section 6.3 discusses flow sampling requirements.

6.6.1 Preapplication Monitoring

Pre-application monitoring provides a baseline for assessment of effects from pre-operation and operation of the BBNPP on the aquatic environment in the vicinity of the site. Information on past studies performed to determine the characteristics of surface water are discussed in ER Section 2.3.3.

Surface Water

The most significant surface water body in the BBNPP area is the North Branch of the Susquehanna River (NBSR). The NBSR is the source of cooling water for the SSES and the BBNPP. All surface water and groundwater discharging from the BBNPP will ultimately reach the NBSR.

The SSES has been collecting water samples from the Susquehanna River at two sites since 1968. The SSES sampling site is located 750 ft (230 m) upstream of the SSES intake structure (Figure 2.3-33) and serves as the upstream control sampling site. The Bell Bend sampling site (also referred to as SSES Indicator Site) is located approximately 2,260 ft (690 m) downstream of the SSES blowdown discharge line (Figure 2.3-33). The location of the site was chosen in order to evaluate the impacts to the river due to the SSES blowdown discharge (Ecology III, 2003 - 2007). River samples are collected quarterly. The SSES river data for 1968 through 1977 are summarized in Table 2.3-43.

The SSES river data for 2002 through 2006 have been averaged for each year and are presented in Table 2.3-44. The overall average water quality values (averages of the 2002-2006 yearly average data) are presented in Table 2.3-40. In addition to the data collected by the SSES, the BBNPP site-specific water quality sampling program included two sampling sites on the Susquehanna River. Site SR01 is co-located with the "SSES Control" sampling site, upstream of the SSES blowdown discharge line (Figure 2.3-33). Site SR02 is located downstream of the "Bell Bend SSES indicator site" identified in Table 2.3-44, downstream of the location of the proposed BBNPP blowdown discharge line, and downstream of the NBSR confluence with Unnamed Tributary No. 3 and Walker Run (Figure 2.3-33). Thus, SR02 is downstream of all potential surface water and groundwater discharges from the SSES and the BBNPP sites. This sampling site was chosen as a reference point to evaluate potential future impacts to the river due to construction and operation of the BBNPP. Analytical data for samples collected from SR01 and SR02 are presented in Table 2.3-40. SR01 and SR02 field parameters measured in the NBSR at the time of sampling are listed in Table 2.3-45.

The BBNPP site-specific data were collected during a site baseline investigation, beginning in 2007. The baseline sampling was performed in:

- autumn (October) 2007,

- winter (February), spring (April), summer (July), and autumn (October) 2008,
- summer (June), autumn (September), and winter (December) 2010, and
- spring (March) 2011.

Data from this study are detailed in Section 2.3.3 and were developed to serve as a baseline reference so that potential water quality impacts due to the construction and operation of the BBNPP can be assessed. Water quality monitoring data for the NBSR is summarized below.

pH and Alkalinity

Between 2002 and 2008, the NBSR water has been alkaline (total alkalinity range: 43 - 95 mg/L, as CaCO3), with pH values typically between 7.20 and 7.80 (Table 2.3-44, Table 2.3-45, and Table 2.3-40). Between 1968 and 1977, the average total alkalinity (43.0 mg/L) and pH (7.18) values were somewhat lower respectively (Table 2.3-43). These data suggest that the pH and the alkalinity of the river have increased over the past 30 years. The anthracite mining industry has declined greatly since the 1970s, and the acidity, iron, and sulfate contained in the abandoned mines and mine refuse piles have gradually leached away, resulting in improved river water quality over time.

Specific Conductance (SC), Total Mineral Solids (TMS), Total Dissolved Solids (TDS), and Total Hardness

Between 1968 and 1977, SC in the river ranged from 0.098 to 0.635 mS/cm and averaged 0.297 mS/cm (Table 2.3-43). Between 2002 and 2004, the annual average SC has ranged from 0.226 to 0.238 mS/cm, and averaged 0.234 mS/cm at the SSES control site (Table 2.3-44). In 2008, the average SC of river water was 0.315 mS/cm (Table 2.3-45). Thus, the SC of the river water is almost identical to what it was in the 1970s.

The TMS, TDS, and total hardness are water quality parameters that are related to SC. Like SC, they reflect the total amount of inorganic constituents that are dissolved in the water. From 1968 to 1977, the average values of these three parameters were 190, 192, and 116 mg/L, respectively (Table 2.3-43). Between 2002 and 2006, the average values of TMS and total hardness were 134 and 92 mg/L, respectively (Table 2.3-44). In 2008, TDS and total hardness ranged from 110 to 250 mg/L and 65 to 140 mg/L, respectively (Table 2.3-40). Thus, these three water quality parameters have decreased since the 1970s. Again, this long-term improvement in general water quality is primarily due to the decline of anthracite mining and general improvements of other types of water quality controls upstream of the SSES and BBNPP.

The values of SC, TMS, TDS, and total hardness are also related to flow rate in the river. As the flow rate increases during storm events and large snowmelt events, more surface runoff and direct precipitation enter the river, thereby diluting groundwater inputs into the river. This causes chemical concentrations to decline due to dilution during large storm and snowmelt events and high river flow (Figure 2.3-78). Conversely, surface water runoff and direct precipitation into the river decreases to zero during drought and low-flow conditions. During these times, values of SC, TMS, TDS, and total hardness increase (Figure 2.3-78).

Dissolved Oxygen

In 2008, the dissolved oxygen (DO) in the NBSR averaged 12.5 mg/L (Table 2.3-45). Between 2002 and 2006, the annual average DO ranged from 8.9 to 11.0 mg/L. These data suggest that the river is well aerated and near oxygen saturation. Between 1968 and 1977, the average DO was similar (10.1 mg/L), but decreased on at least one occasion to a low of 5.8 mg/L (Table 2.3-43). The low value of DO was likely due to a flush of mineral acidity into the river in the 1970s, which consumes DO and could have caused such a short-term decline.

Dissolved oxygen goes through annual cycles. The solubility of DO is higher in cold water, so DO concentrations can be much higher in winter. As shown on Table 2.3-45, the DO at station SR01 was 21.3 mg/L on February 28, 2008 and was measured to be 7.08 mg/L on July 25, 2008 when the river water temperature was much higher.

Inorganic Nitrogen and Phosphorus Compounds (Nutrients)

Between 2002 and 2006, annual average nitrate (as N), ammonia (as N), and total phosphorus (as PO4) concentrations have averaged 0.85, <0.10, and 0.19, respectively (Table 2.3-41 and Table 2.3-44). These levels of nutrients are typical of a river that is slightly affected by agriculture and discharges from sewage treatment plants. The 2008 data ranged from undetectable to 0.73 mg/L for nitrate, and 0.08 to 0.27 mg/L for ammonia, and undetectable for total phosphorus (Table 2.3-40).

Metals

Between 2002 and 2006, monitoring at the two locations on the NBSR indicates that there were no elevated concentrations of minor or trace metals, with the exception of total iron, which ranged from 0.57 to 1.43 mg/L (annual averages) (Table 2.3-44). In 2008, total iron ranged from 0.21 to 0.80 mg/L, and dissolved iron from undetectable to 0.28 mg/L (Table 2.3-40). Total and dissolved iron concentrations (average value: 3.2 and 0.42 mg/L, respectively) were much greater between 1968 and 1977 (Table 2.3-43), when the anthracite mining industry was still active and the number, flow rates, and iron concentrations of the abandoned mine drainage discharges were much greater. Total manganese was also noticeably higher in the period from 1968 through 1977 (average value of 0.41 mg/L) (Table 2.3-43) as compared to the average value measured between 2002 and 2006 (0.11 mg/L) (Table 2.3-44) and the range of values measured in 2008 (0.056 to 0.1 mg/L) (Table 2.3-40).

Biological Parameters

Fecal coliform bacteria, total coliform bacteria, and fecal streptococci were detected in each river sample in 2008 (Table 2.3-40). Farm animals, septic tanks, and discharges from sewage treatment plants upstream of the SSES likely account for the majority of the microbes in the river water.

Groundwater

A total of 41 observation wells with depths extending to 400 ft (120 m) below ground surface (bgs) were installed across the BBNPP site in September and October 2007 (except MW301C, which was installed in May 2008. The wells were located in order to provide adequate distribution with which to determine site groundwater levels, subsurface flow directions, and hydraulic gradients beneath the BBNPP site. Observation wells were installed in three different groundwater-bearing intervals:

14 wells were screened in the Glacial Outwash aquifer at depths of 9.2 to 76.0 ft (2.8 to 23.2 m) bgs,

19 wells were screened in shallow shale bedrock 50 to 181 ft (15 to 55 m) bgs, and

8 wells were screened in the Deep Shale Bedrock aquifer at 170 to 400 ft (52 to 122 m) bgs.

The Glacial Outwash aquifer is distinctly different than the shale bedrock aquifer. The shale bedrock aquifer has been divided into "shallow" and "deep" bedrock aquifer, as a means to determine if the hydraulic properties, the hydraulic potentials, or the ground water flow directions are different between the shallow and deeper shale bedrock. In other words, the division of "shallow" versus "deep" provides a means to evaluate groundwater flow characteristics in the bedrock in three dimensions, rather than two dimensions. A depth of 175 ft (53 m) bgs has been selected as a divider between the "Shallow" and "Deep" Bedrock aquifers. Field hydraulic conductivity tests (slug tests) were conducted in 14 of the glacial outwash observation wells and in 11 of the bedrock observation wells. Monthly water level measurements from the groundwater observation wells began in October 2007 and continued until August 2008.

To evaluate vertical hydraulic gradients, a total of 31 monitoring wells were installed at the first 10 drilling locations (MW301-MW310), thereby creating 10 well clusters. Well clusters are a series of wells placed at the same location, with each well installed in a different water-bearing interval. Each cluster consists of two or more wells. This was done in order to measure vertical differences in hydraulic head, and vertical hydraulic gradients and vertical differences in hydraulic conductivity within the shale bedrock.

An additional 10 observation wells were installed at the BBNPP site in April, 2010. The additional observation wells were installed to depths extending to 167 ft (120 m) bgs. The additional observation wells were located to provide information on groundwater conditions in the northwest portion of the BBNPP site. One of the additional observation wells was screened in the Glacial Outwash aquifer at 21 to 36 ft (6.4 to 11.0 m) bgs. The remaining nine, additional observation wells were screened in the shallow shale bedrock aquifer at 45.45 to 167 ft (13.8 – 50.9 m) bgs. Field hydraulic conductivity testing (slug tests) was conducted on all of the additional observation wells. Pumping tests were conducted on selected additional groundwater observation wells. Monthly groundwater level measurements from the existing and additional observation wells began in August 2010.

Well water quality data are described in Section 2.3.3.2.

6.6.2 Construction and Preoperational Monitoring

Chemical monitoring during construction will aid in controlling adverse impacts to the Susquehanna River and Walker Run and will provide additional water quality data that can be used to measure water-quality changes from operation of the new unit. Accordingly, chemical monitoring of surface water during construction related activities for the new unit will be an extension of more than 30 years of pre-application monitoring. Construction and pre-operational chemical monitoring will be performed during the planned two year and four year periods for site preparation and plant construction, respectively. In accordance with the existing NPDES permit, the Pennsylvania Department of Environmental Protection (DEP) will be notified regarding the new proposed BBNPP. Sample collection, laboratory analyses, data evaluation and reporting practices will comply with permit modifications.

Although storm water discharges will increase during construction, disturbance to existing drainage systems will be avoided, if possible. Environmental controls (i.e., silt screens, dams, settling basins, and spill containment measures), will be implemented to reduce potential pollutants in storm water runoff and to minimize construction impacts to aquatic habitats. Prior to the start of construction, approval of storm water management and erosion/sediment control plans will be obtained from the Department of Environmental Protection and Luzerne Conservation District through submission of an NPDES Individual Permit for Stormwater Discharges Associated with Construction Activities application. These controls are implemented through approvals of an Erosion and Sediment Control Plan and a Post-Construction Stormwater Management (PCSM) Plan designed to minimize runoff impacts and impacts to aquatic habitats during construction and operation of the plant. Similar to the existing Susquehanna SES PCSM, storm water system manholes and handholds will continue to be periodically inspected and cleaned. Storm water from the BBNPP site will be collected through a network of storm sewers, ditches and culverts and will be drained to infiltration beds which will be sized to maintain post-construction hydrological conditions as close to preconstruction conditions as possible. A temporary pond will be installed to manage runoff and suspended solids from the concrete batch plant and aggregate material storage areas. This pond will be removed after construction.

Groundwater monitoring (water level observation) of the BBNPP area is currently being implemented through the use of the groundwater observation wells installed for the BBNPP area subsurface investigation and through periodic review of data from select groundwater level monitoring network wells. Some of the existing BBNPP area observation wells may be taken out-of-service prior to construction activities due to anticipated earth moving and construction requirements. Prior to construction activities, the observation well monitoring network will be evaluated in order to determine groundwater data gaps and needs created by the abandonment of existing wells. These data needs will be met by the installation of additional observation wells, if required. Additionally, the hydrologic properties and groundwater flow regimes of the shallow water bearing units (Glacial outwash, and to a lesser extent the shallow and deep bedrock aquifers) will be impacted by the proposed earthmoving, regrading, and construction of infrastructure (buildings, parking lots, etc.). Revisions to the observation well network will be implemented to ensure that the resulting changes in the local groundwater regime from construction activities will be identified. No chemical monitoring is planned at this time for groundwater.

6.6.3 Operational Monitoring

Operational monitoring will commence from the date of the first appropriation and use of Susquehanna River water and continue as long as required by the NPDES permit applicable for BBNPP. Although operational monitoring elements will be developed in consultation with the Pennsylvania DEP, it is anticipated that sampling locations, frequency and analyses will be similar to those for the existing plant; with the exception that sanitary wastewater from BBNPP will not be treated in an on-site wastewater treatment plant, but will be collected in a sanitary wastewater collection system that will direct sanitary wastes to the municipal sewer system and local POTW operated by the Berwick Area Joint Sewer Authority. No effluent discharge to the river or associated chemical monitoring for treated sanitary wastewater streams is envisioned for BBNPP. However, chemical monitoring of sewage from BBNPP into the municipal sanitary system will be done in accordance with local ordinances and permit requirements. The anticipated discharge limits for sanitary wastewater into the municipal sewer system is provided on Table 3.6-4.

Similar to SSES, the BBNPP Intake Structure will house debris screens, screen wash pumps, make-up water pumps and related equipment so that a new outfall for intake screen backwash will be likely. However, similar to SSES, chemical monitoring at the new outfall will be limited by the new NPDES permit to certain chemical parameters to ensure that the differences between the intake water and discharge water are within the limits specified in the permit.

BBNPP will utilize a closed-loop cooling water system consisting of two, natural draft cooling towers for the circulating water cooling system. Prior to discharge into the river, CWS cooling tower blowdown will be directed into a retention basin, provided as an intermediate discharge reservoir, and held for a period of time to reduce the concentration of solids and chlorine in the water. Essential Service Water System (ESWS) cooling tower blowdown, and other wastewater will also collect in the Combined Waste Water Retention Pond. Piping will transfer wastewater by gravity to the new Discharge Structure, which will provide a flow path for the discharge of water into the river via a submerged outfall.

Chemical monitoring will be performed at the new outfall to assess the effectiveness of retention methods and effluent treatment systems, as well as to detect changes in water quality associated with new plant operations. Similar to the existing plant, chemical monitoring will also be performed at storm water runoff outfalls and at internal monitoring points (i.e., Combined Waste Water Retention Pond influent and/or effluent). Effluent water chemistry will meet all applicable federal and state environmental regulatory requirements.

Test procedures for the analysis of effluent samples will be those approved under 40 CFR 136. In an effort to ensure accurate laboratory results, laboratories used for sample analysis will participate in periodic scheduled quality assurance inspections conducted by the Pennsylvania DEP and the United States Environmental Protection Agency (EPA), and will develop and implement a quality assurance program.

The following discussion provides a basis for the type of data and information that is expected to be required by the NPDES permit for BBNPP. The SSES NPDES permit specifies the monitoring conditions that the existing plant must meet to protect water quality. It is expected that the NPDES permit requirements for BBNPP will be similar.

Pursuant to the SSES NPDES permit PA-0047325, effective as of September 1, 2005, discharges to the Susquehanna River are allowed at Outfalls 070 and 075. Outfalls 071, 072, 073, 074, 075, 079 and 080 discharge to Lake Took-a-While, located adjacent to Susquehanna Riverlands. Outfall 070 monitors discharged stormwater from S-2 Pond (a sedimentation pond). Outfall 071 monitors discharged cooling tower blowdown and includes discharged treated radioactive wastewater and wastewater from the neutralization basin from the demineralizer and drains located in the raw water treatment building. Outfall 072 monitors discharged wastewater from the low volume waste sump in the Service and Administrative Building. Outfall 073 monitors discharged wastewater from the low volume waste sump in the Unit 1 Turbine Building. Outfall 074 monitors discharged wastewater from the low volume waste sump in the Unit 2 Turbine Building. Outfall 075 monitors discharged stormwater from sedimentation pond, Peach Stand Pond. Outfall 079 Monitors discharged sewage from the sanitary wastewater treatment plant. Outfall 080 monitors discharged stormwater from sedimentation pond, C-1 Pond. Oufalls 171 and 371 are internal monitoring points for discharges that are included in Outfall 071, which discharges to the Susquehanna River through the diffuser.

The NPDES permit specifies the monitoring conditions that the existing plant must meet to protect water quality. Table 6.6-1 summarizes the required water sampling protocol for the existing monitoring stations. A map showing the monitoring station locations is provided in ER Section 6.1 (Thermal Monitoring).

Sampling for NPDES permit requirements will be performed in accordance with the quality standards outlined in a Chemical Quality Assurance (QA) and Quality Control (QC) Program. This Chemical QA and QC Program will provide performance instructions for chemical/reagent control, instrumentation control, program control (e.g., sampling methodologies, analysis), minimum quantifiable concentration control, use and evaluation of charts, and data reporting.

Samples representative of the system or stream will be collected and preserved as necessary to prevent contamination or deterioration. Sampling and analytical methods conform to procedures for the analysis of pollutants as identified in Title 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". To ensure accuracy of measurements, monitoring and analytical instrumentation is maintained and periodically calibrated in accordance with manufacturer specifications or those per the Chemical QA and QC Program, whichever are more restrictive. The Chemical QA and QC Program will also provide instructions for calibration standards, prepared or purchased, used for preparing calibration curves and performing calibration checks. Statistical reliability will be achieved by calculating the mean and standard deviation of the data at a 95 percent confidence level. Data quality objectives will include producing accurate, reliable and cost effective measurements and data, adequate for their intended use.

Monthly BBNPP monitoring results will be summarized on Discharge Monitoring Reports and submitted to the Pennsylvania DEP. Sampling data collected during pre-application monitoring serve to document existing water quality conditions.

There are currently no plans to monitor groundwater for chemicals during the operational phase of BBNPP.

6.6.4 References

None

Table 6.6-1— Required Water Sampling Protocol

(Page 1 of 2)

Monitoring Station[a]	Monitoring Location[b]	System(s) Sampled[b]	Parameter Sampled	Sample Type[g]	Sampling Frequency
Outfall 080[h]	S-2 pond	S-2 Sedimentation Pond Stormwater	Oil & Grease pH TSS	Grab	1/Year
Outfall 071[c,d,e]	Diffuser Pipe	Cooling Tower Blowdown	FAC[f]	Grab During Chlorination	Daily
			Total Zinc	8-Hour Composite	1/Year
			Total Chromium	8-Hour Composite	1/Year
			pH	Grab	Daily
Outfall 072[h]	Service and Admin.Building Low Volume Waste Sump	Service and Admin. Building Low Volume Waste Sump	TSS	Grab	Quarterly
			Oil & Grease	Grab	Quarterly
			pH	Grab	Daily When Discharging
Outfall 073h	Unit #1 Turbine Bldg Low Volume Waste Sump	Unit #1 Turbine Bldb Low Volume Waste Sump	TSS	Grab	Quarterly
			Oil & Grease	Grab	Quarterly
			pH	Grab	Daily When Discharging
Outfall 074[h]	Unit #2 Turbine Bldg Low Volume Waste Sump	Unit #2 Turbine Bldb Low Volume Waste Sump	TSS	Grab	Quarterly
			Oil & Grease	Grab	Quarterly
			pH	Grab	Daily When Discharging
Outfall 075[h]	Peach Stand Pond	Peach Stand Pond (Stormwater)	TSS	Grab	1/Year
			Oil & Grease	Grab	1/Year
			pH	Grab	1/Year
Outfall 079[i]	Sewage Treatment Plant	Sewage Treatment Plant	CBOD5	8-Hour Composite	1/Month
			TSS	8-Hour Composite	!/Month
			TRC	Grab	Daily
			pH	Grab	Daily
			Fecal Coliform	Grag	1/Month
			Ammonia-N	8-Hour Composite	2/Month
			Kjeldahl-H	8-Hour Composite	2/Month
			Nitrite-N	8-Hour Composite	2/month
			Nitrite-N	8-Hour Composite	2/Month
			Total Nitrogen	Calculate	2/Month
			Total Phosphorus	8-Hour Composite	2/Month
Outfall 080[h]	C-1 Pond	C-1 Pond (Stormwater)	TSS	Grab	1/Year
			Oil & Grease	Grab	1/Year
			pH	Grab	1/Year
Outfall 171	Radwaste Treatment Bldg	Radwaste Treatment	TSS	Grab	1/Month
			Oil & Grease	Grab	1/Year
Outfall 371	Neutralization Basin	Demineralizer and Raw Water Treatment Building Drain	TSS	Grab	1/Month
			Oil & Grease	Grab	1/Year

Table 6.6-1— Required Water Sampling Protocol

(Page 2 of 2)

Monitoring Station[a]	Monitoring Location[b]	System(s) Sampled[b]	Parameter Sampled	Sample Type[g]	Sampling Frequency

Key:
CBOD5 - Carbonaceous Biochemical Oxygen Demand 5 Day Test
TSS - Total Suspended Solids
TRC - Total Residual Chlorine
Notes:

a. Refer to ER Section 6.1 for a map showing the location of the monitoring stations.

b. Monitoring station locations and systems sampled are specified in the NPDES permit.

c. Includes discharges from internal Monitoring Points.

d. Except for Total Zinc and Total Chromium, there shall be no detectable level of the remaining priority pollutants in this discharge due to the addition of chemicals for cooling tower maintenance.

e. The monthly Discharge Monitoring Reports indicate when chlorine compounds are not in use. Discharge of residual chlorine from any unit is limited to two hours per day.

f. The term Free Available Chlorine (FAC) shall mean the value obtained using the amperometric titration or DPD method described in "Standard Methods for Examination of Water and Wastewater"

g. "Grab sample" means an individual sample of at least 100 milliliters collected in less than 15 minutes. "Composite sample" (except for GC/MS volatile organic analysis) means a combination of individual samples (at least 8 for a 24-hour period) of at least 100 milliliters each obtained at spaced time intervals during the compositing period. The must be flow-proportional; either the volume of each individual sample is proportional to the discharge flow rates or the sampling interval is proportional to the flow rates over the time period used to produce the composite. For GC/MS for volatile organic analysis, a composite sample means at least four aliquots or grab samples collected during the sampling event, not necessarily flow proportional. The samples are combined in the laboratory immediately before analysis, and then one sample is analyzed.

h. Discharge is to Lake Took-A-While. BBNPP will use infiltration beds to manage stormwater, except that a temporary pond will be installed to manage runoff and suspended solids from the concrete batch plant and aggregate material storage areas. This pond will be removed after construction.

i. BBNPP will not have a separate sewage treatment plant or discharge to the river. Sanitary wastewater will be collected at BBNPP and discharged into the municipal sanitary sewer for treatment at the local POTW.

6.7 SUMMARY OF MONITORING PROGRAMS

This section summarizes the monitoring environmental programs described in Chapter 6. The summary is divided into three sections:

- Pre-application monitoring
- Construction and Pre-Operational monitoring
- Operational monitoring

6.7.1 Preapplication Monitoring

Pre-Application monitoring for BBNPP will be fulfilled by the ongoing thermal, radiological, hydrological, meteorological, ecological, and chemical monitoring programs (Section 6.1 through Section 6.6) for the existing SSES Units 1 and 2. This represents over 30 years of monitoring for the site. Pre application ecological monitoring was provided through field studies. Summaries of the pre-application monitoring activities are included in Table 6.7-1 through Table 6.7-7.

6.7.2 Construction and Preoperational Monitoring

The current thermal, radiological, hydrological, meteorological, and chemical monitoring programs will be continued through the construction and preoperational phases of BBNPP. Monitoring required during site preparation, construction and pre-operation will follow guidelines developed by USACE, The Commonwealth of Pennsylvania and the PA Department of Environmental Protection. This monitoring will be performed to minimize impacts to wetlands, ground water and aquatic ecology. Summaries are included in Table 6.7-1 through Table 6.7-7.

6.7.3 Operational Monitoring

While specific operational monitoring requirements and programs for BBNPP have not yet been fully established, they will be similar to and tiered from or added to those monitoring programs described in the previous sections which currently monitor the impacts of SSES Units 1 and 2 on the surrounding environment. Summaries are included in Table 6.7-1 through Table 6.7-7.

The existing and future operational monitoring programs could be modified as a result of future consultations with state regulatory agencies. The need for modifications to established monitoring locations, parameters, collection techniques, or analytical procedures will be assessed prior to and during the course of operation, as is done now for SSES Units 1 and 2.

6.7.4 References

PFBC, 2011. Pennsylvania Fish and Boat Commission, Letter from Christopher A. Urban to Bradley Wise (PPL), Re: Species Impact Review (SIR)- #35087, Bell Bend Nuclear Plant, Salem Township, Luzerne County, Pennsylvania.

Table 6.7-1— Thermal Monitoring

Phase	Summary	Permit
Pre-Application	The existing SSES plume was determined to have limited downstream temperature impact. Spring, fall, and winter studies were completed that measured the temperature and downstream extent of the thermal increase. During these studies the maximum increase above ambient temperatures within the plume ranged from 0.5 to 1.0 °F (0.3 to 0.6 °C) and the plume extent varied from 25 to 130 ft (7.6 to 40 m) downstream from the diffuser pipe. The study indicated that river flow, not discharge temperature increase above ambient, was the most important determinant of the temperature and areal extent of the plume. SSES is not currently required as a condition of its NPDES permit to monitor the plant's cooling water discharge for temperature. Temperature measurements continue to be taken as part of an ongoing water quality monitoring program for the Susquehanna River. Ecology III, Inc. on behalf of SSES Environmental Laboratory records river temperatures on a daily basis at the SSES Environmental Laboratory, and also monitors the cooling water discharge and the river upstream and downstream of the SSES discharge for temperature, among other water quality parameters, on a quarterly basis. Results from the monitoring program are reported on a yearly basis.	NPDES Permit issued for SSES Units 1 and 2
Construction and Pre-Operation	Construction and pre-operational thermal monitoring will be a continuation of the pre-application monitoring program. Construction related discharges will consist mainly of drainage that collects in sumps at the bottom of excavations, which will be pumped to a storm water discharge point, storm water associated with construction activities, and hydrostatic test waters. Therefore, no thermal discharges associated with the BBNPP are expected during the preoperational monitoring program. The PADEP will be notified of pending construction activities and approval of storm water management and erosion/sediment control plans will be obtained in accordance with the NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities.	NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities.
Operation	BBNPP will utilize a closed-cycle, wet cooling system, consisting of two natural draft cooling towers for heat dissipation. BBNPP will also have four smaller Essential Service Water System (ESWS) cooling towers to dissipate heat from safety-related systems. Thermal monitoring will continue during operation of BBNPP to assess water temperature changes associated with effluents from the new plant. The BBNPP thermal plume is predicted to be similar to, and will likely have limited interaction with, the existing SSES thermal plume. The thermal effects of the BBNPP cooling water discharge will be minimized with the proposed installation of closed-cycle cooling systems for the BBNPP CWS and ESWS, by transferring excess heat to the atmosphere via cooling towers. Discharge effects have been studied at SSES and provide a basis for assessing the potential ecological impacts of the BBNPP discharge. The effects of the BBNPP discharge are anticipated to be similar to the SSES discharge. The existing SSES discharge will be used to gauge and evaluate the potential for impacts to result from the BBNPP discharge.	NPDES Permit issued for BBNPP Operation

Table 6.7-2— Radiological Monitoring

Pre-application monitoring for the BBNPP site location will be provided by the existing Radiological Environmental Monitoring Program (REMP) for SSES Units 1 and 2. Annual reporting of these REMP activities, detected radioactivity, trends, and plant related impacts will continue through the construction and operation of BBNPP. Existing sampler locations, sampling frequency, and type of analysis are described further in ER Table 6.2-2 through 6.2-9.

Construction and pre-operational radiological monitoring will be a continuation of the pre-application monitoring program. Changes to the existing SSES Unit 1 and 2 REMP may result from the location of Bell Bend near the SSES units and the inner ring of on-site sample locations. Bell Bend is centered approximately one mile west-southwest from the centerline between SSES Units 1 and 2. This creates the potential need to re-locate existing SSES sample sites if interferences during plant construction of BBNPP are identified. As an example, existing TLD sample site 12S7, 1.1 mile WSW of the SSES units, will need to be moved since it falls within the footprint of the BBNPP main facility structures.

For the operational phase, the BBNPP REMP includes the addition of several new sampling locations in order to meet the sampling criteria of Table 6.2-4 as related to the specific location of the BBNPP facilities and its effluent release points (the main vent stack located directly next to the BBNPP Containment, and the BBNPP liquid effluent discharge line to the Susquehanna River located down stream from the SSES liquid discharge to the river).

Effluent Exposure Pathways	REMP Sampling Media	Frequency	Phase
Direct Radiation	TLDs	Quarterly	All Phases
Airborne Radioiodine and Particulates	a. Radioiodine Canister & b. Particulate Sampler	a. Weekly b. Quarterly	All Phases
Waterborne - Surface	Samples at intake and discharge areas.	Composite sample over one month period	All Phases
Waterborne - Sediment from shoreline	Samples from downstream area with recreational value	Semiannually	All Phases
Waterborne - Ground Water	Samples from 8 on-site locations.	Quarterly	All Phases
Ingestion - Milk	Samples from milking animals in three locations within 3mi (5 km) distance having the highest dose potential. If there are none, then one sample from milking animals in each of three areas between 3 to 8 mi (5 to 8 km) distances where doses are calculated to be greater than 1 mrem/yr. Broad leaf vegetation sampling is performed in lieu of milk sampling if the required minimum number of milk locations is not available in the site area. Milk samples need be collected and analyzed if the milk is commercially available in quantities greater than 130 liters (34.3 gal) per year.	Semimonthly when animals are on pasturel monthly at other times	All Phases
Ingestion - Fish	One sample from each of two recreationally important species in vicinity of plant discharge area.	Sample in season, or semiannually if they are not seasonal	All Phases
Ingestion - Food Products	Samples of 3 different kinds of broad leaf vegetation grown near the Site Boundary at 2 different locations of high predicted annual average ground level D/Q.	At harvest time	All Phases

Table 6.7-3— Hydrological Monitoring

(Page 1 of 2)

Phase	Surface Water	Groundwater
Pre-Application	SSES conducts hydrological monitoring of surface water in accordance with the National Pollutant Discharge Elimination System (NPDES) program. Flows from storm water, plant-associated activities such as equipment blowdown, and various system effluents are measured at different monitoring locations. Flow is monitored daily and reported to the Pennsylvania Department of Environmental Protection (PADEP) monthly. In addition, water withdrawn from the Susquehanna River that is used for plant system cooling is monitored as part of the Susquehanna River Basin Commission (SRBC) Regulation 806.30. Withdrawal is monitored daily and reported to SRBC quarterly and to PADEP annually. Susquehanna River water flow and quality is monitored by Ecology III, Inc. on behalf of the SSES Environmental Laboratory. Water flow is measured daily upstream of the SSES intake structure. Water quality samples are taken on a quarterly basis upstream and downstream of the SSES discharge. Results from the monitoring program are reported on a yearly basis.	As described in Section 2.3.2.2, the SSES site has five groundwater wells that supply water for domestic and miscellaneous process water uses on either a regular or emergency basis. These existing wells require periodic monitoring. Section 2.3.2.2 describes the well locations, permit limits, and withdrawal volumes.
Construction and Pre-Operational	Surface water on site will be monitored as part of the NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities. Conditions of the permit will include compliance with erosion/sediment control and stormwater management plans. Both plans, as part of the permit, will require inspections as well as monitoring and recordkeeping to insure stormwater controls are installed properly and working effectively as the various stages of construction are performed. Susquehanna River surface water will be monitored during construction of the BBNPP intake and discharge structures. Monitoring will be accordance with the U.S. Army Corps Section 404 permit and PADEP 401 Water Quality Certification to ensure compliance with applicable water quality (e.g. turbidity) requirements. Susquehanna River water flow and quality will continue to be monitored upstream and downstream of the existing SSES discharge.	Groundwater monitoring during construction of BBNPP will include, as needed, data from groundwater observation wells installed across the site as part of COL pre-application studies (ER Section 2.3.1.2, Local Hydrogeology). The purpose will be to monitor the potential effects of dewatering on perched water levels. Some of the existing BBNPP area observation wells may be taken out of service prior to construction activities due to earth moving and construction requirements. Prior to construction activities, the observation well monitoring network will be evaluated in order to determine groundwater data gaps and needs created by the abandonment of existing wells. These data needs will be met by the installation of additional observation wells, if required. Additionally, the hydrologic properties and groundwater flow regimes of the shallow water bearing units will be impacted by the proposed earthmoving, regarding, and construction of infrastructure (buildings, parking lots, etc.). Revisions to the observation well network will be implemented to ensure that the resulting changes in the local groundwater regime from construction activities will be identified. No groundwater wells are anticipated for consumptive use during construction.

Table 6.7-3— Hydrological Monitoring

(Page 2 of 2)

Phase	Surface Water	Groundwater
BBNPP Operational	Hydrological monitoring at BBNPP during operation will be designed, as needed, to monitor the potential impacts from plant operation as well as detect unanticipated operational impacts. During BBNPP operation, plant water supply will be from the Susquehanna River at a BBNPP intake structure to be located on the Susquehanna River downstream of the existing SSES intake. Operation of the BBNPP and existing intake structures will require surface water monitoring and reporting. In addition, discharge effluents to the Susquehanna River from BBNPP will require monitoring to satisfy the conditions of the facility's NPDES permit. Non-radioactive liquid effluents that could potentially drain to the Susquehanna River will be limited under a NPDES permit with the PADEP. Chemical monitoring will be performed at the BBNPP discharge outfalls to assess the effectiveness of the effluent treatment systems, as well as to detect changes in water quality associated with plant operations.	NRC has published new regulation 10 CFR 20.1406(c) which requires licensees, to the extent practical, to conduct operations to minimize the introduction of residual radioactivity into the site, including the site's subsurface soil and groundwater. If there are pathways that would allow the contamination to migrate, the licensee may need to monitor the groundwater on-site for contamination based on site-specific conditions. Additionally, this final rule amends 10 CFR 20.1501(a) to require surveys of subsurface residual radioactivity identified at the site. Potable water for domestic and miscellaneous process uses will be supplied by the Pennsylvania American Water Company.

Table 6.7-4— Meteorological Monitoring

Phase	Primary Tower	Backup Tower	Supplemental (Downriver) Tower	Detailed Descriptions
	(197 ft [60 m] and 33 ft [10 m] elevations above ground level)	(30 ft [9 m] elevation above ground level)	(33 ft [10 m] elevation above ground level)	
Pre-Application	Temperature Sensor, Wind Speed and Direction Sensors, Sigma Theta (standard deviation of wind direction), Dew Point Sensor (10 m level only) and Precipitation (base of tower only).	Wind Speed Sensor, Wind Direction Sensor	The meteorological data collected from the supplemental tower is used only to support assessment and restoration efforts in the event there is an accidental release of radioactive material from SSES.	Section 6.4.1.3, Table 6.4-1
Construction and Pre-Operational	Temperature Sensor, Wind Speed and Direction Sensors, Delta temperature), Dew Point Sensor (10 m level only) and Precipitation (base of tower only). The BBNPP construction and pre-operation phase will be based only on the SSES Primary Tower.	Not relied upon for the BBNPP construction and pre-operation phase.	Not relied upon for the BBNPP construction and pre-operation phase.	Section 6.4.1.3, Table 6.4-1
BBNPP Operational	Temperature Sensor, Wind Speed and Direction Sensors, Delta temperature), Dew Point Sensor (10 m level only) and Precipitation (base of tower only). The BBNPP operational phase will be based on the BBNPP primary tower.	Not relied upon for the BBNPP operation phase.	Not relied upon for the BBNPP operation phase.	Section 6.4.2.3, Table 6.4-2

Table 6.7-5— Terrestrial Ecology Monitoring

Phase	Summary	Permits
Pre-application	Field surveys and aerial photography of the proposed site and transmission line system were obtained prior to construction. The resulting map of vegetation types by structure (e.g., old field, upland shrub-scrub, and upland forest) and moisture regime (e.g., emergent wetland) serve as a guide to identify habitats of Federal and State-listed species of animals. Access roads and staging areas within the proposed site were located so as to avoid such habitats to the extent possible. Management plans will be prepared that aim to enhance or at least perpetuate the habitat for target species. Wildlife surveys of mammals, birds, reptiles, amphibians, and terrestrial invertebrates were conducted at the BBNPP site during 2007 and 2008. In addition, plant species were inventoried as part of the wetlands delineation and plant community mapping field studies conducted during the same time period. Table 2.4-1 identifies the important terrestrial specials at the BBNPP OCA. The Northern myotis, peregrine falcon, long dash butterfly, and black dash butterfly have been observed on the site. In addition, recreationally important fauna (white-tailed deer, black bear, wild turkey) and ecologically important fauna (meadow vole, deer mouse, white-footed mouse, scarlet tanager) were observed but are also known to commonly occur in surrounding areas. Plants that are commercially important (black cherry) and ecologically important (red maple, river birch, spicebush, skunk cabbage, Canada goldenrod) were also observed onsite. Similarly, these plant species are very common both locally and regionally. Mitigation requirements for unavoidable impacts to wetlands will be guided by conditions established in permits issued by the U.S. Army Corps of Engineers (USACE) and by the Pennsylvania Department of Environmental Protection (PADEP). Section 1.3 contains a list of the permits required for this project as well as the applicable Federal and State regulations. Monitoring of mitigation success will be defined and executed with reference to these regulations. There are no continuous monitoring programs required for terrestrial ecology and land use in this phase of the project.	US Army Corps of Engineers Pennsylvania Department of Environmental Protection
Construction and Pre Operational	Mitigating for wetlands lost to BBNPP site development will commence concurrently with project construction with mitigation plans developed for USACE and PADEP approval. Any monitoring required during site preparation, construction and pre-operation will follow guidelines developed by the USACE and the Commonwealth of Pennsylvania in accordance with conditions specified in required permits listed in Table 1.3-1. Additional monitoring including program elements, actions and reporting levels will be specified as required by the PA Department of Environmental Protection; Pennsylvania Stormwater Best Management Practices Manual; and Best Management Practices (BMPs) for erosion and sediment control as provided in applicable permits obtained for construction. This plan and program will be implemented during this phase in order to minimize impacts to wetlands, groundwater and aquatic ecology. In accordance with the baseline studies performed during the preapplication timeframe and existing plant experience at the BBNPP site, no additional monitoring programs are proposed for: ♦ Bird collisions with plant structures, transmission lines and towers, and cooling towers; and ♦ Impacts to important species and habitats. These parameters have all been determined to have a small impact on terrestrial ecology. Note that there is a commitment to place flashing lights or reduce lighting on the large cooling towers to minimize bird collisions once these structures are built. There are no continuous monitoring programs required for terrestrial ecology and land use in this phase of the project.	US Army Corps of Engineers Pennsylvania Department of Environmental Protection
Operational	Operation and maintenance impacts of the proposed transmission system are addressed in Section 5.6.1. There are no continuous monitoring programs required for terrestrial ecology and land use in this phase of the project	US Army Corps of Engineers Pennsylvania Department of Environmental Protection

Table 6.7-6— Aquatic Ecology Monitoring

Phase	Summary	Permits
Pre-Application Monitoring	Long-term monitoring of the Susquehanna River has occurred in relation to operation of SSES. This long-term monitoring program included water quality, algae, periphyton, benthic macroinvertebrates, and fish. Currently, the program samples river water quality on a quarterly basis and the fish assemblage is sampled from spring to fall. Other preapplication monitoring has been conducted on the BBNPP site, including sampling for fish in the ponds and Walker Run, and benthic macroinvertebrate collections in Walker Run. An impingement and entrainment study was initiated at the SSES intake structure to provide data on potential impingement and entrainment at the proposed BBNPP water intake structure. Data collection efforts provide a sufficient basis for describing the ecological resources existing on and in the vicinity of the BBNPP site. Two important species of mussels, green floater and yellow lampmussel, were collected from the river. Both species are listed as rare by the Pennsylvania Fish and Boat Commission (PFBC, 2011). Construction activities will likely have minimal impact to mussels in the river. However, surveys may be required prior to intake/discharge structure construction to determine if mussels are present in the vicinity of these areas and, if so, these mussels may need to be relocated. In addition, a brook stickleback found in 2010 at the outlet of the North Branch Canal is considered a candidate species (Normandeau Associates, Inc. 2010). There are no continuous monitoring programs required for aquatic ecology in this phase of the project. The surveys performed to establish baseline conditions were sufficient to document the composition and abundance of aquatic organisms on site and in the river.	General NPDES Operations Permit for SSES Units 1 and 2
Pre-Operation and Construction Monitoring	Construction and preoperational monitoring programs are proposed for resources that may affect aquatic ecology such as thermal, hydrological and chemical monitoring. Aquatic ecology monitoring is proposed during BBNPP site preparation and plant constuction for Walker Run. Walker Run will be monitored after re-routing of two sections of the stream on the BBNPP Site. Construction monitoring mainly consists of drainage from excavations which are pumped to a storm water discharge point. Approval of storm water management and erosion/sediment control plans will be obtained in accordance with the National Pollution Discharge Elimination System (NPDES) permit. The Pennsylvania Department of Environmental Protection will issue a permit to include pollutants typically found at a construction site such as sediments and petroleum hydrocarbons. Storm water discharges from impervious surfaces at the new facility will be controlled and minimized by following guidelines established in Pennsylvania's Stormwater Best Management Practices Manual. The U.S. Army Corps of Engineers 404 Permit may contain requirements for aquatic monitoring as it relates to chemical spills or control of silt discharging into water bodies. Details as to monitoring program elements, sampling procedures and equipment, data analysis, quality control and reporting will be contained in the various permits and approvals required for construction. BBNPP will be designed to meet the requirements of the Clean Water Act to verify there will be minimal adverse environmental impact to fish and other aquatic organisms due to impingement and entrainment for the new intake structure.	NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities Army Corps of Engineers 404 Permit Spill Prevention, Control and Countermeasures Plan
Operation Monitoring	Operational aquatic ecology monitoring may be required as a condition of a new NPDES permit and for compliance with the Clean Water Act 316(b) Rule. Aquatic biological monitoring may be required in the Susquehanna River, Walker Run, and in several unnamed tributaries after completion of construction and after initiation of plant operation. This monitoring would most likely entail additional aquatic collections at the same locations as the preapplication monitoring. The Clean Water Act Section 316(b) requires that the location, design, construction and capacity of a cooling water intake structure reflect the best technology available (BTA) for minimizing adverse environmental impacts including impingement and entrainment.	NPDES issued for BBNPP Operations

Table 6.7-7— Chemical Monitoring

	Summary	Permits
Pre-Application	Information on past studies performed to determine the characteristics of surface water are discussed in ER Section 2.3.3. SSES has been collecting water samples from the Susquehanna River since 1968. A baseline sampling program, that covered the four seasons of 2008, was conducted so potential water quality issues due to construction and operation of BBNPP can be assessed. An overview of analyses results is summarized in ER Section 6.6.1. Groundwater observation wells were installed across the BBNPP site. The wells were established to determine site groundwater levels, subsurface flow directions, and hydraulic gradients beneath the BBNPP site. To evaluate vertical hydraulic gradients, several observation wells were installed as well clusters. Well Clusters are a series of wells placed at the same location, with each well monitoring a distinct water bearing interval. Well water quality data are described in Section 2.3.3.2.	Existing NPDES permit for SSES Units 1 and 2
Construction and Pre Operational	Chemical monitoring during construction will aid in controlling adverse impacts to the Susquehanna River and Walker Run and will provide additional water quality data that can be used to measure water-quality changes from operation of the new unit. Construction and pre-operational chemical monitoring will be performed during site preparation and plant construction. In accordance with the existing NPDES permit, the Pennsylvania Department of Environmental Protection (DEP) will be notified regarding the proposed plant expansion. Sample collection, laboratory analyses, data evaluation and reporting practices will comply with permit modifications. Groundwater monitoring (water level observation) of the BBNPP area is currently being implemented through the use of the groundwater observation wells. Some of the existing BBNPP area observation wells will be taken out-of-service prior to construction activities due to anticipated earth moving and construction requirements. Revisions to the observation well network will be implemented to ensure that the resulting changes in the local groundwater regime from construction activities will be identified. No chemical monitoring is planned at the time for groundwater.	NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities
Operation	Operational monitoring will be in accordance with the NPDES permit for the new plant. Operational monitoring elements will be developed in consultation with the Pennsylvania DEP. Sanitary wastewater from BBNPP will not be treated in an on-site wastewater treatment plant, but will be collected in a sanitary wastewater collection system that will direct sanitary wastes to the municipal sewer system and local POTW operated by the Berwick Area Joint Sewer Authority. No effluent discharge to the river or associated chemical monitoring for treated sanitary wastewater streams is envisioned for BBNPP. However, chemical monitoring of sewage from BBNPP into the municipal sanitary system will be done in accordance with local ordinances and permit requirements. The anticipated discharge limits for sanitary wastewater into the municipal sewer system is provided on Table 3.6-4. The BBNPP Intake Structure will house debris screens, screen wash pumps, make-up water pumps and related equipment so that a new outfall for intake screen backwash will be likely. Chemical monitoring at the new outfall will be limited by the new NPDES permit to certain chemical parameters to ensure that the differences between the intake water and discharge water are within the limits specified in the permit. CWS cooling tower blowdown will be directed into the Combined Waste Water Retention Pond and held for a period of time to reduce the concentration of solids and chlorine in the water. Essential Service Water System (ESWS) cooling tower blowdown and other wastewater will also collect in the Combined Waste Water Retention Pond. Piping will transfer retention basin wastewater by gravity to the new Discharge Structure, which will provide a flow path for the discharge of water into the river via a submerged outfall. Chemical monitoring will be performed at the new outfall to assess the effectiveness of retention methods and effluent treatment systems, as well as to detect changes in water quality associated with new plant operations. Chemical monitoring will also be performed at storm water runoff outfalls and at internal monitoring points. Effluent water chemistry will meet all applicable federal and state environmental regulatory requirements. There are currently no plans to monitor groundwater for chemicals during the operational phase of BBNPP.	NPDES issued for BBNPP Operations