2.4 HYDROLOGIC ENGINEERING

This section of the U.S. EPR FSAR is incorporated by reference with the following departures and supplements.

2.4.1 Hydrologic Description

The U.S. EPR FSAR includes the following COL Item for Section 2.4.1:

> A COL applicant that references the U.S. EPR design certification will provide a site-specific description of the hydrologic characteristics of the plant site.

This COL Item is addressed as follows:

{This section identifies the interface of BBNPP with the hydrosphere. It also identifies the hydrologic causal mechanisms that will establish the design basis with respect to floods and water supply requirements. Information on surface water and groundwater uses that may be affected by plant operation is also included in this section.

References to elevation values in this section are based on the North American Vertical Datum of 1988 (NAVD 88), unless stated otherwise.

Sections 2.4.1.1 through 2.4.1.3 are added as a supplement to the U.S. EPR FSAR.

2.4.1.1 Site and Facilities

2.4.1.1.1 BBNPP Site Description

The proposed BBNPP site is located in Salem Township, Luzerne County, Pennsylvania (PA), on the west side of the North Branch of the Susquehanna River (NBSR) (within the Middle Susquehanna Sub-basin), as shown on Figure 2.4-1. The proposed BBNPP site is situated in the Walker Run watershed, which is has a drainage area of 4.10 mi^2 (10.6 km^2). The site is also adjacent to Susquehanna Steam Electric Station (SSES) Units 1 and 2 in an area of open deciduous woodlands, interspersed with cultivated fields and orchards. The site sits on a relatively flat upland area, 219 ft (66.8 m) above the nominal Susquehanna River level, as shown in Figure 2.4-2. The BBNPP site is approximately:

- 1.6 mi (2.6 km) north-northeast of the confluence of Walker Run and the NBSR,
- 22 mi (35 km) downstream of Wilkes-Barre, PA,
- 5 mi (8 km) upstream of Berwick, PA, and
- 70 mi (113 km) north-northeast of Harrisburg, PA.

The BBNPP site is covered by glacial deposits and was subjected to both glacial and periglacial events during the Quaternary Epoch. Underneath this glacial overburden lies Devonian bedrock. Erosion and down cutting from the Susquehanna River and its tributary streams have dissected the overburden, leaving many exposed bedrock outcrops throughout the site area. Topographic relief within a 5 mi (8 km) radius around the BBNNP site varies from just under 500 ft (152 m) mean sea level (msl), on the floodplain of the NBSR, to a maximum of approximately 1,560 ft (476 m) msl. Thus, the topographic relief within 5-mi (8 km) radius is approximately 1,060 ft (323 m).

The NBSR flows from north to south past the SSES and makes a broad, 90 degree angle turn (i.e., Bell Bend) to the west before reaching Berwick, PA. The proposed BBNPP Intake Structure

is approximately 22 miles (35 km) downstream of Wilkes-Barre, PA and 5 miles (8 km) upstream of Berwick, PA. The site of the BBNPP Intake Structure is the reference for the BBNPP site with respect to distances along the NBSR. The NBSR ultimately receives all surface water that drains from the BBNNP site.

An east-west trending ridge lies just to the north of the BBNPP site and Beach Grove Road. Small streams drain from the ridge top and flow southward toward the NBSR. Walker Run is a relatively small stream but is the largest in the immediate vicinity of the BBNPP site. Walker Run flows southward along the western side of the BBNPP, and has a gradient drop from upstream (referred in Table 2.4-1 as Upper Walker Run) to downstream (referred as Lower Walker Run in Table 2.4-1) of almost 290 ft (88 m) over a distance of approximately 4 mi (6 km). An unnamed tributary to Walker Run shown in Figure 2.4-3 as Unnamed Tributary No. 1 flows along the eastern and southern site boundaries and enters Walker Run on the southwest side of the site. A second unnamed tributary shown in Figure 2.4-3 as Unnamed Tributary No. 2 flows southeastward within the BBNPP site and empties into Unnamed Tributary No. 1. The Walker Run watershed (Table 2.4-3) has a drainage area of 4.10 mi^2 (10.60 km^2). Based on the runoff of these streams, the Walker Run watershed can be divided into three sub-basins (A1, A2, and A3) as illustrated in Figure 2.4-3.

SSES is located approximately 1 mi (1.6 km) from the BBNPP Nuclear Island, on the west bank of the NBSR on a relatively flat plain of gently rolling hills. The grading of the SSES was designed to direct storm water away from the safety related buildings by a system of culverts, surface drainage channels, and underground storm drains towards the NBSR (PPL, 1999b). Furthermore, a topographic divide separates the runoff from the existing SSES site and the BBNPP site. Confers Lane acts as the drainage divide for the BBNPP site and the Walker Run Watershed, all illustrated in Figure 2.4-3 with all drainage ditches to the west direction flow towards Stormwater Pond #1 and all ditches to the east directing flow towards Stormwater Pond #2. Runoff from the BBNPP is directed towards stormwater ponds located on the east and west side of the plant and would not impact the SSES site.

Figure 2.4-4 illustrates the BBNPP post construction site drainage and grading. The post-construction grading of the BBNPP site directs runoff from plant north to plant south with drainage ditches collecting stormwater and diverting flow to Stormwater Pond No. 1 on the far western side of the site and Stormwater Pond No. 2, located on the southeast side of SSES plant and east of the BBNPP. In Figure 2.4-5, red arrows indicate the direction of sub-basin runoff that eventually drains into Stormwater Pond No. 1, while the green arrows show sub-basin runoff that is directed towards Stormwater Pond No. 2. The two planned stormwater Retention Ponds, located on the west side of the nuclear island and southeastern side of the existing SSES plant will be unlined basins with a simple earth-fill berms and will include piping systems that direct discharges to the adjacent water courses. Stormwater Pond #1 has a contributing area of 310 acres (125 hectares) with a runoff volume of 126.92 acre-ft (163,741 m^3). Evaluation of site drainage is presented in Section 2.4.2.

2.4.1.1.2 BBNPP Facilities

The BBNPP will be a U.S. Evolutionary Power Reactor (EPR). The U.S. EPR is a pressurized water reactor design. The BBNPP design is a four-loop, pressurized water reactor, with a reactor coolant system composed of a reactor pressure vessel that contains the fuel assemblies, a pressurizer including ancillary systems to maintain system pressure, one reactor coolant pump per loop, one steam generator per loop, associated piping, and related control systems and protection systems. The BBNPP Reactor Auxiliary Building and Turbine Building will be oriented side by side, with the Reactor Building oriented towards the east.

The Reactor Building is surrounded by the Fuel Building, four Safeguard Buildings, two Emergency Diesel Generator Buildings, the Nuclear Auxiliary Building, the Radioactive Waste Processing Building and the Access Building. Figure 2.4-5 shows the layout for BBNPP, depicting main features: property boundary, water intake, discharge pipelines, and switchyard.

The BBNPP Reactor Building is a cylindrical reinforced concrete vertical structure, capped with a reinforced \ enclosed spherical dome ceiling. The Reactor Building is approximately 186 ft (56.7 m) in diameter with an overall height of about 240 ft (73.2 m). The plant grade for BBNPP will be at an elevation of approximately 719 ft (219.2 m). With the bottom of the Reactor Building foundation 35 ft (11 m) below grade, the new Reactor Building will rise 205 ft (62.5 m) above grade. The top of the Reactor Building will be at an elevation of approximately 924 ft (281.6 m).

Safety-related facilities for the BBNPP are located at the grade elevation of 719 ft (219.2 m) msl. The safety-related structures in the BBNPP power block area include the following: reactor complex (consisting of the reactor, fuel, and safeguards buildings), emergency diesel generator buildings, and the ESWS cooling towers.

The BBNPP will have a closed-loop cooling system. The BBNPP Cooling Towers will be round concrete structures with a diameter of approximately 350 ft (107 m) at the base and an approximate height of 475 ft (145 m). Other BBNPP buildings will be concrete or steel with metal siding.

The BBNPP Intake Structure will be located on the NBSR downstream from the existing SSES Units 1 and 2 intake structure as shown in Figure 2.4-10. The makeup water for the ESWS cooling towers will normally be supplied from the non-safety-related Raw Water Supply System, located in the BBNPP Intake Structure. It withdraws water from the NBSR. ESWS cooling tower basins will also serve as the Ultimate Heat Sink (UHS) cooling water storage volumes for use during design basis accidents (DBA). ESWS cooling tower basin inventory will provide cooling water for safety-related heat removal for the first 72 hours during DBA conditions. The ESWS makeup water after the first 72 hours under DBA conditions will be supplied directly from the ESWEMS Retention Pond.

2.4.1.1.3 BBNPP Flood Design Basis

The design basis flood elevation for the BBNPP site was determined by considering a number of different flooding possibilities. These include the Probable Maximum Flood (PMF) on streams and rivers, potential dam failures, probable maximum surge and seiche flooding, probable maximum tsunami, and ice effect flooding. Each of these flooding scenarios was investigated in conjunction with other flooding and meteorological events, such as wind generated waves, in accordance with guidelines presented in ANSI/ANS 2.8-1992 (ANS, 1992). Adequate drainage capacity will be provided to prevent flooding of safety-related facilities and to convey storm water runoff from the roofs and buildings away from the plant site area. Detailed discussions on each of these flooding events and how they were estimated are found in Section 2.4.2 through Section 2.4.7.

The most significant flood event on record is the 1972 flood which resulted from Hurricane Agnes and occurred throughout the Mid-Atlantic region of the United States. On June 25, 1972, a river crest of 517.35 ft (157.7 m) msl was observed near the SSES Units 1 and 2 intake structure (Ecology III, 1986). Discussion of peak stream flow is presented in Section 2.4.1.2.1.7.

The plant grade elevation will be 719 ft (219.2 m) msl (Section 2.5.4). The elevation of the Susquehanna River 100-year (yr) floodplain is approximately 513 ft (156 m) msl (FEMA, 2008). The nominal water level of the Susquehanna River is 500 ft (152 m) msl. Thus, the BBNPP site is approximately 206 ft (62.8 m) above the Susquehanna River 100-yr floodplain and 219 ft (66.8 m) above the nominal Susquehanna River level of 500 ft (152 m) msl. The PMF evaluation for SSES Units 1 and 2 (see SSES FSAR) showed that the PMF elevation on the Susquehanna River would reach an elevation of 548 ft (167 m) msl. The BBNPP site elevation is 719 ft (219.2 m) msl, and after assessing the existing PMF evaluation, it is not possible for the PMF to increase 171 ft (52.1 m) to cause any flooding at the BBNPP site. Thus flooding from the Susquehanna River would have no impact on the BBNPP site.

The maximum water level due to local intense precipitation or the local Probable Maximum Precipitation (PMP), at the BBNPP site is estimated and discussed in Section 2.4.2. The maximum water level in the BBNPP power block area due to local PMP is approximately 671 ft (204.5 m) msl which is the design basis flood elevation for safety-related facilities in the power block area, the ESWEMS Pumphouse and ESWEMS Retention Pond. The safety-related buildings are located above this elevation. The top of the dike for the ESWEMS Retention Pond is also located above this elevation. Since the plant facilities are located on the crest of a plateau that has a well-developed natural drainage system and because final grading of the site area is integrated with this natural system, potential local flooding, even from extremely heavy rainfall, will be controlled by the plant site drainage system as discussed in Section 2.4.2.

Walker Run, was analyzed for the PMF due to its proximity to the project site. Walker Run flows towards the south and converges with the Susquehanna River at approximately river mile 164 (264 km). Walker Run collects runoff from the site and also areas north, west, and southwest of the plant site. The total drainage area of the Walker Run watershed is approximately 4.10 mi^2 (10.60 km^2). The maximum water level in the area of the proposed BBNPP site during the PMF event from Walker Run is 670.96 ft (204.51 m) msl at Cross Section 12,715 (Section 2.4.3) which is approximately 48 ft (14.6 m) below the plant grade elevation.

The BBNPP site lies approximately 107 mi (172 km) inland from the Chesapeake Bay, which is downstream from the BBNPP site. Because the plant site is more than 100 mi (161 km) from the nearest coast, the elevation of the plant site is 206 ft (62.8 m) above the 100-yr floodplain of the Susquehanna River, and there are no major water bodies adjacent to the BBNPP site, potential tsunami flooding and storm surge and seiches flooding are not applicable considerations for this site and are not factors which could cause flooding. Further discussion is presented on FSAR Section 2.4.4 and Section 2.4.6.

2.4.1.2 Hydrosphere

2.4.1.2.1 Hydrological Characteristics

An east-west trending ridge runs along the north side of the BBNPP site. The ground surface is highest in elevation along the ridge top (800 ft (244 m) msl); surface elevation decreases toward the NBSR, to the east and south. Surface drainage from the ridge, the BBNPP and SSES sites, and from adjacent farmlands, drain via small creeks southward and eastward toward the NBSR. These creeks include two named creeks (Walker Run and Salem Creek) and several small unnamed creeks.

From the ridge top to the Susquehanna River, the creeks drop considerably in elevation (approximately 800 ft to 517 ft (244 m to 158 m) msl). Table 2.4-1 shows the approximate lengths and approximate gradients of stream extent located near the BBNNP Site.

2.4.1.2.1.1 Susquehanna River

The Susquehanna River is approximately 444 mi (715 km) in length. The Susquehanna River has its headwaters at Cooperstown, Otsego County, located in upstate New York (NY). The Susquehanna River profile is shown in Figure 2.4-6.

The Susquehanna River Basin has a delineated area of 27,510 mi^2 (71,251 km^2) (SRBC, 2008b). The location and extent of the Susquehanna River Basin and its six (6) sub-basins are shown in Figure 2.4-1. More than three-quarters of the entire Susquehanna River Basin lies in Pennsylvania (PADEP, 2008e).

In New York, several headwater tributaries discharge into the Susquehanna River including the Unadilla, the Chenango, the Otselic and the Tioughnoiga rivers (PADEP, 2008g). To the west, the Chemung River is formed by Cohocton, Canisteo, Cowanesque and Tioga rivers. The Chemung River joins the Susquehanna in Bradford County, Pennsylvania. In total, 6,275 mi^2 (16,252 km^2) of New York drain to the Susquehanna River (PADEP, 2008g).

In Pennsylvania, the Susquehanna River flows south and east before turning southwest above Wilkes-Barre. The branch of the Susquehanna River upstream from Sunbury is unofficially referred to as the NBSR. From Sunbury, the river flows south towards Harrisburg, being joined north of Harrisburg by another large tributary, the Juniata. Beyond Harrisburg, the Susquehanna River again turns southeast forming the boundary between York and Lancaster counties before entering Maryland (PADEP, 2008g). At its mouth, it empties into the northern end of the Chesapeake Bay at Harve de Grace, Hartford County, Maryland (MD), at an elevation of 0 ft (0 m) msl.

The BBNPP site is located within the Middle Susquehanna River sub-basin. The Middle Susquehanna River Sub-Basin covers an area of 3,771 mi^2 (9,767 km^2).

2.4.1.2.1.2 North Branch of the Susquehanna River (NBSR)

The branch of the Susquehanna River upstream from Sunbury is unofficially referred to as the NBSR. The NBSR flows southeast through high, flat-topped plateaus separated by steep-sided valleys. As it flows downstream the NBSR is joined by the Lackawanna River where it turns southwest and flows towards Sunbury, PA (SRBC, 2008a).

The NBSR flows through 8 counties in Pennsylvania, while receiving drainage from areas within 14 counties in Pennsylvania.

The NBSR is utilized to supply makeup to the Circulating Water System and Raw Water Supply System. It does not serve as the ultimate heat sink. The NBSR is not utilized for any safety-related purposes. Low water levels in the NBSR are investigated, along with legal consumptive use restrictions.

2.4.1.2.1.3 Walker Run & Unnamed Tributary No. 1

Walker Run flows towards the south until it converges with the NBSR, at approximately River Mile 164 (264 km). Walker Run collects runoff from the area surrounding the BBNNP site and areas north, west, and southwest of the BBNPP site. The drainage area for the Walker Run watershed is approximately 4.10 mi^2 (10.60 km^2) (Figure 2.4-3). Walker Run has a difference in elevation of approximately 450 ft (137 m) over its entire length with an overall slope of 1.95% (Table 2.4-1).

Unnamed Tributary No. 1 (also known as the East Branch of Walker Run) flows along the eastern and southern site boundaries of BBNPP and discharges into Walker Run on the southwest side of the site. The Unnamed Tributary No. 1 encompasses a drainage area of about 0.68 mi^2 (1.76 km^2) and an approximate length of 2 mi (3.2 km) with an overall slope of 3.06% (Table 2.4-1).

2.4.1.2.1.4 Unnamed Tributary No.2

A second unnamed tributary flows southeastward within the BBNPP site and empties into Unnamed Tributary No. 1. Its drainage area is part of the Walker Run watershed (see Section 2.4.3).

2.4.1.2.1.5 Unnamed Tributary No.3

A third unnamed tributary flows southeastward below the BBNPP site and empties into the NBSR about 0.8 mi (1.3 km) upstream from the Walker Run confluence. Its drainage area is not part of the Walker Run watershed (see Section 2.4.3).

2.4.1.2.1.6 Gauging Stations

There is no gauging station within the Walker Run watershed. The NBSR gauging stations in Pennsylvania that gauge both surface water elevation and water flow and are located close to the BBNPP site, include the United States Geological Survey (USGS) gauging stations at Wilkes-Barre, PA (Station No. 01536500), and Danville, PA (Station No. 01540500). These stations are located upstream, and downstream of the proposed BBNPP Intake Structure, respectively (Figure 2.4-7).

The Wilkes-Barre gauging station is located approximately 24 mi (38.6 km) upstream from the BBNPP site. The drainage area of the NBSR at Wilkes-Barre is approximately 9,960 mi^2 (25,796 km^2) (USGS, 2008b), and the average annual flow calculated from the mean daily streamflow data recorded at the USGS gauging station for a 108-yr period (1899-2006) is 13,641 cfs (386 m^3/s) (USGS, 2008i). At Wilkes-Barre, the maximum streamflow was recorded on June 24th, 1972 and noted as 345,000 cfs (9,769 m^3/s) and the daily minimum streamflow noted was 532 cfs (15.1 m^3/s), recorded on September 27th, 1964 (USGS, 2008i). The maximum recorded flood level was 40.91 ft (12.47 m), recorded on June 24, 1972 (USGS, 2008i). Temperature data has not been recorded for this station.

Peak annual streamflow recorded at the Wilkes-Barre gauging station is presented in Table 2.4-2 (USGS, 2008b). Monthly streamflows and mean, maximum and minimum daily streamflows at Wilkes-Barre, PA, are presented in Table 2.4-3 through Table 2.4-6, respectively (USGS, 2008i). Mean streamflow discharges at Wilkes-Barre are also presented in Figure 2.4-8 along with maximum and minimum monthly average values.

The USGS gauge at Danville, PA (Station No. 01540500) has been in continuous operation since April 1905 (USGS, 2008a). The Danville gauging station is located approximately 28 mi (45 km) downstream from the BBNPP Site. The drainage area of the NBSR at Danville is approximately 11,200 mi^2 (29,008 km^2) (USGS, 2008a). The average annual flow calculated from the mean daily data recorded during the 102-year period (1905-2006) is 15,483 cfs (438 m^3/s) (USGS, 2008a). At Danville, the maximum streamflow at this station was 363,000 cfs (10,279 m^3/s) (USGS, 2008h), which was recorded on June 25, 1972, during Hurricane Agnes. The maximum flood level, 32.16 ft (9.8 m), was recorded on the same date (June 25, 1972) and the daily minimum streamflow noted was 558 cfs (15.8 m^3/s), recorded on September 24th, 25th and 27th in 1964 (USGS, 2008h).

Peak annual streamflow recorded at the Danville gauging station is presented in Table 2.4-7 (USGS, 2008a). Monthly streamflows and mean, maximum and minimum daily streamflows at Danville, PA, are presented in Table 2.4-8 through Table 2.4-11 (USGS, 2008h), respectively. Mean streamflow discharges at Danville are also presented in Figure 2.4-9 along with maximum and minimum monthly values.

2.4.1.2.1.7 Periods of Peak Streamflow

Hurricane Agnes caused the maximum flood on record within the area that was defined previously as the North Branch of the Susquehanna River (NBSR). The critical factor affecting the record flooding was the near continuous nature of rainfall during the hurricane. From June 21-25, an average of 6-10 inches (15-25 cm) of rain fell over the Mid-Atlantic region (NOAA, 2008). These high rainfalls produced record flooding on the Susquehanna River, equaling or exceeding flood recurrence intervals of 100 years along portions of the Susquehanna River (NOAA, 2008). Hurricane Agnes generated peak stream flows of 345,000 cfs (9,769 m^3/s) at Wilkes-Barre on June 24th and 363,000 cfs (10,279 m^3/s) at Danville on June 25th (USGS, 2008a)(USGS, 2008b).

On June 25, 1972 a river crest of 517.35 ft (157.7 m) msl was observed near the SSES intake structure (Ecology III, 1886). The BBNPP plant grade will be at approximately elevation 719 ft (219.2 m) msl, which is approximately 202 ft (61.6 m) above the recorded peak flood elevation.

2.4.1.2.1.8 Bathymetry of the North Branch of the Susquehanna River (NBSR)

The bathymetry of the NBSR near the BBNPP intake is illustrated in Figure 2.4-10. Streambed elevations in the vicinity of the BBNPP Intake Structure range from 473 to 484 ft (144 to 148 m) msl). The BBNPP Intake Structure draws water from the NBSR from approximately 1 ft (0.3 m) below the design basis low water level elevation 484 ft (148 m) msl. As a result, the bathymetry of the NBSR will not be affected by the intake system.

2.4.1.2.1.9 Floodplain of the North Branch of the Susquehanna River (NBSR)

The elevation of the NBSR, 100-yr floodplain is approximately 513 ft (156 m) msl (FEMA, 2008) and the floodplain illustrated in Figure 2.4-13 and Figure 2.4-14, is approximately 0.44 mi (0.71 km) wide in this area. The FEMA Flood Insurance Rate Map in the vicinity of the BBNPP site (Figure 2.4-11 through Figure 2.4-14) shows that the predicted Susquehanna River flooding that will occur during a 500-yr recurrence interval extends up to elevation 514 ft (157 m) msl near the BBNPP Intake Structure. Figure 2.4-11 through Figure 2.4-14 show the 100-yr and 500-yr Susquehanna River flooding impacts in the vicinity of the BBNPP. The BBNPP plant grade elevation will be 719 ft (219.2 m) msl, thus the BBNPP site is approximately 206 ft (62.8 m) above the NBSR 100-yr floodplain and 219 ft (66.8 m) above the nominal Susquehanna River level.

Figure 2.4-11 and Figure 2.4-12 illustrates the predicted 100-yr and 500-yr flood levels in the Walker Run watershed and the Susquehanna River. The 100-yr and 500-yr flood on Walker Run brings water levels to elevations 658 ft (200.6 m) and 659 ft (201 m) msl, respectively. The BBNPP plant grade will be at elevation 719 ft (219.2 m) msl. Thus, flooding from a 100-yr or a 500-yr storm should be at least 60 or 61 ft (18.3 or 18.6 m) below the plant grade.

2.4.1.2.2 Dams and Reservoirs

A total of 492 water control structures are located on tributaries that drain into the Susquehanna River upstream of the site (Figure 2.4-15). Information obtained for 8 significant upstream multipurpose dams with flood control storage capacity located on tributaries that drain directly into the Susquehanna River, including pool elevations and storage volumes, is

presented in Table 2.4-12 (USGS, 2002; USGS, 2008c; USGS, 2008d; USGS, 2008e; USGS, 2008f; USGS, 2008g; PPL, 1999a)

Out of these 8 dams, Aylesworth Creek Dam and Stillwater Dam are the only water control structures located within the Middle Susquehanna Sub-basin. Aylesworth Creek Dam and Stillwater Dam are located about 50 mi (80 km) and 65 mi (105 km) upstream from the BBNPP Intake Structure, respectively. The flood control storage volume for Aylesworth Creek Dam is approximately 3.32E10 ft^3 (9.40E8 m^3) and the Stillwater Dam has a flood control storage volume of approximately 5.23E8 ft^3 (1.48E7 m^3) (USGS, 2008c; USGS,2008d).

Other significant upstream multipurpose dams with flood control storage capacity located on tributaries of the Susquehanna River are in different sub-basins. The Cowanesque, Hammond and Tioga Dams are located within the Pennsylvania portion of the Chemung Sub-basin; the Almond Dam is located in the New York portion of the Chemung Sub-basin; and all other significant dams are located in New York in the Upper Susquehanna Sub-basin (Figure 2.4-15). Among all the dams in the Chemung Sub-basin, the Cowanesque Dam is closest to the site with an approximate distance of 164 mi (264 km) upstream. Whitney Point Dam is the closest from the Upper Susquehanna Sub-basin with an approximate distance of 176 mi (283 km) upstream from the BBNPP Intake Structure.

Figure 2.4-15 also shows dams located downstream from BBNPP. The Adam T. Bower Memorial Dam is the world's largest inflatable dam and the first dam downstream from the site of the BBNPP Intake Structure. The Adam T. Bower Memorial Dam was completed in 1970 and creates a 3,060-acre (1238-ha) lake during summer months (DCNR, 2008). The dam and lake are part of the Shikellamy State Park in Snyder County, PA.

2.4.1.2.3 Surface Water Users

In the Susquehanna River Basin, water use is regulated by the Susquehanna River Basin Commission (SRBC). Water use in Pennsylvania, is registered with and reported to the Pennsylvania Department of Environmental Protection (PADEP).

The Water Resources Planning Act (Act 220) requires the PADEP to conduct a statewide water withdrawal and use registration and reporting program (PADEP, 2008a). Each public water supply agency, each hydropower facility (irrespective of the amount of withdrawal), and each person who withdraws or uses more than 10,000 gallons of water per day (gpd) (37,854 liters per day (lpd)) over any 30-day period, must register their withdrawal or withdrawal use.

The SRBC, was created by a compact between the Federal government and the three states which the Susquehanna River Basin lies. Operations subject to the SRBC are those that exceed the consumption rate of 20,000 gpd (75,708 lpd) over a 30-day average (SRBC, 2007) or that exceed an average withdrawal (groundwater, surface water or combined) of 100,000 gpd (378,541 lpd) over a 30-day period.. Consumption rates less than the 20,000 gpd (75,708 lpd) fall under the Water Resources Planning Act (Act 220).

The Middle Susquehanna sub-basin (Figure 2.4-1) is 3,755 mi^2 (9,725 km^2) in area and has a population representing 16% of the total Susquehanna River Basin. Total water consumption (surface water and groundwater) in the sub-basin is: 40.7% for power generation, 37.6% for municipal use, 15.2% for industrial use, 4.1% for agriculture, and 2.4% for domestic use (SRBC, 2008a).

Surface water use data for Luzerne County were obtained from the PADEP (PADEP, 2008f). Figure 2.4-16 illustrates the registered surface water withdrawal locations reported by major water users in Luzerne County (PADEP, 2008a). This figure does not include public water supplies, because the state does not publish the locations of public water supplies for security reasons. Table 2.4-13 identifies active surface water users (not including the public water supplies) within Luzerne County (PADEP, 2008f); these withdrawals are mainly used for irrigation and industrial purposes. Figure 2.4-17 shows the locations of the surface water intakes portrayed in Figure 2.4-16, but includes only those which are within a 5 mi (8 km) radius of the BBNPP site. SSES Units 1 and 2 are the largest water user in the vicinity the of BBNPP. Presently, Walker Run is not among the listed sources of water for agricultural, domestic, or industrial purposes.

Water usage at SSES Units 1 and 2 is regulated by SRBC under Docket No. 19950301-1. SSES Unit 1 and 2 reported an average withdrawal of 58.3 million gallons per day (MGD) (220 million lpd). The maximum allowable withdrawal rate is 66 MGD (250 million lpd). The peak daily consumptive water allowed is 48 MGD (182 million lpd).

Table 2.4-14 shows the consumptive water use pattern by SSES Units 1 and 2 from 2001 to 2006 (PPL, 2008). During that period, the highest total monthly consumptive use was 1,175 million gallons per month (4,448 million liters per month) in July 2002, and an annual average consumptive use (from 2001 to 2006) of 909.5 million gallons per month (3,443 million liters per month).

Between 1961 and 2002, the Susquehanna River had an annual mean flow of 14,586 cfs (413 m^3/s) (NRC, 2006) (USEPA, 2008a). The SRBC works with local, state, and federal agencies to augment and protect in stream water needs during times of low flow. As part of this low flow management, activities such as the low flow augmentation for the existing SSES Units 1 and 2 were achieved by an agreement between Pennsylvania Power and Light Company (PPL) and the U.S. Army Corps of Engineers (USACE). USACE manages the Cowanesque Reservoir located in Lawrenceville, PA, to provide water supply storage and releases during low flow periods to replace the cunsumptive water use by SSES Units 1 and 2. In addition, the SRBC dictates that if the surface-water withdrawal impact is minimal in comparison to the natural or continuously augmented flows of a stream or river, no further mitigation is necessary (SRBC, 2002).

Currently, the SRBC is studying existing reservoirs to identify additional water storage capacity that might be released during low flow in the Susquehanna River.

Major public water Suppliers within Luzerne and Columbia Counties are presented in Table 2.4-15 (USEPA, 2008b) (PADEP, 2008d). Water sources for Luzerne and Columbia counties include lakes, rivers, reservoirs, and their tributaries, but does not include water withdrawal directly from the Susquehanna River.

Surface and wastewater discharges at SSES Units 1 and 2 are regulated through the National Pollutant Discharge Elimination System (NPDES). In Pennsylvania, these are issued and enforced by the PADEP Bureau of Water Management. The SSES Units 1 and 2 current NPDES permit (Permit No. PA0047325) was effective beginning on September 1, 2005, and is valid through August 31, 2010. Table 2.4-16 shows the average and maximum monthly SSES cooling tower blowdown discharge rates for 2000 through 2007 (PPL, 2008). The highest recorded monthly maximum discharge (17.78 MGD, or 67 million lpd) occurred in 2003.

Figure 2.4-18 illustrates water pollution control facilities locations within a 5-mile (8-km) radius from BBNPP and Figure 2.4-19 shows their locations within Luzerne County. Table 2.4-17 lists the water pollution control facilities located within Luzerne County. PADEP has recorded 159 outfalls in Luzerne County and 1,723 outfalls within a 50-mile (80-km) radius of the BBNPP site (PADEP, 2008c). Since each individual permit may have more than one outfall, the number of actual permits is less than the number of outfalls quoted above.

2.4.1.2.4 Groundwater Characteristics

The local and regional groundwater characteristics are described in Section 2.4.12. A detailed list of current groundwater users, groundwater well locations, and the withdrawal rates in the vicinity of the BBNPP site is presented in Section 2.4.12.2.

The water source to meet the water demand requirements during operation of the BBNPP is the Susquehanna River. All cooling makeup water will be obtained from the Susquehanna River. All water for drinking and several other smaller uses will be obtained from a public water supply (Luzerne County). Construction water needs are expected to be satisfied by appropriating water from the nearby township. Additional information regarding the use of groundwater at the BBNPP site is presented in Section 2.4.12.1.4.

2.4.1.3 References

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2.4.2 Floods

The U.S. EPR FSAR includes the following COL Item in Section 2.4.2:

> A COL applicant that references the U.S. EPR design certification will identify site-specific information related to flood history, flood design considerations, and effects of local intense precipitation.

This COL Item is addressed as follows:

{This section identifies historical flooding at the site and in the region of the site. It summarizes and identifies individual flood types and combinations of flood producing phenomena in establishing the flood design basis for safety-related plant features. This section also covers the potential effects of local intense precipitation. Although topical information is discussed in

Section 2.4.3 through Section 2.4.7 and Section 2.4.9, the types of events considered and the controlling event are reviewed in this section.

References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD 29), unless stated otherwise.

Section 2.4.2.1 through Section 2.4.2.4 are added as a supplement to the U.S. EPR FSAR.

2.4.2.1 Flood History

BBNPP will be located on a relatively flat upland area 174 ft (53 m) above the North Branch of the Susquehanna River (NBSR) water level. The proposed BBNPP Intake Structure is approximately 22 mi (35 km) downstream of Wilkes-Barre, PA and 5 mi (8 km) upstream of Berwick, PA. The BBNPP site is situated in the Walker Run watershed, which has a drainage area of 4.10 mi^2 (10.61 km^2). Walker Run flows along the western side of the BBNPP site and discharges into the Susquehanna River at approximately river mile 164 (264 km).
The "Unnamed Tributary No. 1" (see Figure 2.4-3) flows along the south/southeast boundary of the site and discharges into Walker Run approximately 600 ft (183 m) south of the BBNPP site. Flood potential from Walker Run is discussed in Section 2.4.3.

The closest gauging station to the BBNPP site in the Susquehanna River is the United States Geological Society (USGS) station at Bloomsburg, PA (number 01538700). However, this gauging station has only been in service since 1994 and only records gage height and not water flow (USGS, 2009).

The closest gauging stations to the BBNPP in the Susquehanna River that measure both surface water elevation and water flow are USGS stations at Wilkes-Barre, PA (number 1536500) and Danville, PA (number 1540500), which are upstream and downstream of river mile 164 (264 km) (the confluence of Walker Run), respectively (see Figure 2.4-7).

Gauging of the Susquehanna River on a continuous basis began in 1900 at Wilkes-Barre and 1905 at Danville. The 1972 flood that occurred throughout the Mid-Atlantic United States as a result of Hurricane Agnes is the most significant flood event on record. The critical factor affecting the record flooding was the near continuous nature of rainfall during Hurricane Agnes. From June 20-25, 1972 an average of 6-10 inches (15-25 cm) of rain fell over the Mid-Atlantic region (NOAA, 2008). These high rainfalls produced record flooding on the Susquehanna River, equaling or exceeding flood recurrence intervals of 100 years along portions of Susquehanna River (NOAA, 2008). The 1972 flood generated peak stream flows of 345,000 cfs (9,769 m^3/s) at Wilkes-Barre on June 24th and 363,000 cfs (10,279 m^3/s) at Danville on June 25th (USGS, 2008a)(USGS,2008b). On June 25, 1972 a river crest of 517.35 ft (157.7 m) msl and mean daily flow of 329,837 cfs (9,340 m^3/s) was recorded near the SSES intake structure (Ecology III, 1986).

At Wilkes-Barre, the maximum recorded flood level was 40.91 ft (12.47 m) (elevation 551.77 ft, 168.18 m) msl, recorded on June 24, 1972. In Danville, the maximum flood level, 32.16 ft (9.80 m) (elevation 463.45 ft , 141.26 m) msl, was recorded on June 25, 1972. Maximum stream flow records are presented and discussed for both stations in Section 2.4.1. Figure 2.4-20 shows the recorded peak streamflow for Wilkes-Barre and Danville gauging stations (USGS, 2008a and 2008b).

The probable magnitude and frequency of floods on the Susquehanna River have been evaluated by the USGS based on the historical record of floods at Wilkes-Barre and Danville stations on the Susquehanna River.

The most common type of flooding that occurs in the Susquehanna River is the result of runoff from the large contributing drainage area due to heavy rainfall and snowmelt during the spring and early summer seasons. During a large flood, the Susquehanna River spills over its banks onto the broad floodplain areas of the valley. Aylesworth Creek Dam and Stillwater Dam are the only significant water control structures with flood control storage capacity within the Middle Susquehanna Sub-basin. There are no dams present in the Walker Run watershed.

As discussed in Section 2.4.7, ice sheets have formed on the Susquehanna River on more than one occasion. Despite the formation of ice on the Susquehanna River, there have been no instances of ice jams or ice induced flooding at the existing Susquehanna SES Units 1 and 2 intake. Further details of historic ice sheets and ice effects are discussed in Section 2.4.7.

Landslides (submarine or subaerial) have occurred in the vicinity of the BBNPP site but have not caused any flooding impacts at the existing SSES Units 1 and 2. Landslide impacts are further discussed in Section 2.4.9.

2.4.2.2 Flood Design Considerations

The design basis flood elevation for the BBNPP site is determined by considering a number of different flooding possibilities. The possibilities applicable and investigated for the site include the Probable Maximum Flood (PMF) on streams and rivers, potential dam failures, probable maximum surge and seiche flooding, probable maximum tsunami, and ice effect flooding. Each of these flooding scenarios was investigated in conjunction with other flooding and meteorological events, such as wind generated waves, as required in accordance with guidelines presented in ANSI/ANS 2.8-1992 (ANS, 1992). Detailed discussions on each of these flooding events and how they were estimated are found in Section 2.4.3 through Section 2.4.7. Adequate drainage capacity will be provided to prevent flooding of safety-related facilities and to convey storm water runoff from the roofs and buildings away from the plant site area. Stormwater from the roof drains will be drained through the downspouts for each of the plant buildings and will be collected and routed into the drainage system.

The estimation of the PMF water levels on Walker Run located near the BBNPP site is discussed in detail in Section 2.4.3. Section 2.4.3 describes the Walker Run watershed model developed to determine the hydrographs and peak flows. The scope of this calculation includes the HEC-HMS 3.1.0 evaluation of the all-season Probable Maximum Storm (PMS) to develop the flood elevations at the BBNPP site.

On June 25,1972 a river crest of 517.36 ft (157.69 m) msl was recorded near the SSES intake structure (Ecology III, 1986).

The BBNPP plant grade elevation is 674 ft (205.4 m) msl, which is 156.64 ft (47.74 m) higher than the highest recorded water level. Therefore it is anticipated that the Susquehanna River flooding does not affect the plant. Only a localized PMP storm was considered for flood design protection of safety-related facilities. The plant grade is about 3 ft (1 m) above the PMF of Walker Run (Section 2.4.3), and extreme floods on the tributary creeks would not affect the site. However, potential flooding conditions in Walker Run were analyzed in Section 2.4.3.

Probable maximum surge and seiche flooding on the Susquehanna as a result of the probable maximum hurricane is discussed in Section 2.4.5. Because of the location of the BBNPP site relative to the nearest coast and the elevation of the plant site relative to the Susquehanna River, storm surge and seiche flooding considerations are not applicable for this site.

Section 2.4.6 describes the derivation of the Probable Maximum Tsunami (PMT) flooding. The potential of Tsunami events that could affect the BBNPP site caused by local or distant seismic activities is negligible. The BBNPP site is far inland from the coastal line (approximately 107 mi (172 km) inland from the nearest coast which is the Chesapeake Bay) to suffer from any tsunami flooding. Thus, the PMT does not pose a flood risk to the BBNPP site.

The maximum water level due to local intense precipitation or the local Probable Maximum Precipitation (PMP) is estimated and discussed in Section 2.4.2.3. The maximum water level in the BBNPP power block area due to the local 1 hour 1 mi^2 PMP event is at elevation 670.66 ft (204.42 m) msl. This water level becomes the design basis flood elevation for all safety-related facilities in the power block area. All safety-related building entrances in the power block are located above this elevation at an elevation of 674.0 ft (205.4 m) msl.

The post-construction grading of the BBNPP site directs runoff from plant north to plant south with drainage ditches collecting storm water and diverting flow to Stormwater Pond #1 and Stormwater Pond #2. The parking lot area located south of the power block and switchyard is the only exception to this site drainage pattern, draining runoff from plant south to plant north into collection ditches that direct all flow to Stormwater Pond #1. The direction of all runoff flow at the BBNPP site can be seen in Figure 2.4-4. Therefore, potential local flooding, even from extremely heavy rainfall, will be controlled by the plant site drainage system, as discussed in Section 2.4.2.3.

2.4.2.3 Effects of Local Intense Precipitation

The 1-hour Probable Maximum Precipitation (PMP) event is the worst-case scenario when analyzing the sub-basins containing all safety-related structures since peak discharges are higher due to the extreme intensity of rainfall over a short duration, causing water surface levels to rise higher during the runoff process. Under the assumption that no losses occur, the 72-hour PMP event is the worst-case scenario when analyzing the ESWEMS Retention Pond since it generates more total rainfall than the 1-hour PMP event. The design basis for local intense precipitation is the all-season Probable Maximum Storm (PMS) as obtained from the U.S. National Weather Service (NWS) Hydro-meteorological Report Number 52 (HMR-52) (NOAA, 1982). The cumulative storm hyetograph for the 1-hour PMP event is generated by using ratio analysis to obtain the 5-minute, 15-minute and 30-minute PMP from the Hydro-meteorological Report Number 52 (HMR-52) once the 1-hour PMP is determined (NOAA, 1982). The 1-hour cumulative rainfall hyetograph is used as the time-series input when conducting the BBNPP site drainage system Probable Maximum Flood (PMF) analysis in the Hydrologic Engineering Center Hydrologic Modeling System Version 3.1.0 (HEC-HMS 3.1.0) (USACE, 2006). Table 2.4-18 shows the PMP depths obtained from the HMR-52 for the 1-hour storm event. The 72-hour cumulative rainfall heytograph is determined over the Walker Run Watershed drainage area using the HMR-52 computer program. The 72-hour cumulative rainfall heytograph is used as the time-series input when conducting the ESWEMS Retention Pond Probable Maximum Flood (PMF) analysis in HEC-HMS 3.1.0 (USACE, 2006). Table 2.4-19 (NOAA, 1978) shows the Probable Maximum Precipitation (PMP) depths obtained from the HMR-51 report for the 72-hour storm event (NOAA, 1978).

The site layout and drainage system are shown in Figure 2.4-4. The proposed post-construction site grading directs runoff from plant north to plant south with drainage ditches collecting storm water and diverting flow to Stormwater Pond #1 and Stormwater Pond #2. The parking lot area located south of the power block and switchyard is the only exception to this site drainage pattern, draining runoff from plant south to plant north into collection ditches that direct all flow to Stormwater Pond #1.

As indicated in Figure 2.4-4, the containment, fuel and safeguard buildings are located in the center and along the high point of the BBNPP power block area at an elevation of 674 ft (205.4 m) msl. From the high point, site grading directs runoff towards drainage ditches located on the eastern, western, and southern sides of the power block which route all flow west of the power block to Stormwater Pond #1. Grading in the vicinity of the safety-related structures slopes away from the individual structures such that PMP ground and roof runoff will sheet flow away from each of these structures towards the collection ditches. Thus, sheet flows are prevented from entering the structures. To evaluate the site drainage during the PMF scenario, the BBNPP site was divided into seven sub-basins. The drainage areas for these sub-basins are shown in Figure 2.4-3 and presented in Table 2.4-20. As shown in Figure 2.4-4, only the runoff from the Switchyard Extension Sub-basin is diverted to Stormwater Pond #2, which is located east of the proposed BBNPP site. Runoff that is generated within the Power Block, Switchyard, ESWEMS Retention Pond, Wetlands Area, Parking Lot and Waste Disposal Area Sub-basins is directed to Stormwater Pond #1.

Peak water levels generated by the PMP within the BBNPP site, including the increase in Water Surface Elevation (WSE) that occurs within the power block area (evaluated using the 1-hour PMP data shown in Table 2.4-18) and the ESWEMS Retention Pond (evaluated using the 72-hour PMP data shown in Table 2.4-19), were determined by performing a hydrologic runoff analysis. The U.S. Army Corps of Engineers (USACE) computer program HEC-HMS (USACE, 2006) was used to develop the hydrologic model and determine the peak WSE within each of the seven sub-basins that make up the BBNPP site: the Power Block, Switchyard, Switchyard Extension, ESWEMS Retention Pond, Wetlands Area, Parking Lot and Waste Disposal Area (see Figure 2.4-21). Ground cover in the power block consists of primarily two types of surface characteristics, namely: 1) developed impervious area and 2) gravel surface on compacted fills. For the assessment of the PMF levels, all areas within the BBNPP site are assumed to be impervious, all overflow pipes and culverts in the drainage system are assumed to be clogged as a result of ice or debris blockage, and all drainage ditches are assumed to be full in order to simulate the "worst-case-scenario" site drainage condition. With all culverts completely blocked, open channel drainage ditches and their surrounding areas will act as small isolated reservoirs for the runoff from their respective drainage areas; assuming the conditions that all areas are impervious and all drainage ditches are full allows all rainfall to be converted into runoff. In addition to site drainage ditches, the Vehicle Barrier System (VBS) was included as part of the 1-hour PMP storm analysis of the BBNPP site drainage system. The VBS openings have been modeled at strategic elevations to accommodate the PMP runoff.

The methodologies suggested by the U.S. National Resources Conservation Service (NRCS) that are presented in the TR-55 Manual (USDA, 1986) were used to estimate the times of concentration (Tc) for the various sub-basins. To account for non-linearity effects during extreme flood conditions, the computed Tc was reduced by 25 percent in accordance with EM-1110-2-1417 (USACE, 1994). The lag time, estimated as 60 percent of Tc, (USACE, 2000) and the local intense precipitation presented in Table 2.4-18 and Table 2.4-19 were input to the USACE computer program HEC-HMS (USACE, 2006). A runoff curve number of 98, representing impervious surfaces (USDA, 1986), was conservatively used for the entire drainage area and

also input into the HEC-HMS computer model. The NRCS dimensionless unit hydrograph option for developing peak discharges within the various sub-basins was utilized in HEC-HMS.

The runoff analysis was divided into three models: Series 1, Series 2, and Parking Lot ONLY. Series 1 takes into account the drainage area of the waste disposal sub-basin. Series 2 uses the outflow from Series 1 as an input to accommodate the VBS outflow into the power block sub-basin. The parking lot is modeled as a separate basin because, like the waste disposal sub-basin in the Series 1 basin model, surface runoff flows towards the power block and switchyard sub-basins; the VBS prevents parking lot runoff from discharging into the power block and switchyard. A schematic of the HEC-HMS model is shown in Figure 2.4-22 and the peak discharges that develop in each modeled sub-basin are presented in Table 2.4-21.

The effect of potential ice and debris blockage of storm drains, roof drains, culverts, and outlet pipes has been considered in the site PMP runoff analyses. As mentioned previously, all storm drains, outlet pipes, and culverts are assumed to be blocked for the PMP runoff analysis. Since all roof drains are considered blocked, runoff from roofs is assumed to be sheet flow over the edge of the roofs that contributes to the sheet flow runoff from each sub-basin. The runoff model does not consider any detention or storage for roof runoff. All runoff from roofs is included as direct runoff from the sub-basin drainage areas.

The safety-related structures in the BBNPP power block area consist of two ESWS Cooling Towers located in the northwest corner, two ESWS Cooling Towers located in the southeast corner, Emergency Diesel Generator Buildings located north and south of the Nuclear Island and the Reactor complex, which consists of the Reactor, Fuel and Safeguards Buildings. The locations of the buildings are shown on Figure 2.4-5. The entrances to each of these structures are located at or close to the grade slab elevation 674 ft (205.4 m). Table 2.4-22 gives the entrance elevations at the various safety-related facilities and compares them with the PMP water levels near those facilities. The maximum computed PMP water level in the Power Block Sub-basin is elevation 670.66 ft (204.42 m), which is 3.34 ft (1.02 m) below the reactor complex grade slab at elevation 674 ft (205.4 m).

The maximum computed PMP water level in the ESWEMS Retention Pond is elevation 672.13 ft (204.87 m), which is 1.87 ft (0.57 m) below the top of the dike at elevation 674 ft (205.4 m). Sufficient freeboard is maintained in the Waste Disposal Area, Switchyard, Switchyard Extension, Wetlands Area, and Parking Lot Sub-basins where peak PMP water levels are 673.25 ft (205.21 m), 673.11 ft (205.16 m), 675.02 ft (205.75 m), 666.57 ft (203.17m) and 670.62 ft (204.40m), respectively.

Based on the BBNPP power block grading, entrance locations, and peak PMP water levels in each sub-basin, all safety-related facility entrances are located above peak PMP water levels and collection ditches prevent PMP sheet flows from reaching safety-related entrances.

Flood protection measures are not required for the BBNPP ESWEMS. The grade level at the ESWEMS Retention Pond location is at elevation 674 ft (205.4 m) msl and elevation 674.5 ft (205.6 m) msl for the ESWEMS Pumphouse. The ESWEMS Pumphouse is 2.37 ft (0.72 m) above the estimated PMP. Therefore, flood protection measures are not required for these structures.

A general arrangement of the ESWEMS Pumphouse is shown on Figure 2.4-39. A plan view of the ESWEMS Pumphouse and section view are shown on Figure 9.2-5 through Figure 9.2-7.

The area surrounding the ESWEMS Retention Pond is graded so as to prevent surface runoff from entering the pond. A spillway will be provided to route excess water from the pond to the drainage ditches.

The BBNPP site drainage system is designed to convey runoff from a 100-year storm away from the plant area. The design rainfall intensities for a 100-year storm will be used for sizing drainage structures, culverts and ditches.

2.4.2.4 References

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2.4.3 Probable Maximum Flood (PMF) on Streams and Rivers

The U.S. EPR FSAR includes the following COL Item in Section 2.4.3:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information to describe the probable maximum flood of streams and rivers and the effect of flooding on the design.

This COL Item is addressed as follows:

{References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD 29), unless stated otherwise.

The proposed Bell Bend Nuclear Power Plant (BBNPP) site is located in Salem Township, Luzerne County, Pennsylvania on the west side of the North Branch of Susquehanna River as shown on Figure 2.4-23. The source of potential flooding at the proposed site is local intense precipitation directly over the site. This section discusses the Probable Maximum Flood (PMF) on streams and rivers as a result of the Probable Maximum Precipitation (PMP) over the watershed.

All runoff from the BBNPP site enters the North Branch Susquehanna River at the mouth of Walker Run. The BBNPP site sits on a relatively flat upland area about 174 ft (53 m) elevation above the nominal Susquehanna River level. The site is 22 mi (35 km) downstream of Wilkes-Barre, PA and 5 mi (8 km) upstream of Berwick, PA. The BBNPP site is situated in the Walker Run watershed, which is within the Middle Susquehanna River Sub-basin and has a drainage area of 4.10 mi^2 (10.6 km^2). Walker Run Stream flows along the western side of the BBNPP site. An Unnamed Tributary to Walker Run flows along the south/southeast boundary of the site.

The 1972 flood that occurred throughout the Mid-Atlantic United States as a result of Hurricane Agnes is the most significant flood event on record. The critical factor affecting the record flooding was the near continuous nature of rainfall during Hurricane Agnes. From June 20 through June 25, an average of 6-10 in (15-25 cm) of rain fell over the Mid-Atlantic region (NOAA, 2008). These high rainfalls produced record flooding on the Susquehanna River, equaling or exceeding flood recurrence intervals of 100 years along portions of Susquehanna River (NOAA, 2008).

The 1972 flood generated peak stream flows of 345,000 cfs (9,769 m^3/s) at Wilkes-Barre on June 24th and 363,000 cfs (10,279 m^3/s) at Danville on June 25th (USGS, 2008a)(USGS,2008b). On June 25, 1972 a river crest of 517.36 ft (157.7 m) msl and mean daily flow of 329,837 cfs (9,340 m^3/s) was recorded near the SSES intake structure (Ecology III, 1986).

The PMF evaluation for SSES Units 1 & 2 showed the PMF elevation on the Susquehanna River would not reach an elevation of 548 ft (167 m) msl (PPL, 1999). A simplified analysis was performed to determine whether this PMF elevation is valid for the adjacent BBNPP site. A stage-discharge curve for the Susquehanna River near the BBNPP site was developed through interpolation using data from the Wilkes-Barre (USGS 01536500) and Danville (USGS 01540500) gauge stations (immediately upstream anddownstream from the BBNPP site, respectively). The peak discharges in the Susquehanna River near the BBNPP site were interpolated on a drainage area basis using the upstream and downstream gauge drainage areas as established by the USGS (DA_{ug} = 9,960 square miles (USGS, 2008b) and DA_{dg} = 11,220 square miles (USGS, 2008a), respectively) and an impact point drainage area (DA_{ip}) of 10,200

square miles (PPL, 1993). The formula used to conduct the interpolation of peak discharges in the Susquehanna River near the BBNPP site is as follows (NHDES, 2003):

$$X_{ip} := \left[\left(1 - \frac{DA_{ip} - DA_{ug}}{DA_{dg} - DA_{ug}} \right) \cdot \frac{X_{ug}}{DA_{ug}} + \left(1 - \frac{DA_{dg} - DA_{ip}}{DA_{dg} - DA_{ug}} \right) \cdot \frac{X_{dg}}{DA_{dg}} \right] \cdot DA_{ip}$$

DA = Drainage Area.

X = Peak Discharge.

ug = Upstream gage (Wilkes-Barre)

dg = downstream gage (Danville)

ip = impact point (BBNPP site location)

The corresponding stage elevations (or water surface elevation) near the BBNPP site were calculated through linear interpoaltion between the upstream and downstream gauges. The upstream gauge, downstream gauge and the BBNPP site (or the BBNPP Intake Structure) are located at approximately river mile 189.5, 136.9and 167.8, respectively.

Using the Region 4 envelope curve provided in USGS Water-Supply Paper 1887 (Crippen and Bue, 1977), which considers the peak discharges that were generated on the Susquehanna River by the Hurricane Agnes flood event of 1972, two (2) maximum"credible" peak discharges were estimated for the Susquehanna River near the BBNPP site:(1) the maximum "credible" peak discharge corresponding to a drainage area of 10,000 square miles, which is the approximate size of the BBNPP site drainage area and can be read directly from the envelope curve (Crippen and Bue, 1977); and (2) the discharge corresponding to a drainage area of 10,200 square miles, which is equal to the size of the BBNPP site drainage area (PPL, 1993) and can be extrapolated after digitizing the envelope curve in MS Excel 2003. The water surface elevation (WSE) corresponding to each estimated peak discharge was determined using the interpolated stage-discharge curve developed previously. The maximum "credible" peak discharge and the corresponding water surface elevation in the Susquehanna River near the BBNPP site estimated for site drainage areas of 10,000 and 10,200 square miles were calculated to be 500,000 cfs (14,158m^3/s) (527.70 ft (160.84 m) msl) and 612,591 cfs (17,347 m^3/s) (533.09 ft (162.49 m) msl),respectively. Assuming that the BBNPP site drainage area is 10,200 square miles (PPL,1993), the PMF elevation is best estimated as 533.09 ft (162.49 m) msl based on the simplified analysis performed. Therefore, it can be concluded that the PMF elevation of 548 ft (167 m) msl for the neighboring SSES Units 1 & 2 is also valid for the BBNPP site since it provides a more conservative definition of the PMF elevation when compared to the result obtained from the simplified analysis (PPL, 1999). The BBNPP site plant grade elevation is 674 ft (205 m) msl, which is 126 ft (38 m) above the PMF elevation of 548 ft (167 m) (PPL, 1999). Furthermore, the BBNPP site is approximately 140.91 ft (42.95 m) above the estimated PMF elevation of 533.09 ft (162.49 m) msl..

Walker Run was analyzed for the Probable Maximum Flood (PMF) due to its proximity to the fact that the site lies within Walker Run Watershed. The analysis was based on the reroute of Walker Run to reflect the post-construction site layout as displayed in Figure 2.4-5. Walker Run

flows towards the south until it converges with the Susquehanna River at approximately river mile 164 (km 264). Walker Run collects runoff from the area surrounding the plant site and also areas northwest, west, and southwest of the plant site. The total collection area for the Walker Run watershed is approximately 4.10 mi^2 (10.61 km^2). Walker Run has a difference in elevation of approximately 290 ft (88 m) over its entire length with an overall slope of 1.5 percent. The Unnamed Tributary adjacent to the project site was modeled as a flow change location within the Hydrologic Engineering Center's River Analysis System Version 3.1.3 (HEC-RAS 3.1.3) at the corresponding cross section location 11,594. The Unnamed Tributary channel will be removed and the flow will be diverted to ESWEMS Retention Pond. All safety-related structures, systems, and components for BBNPP are located at approximately el. 674 ft (205.4 m) msl.

The results of the PMF analysis indicate a maximum PMF water surface elevation of 670.96 ft (204.51 m) msl at Walker Run. The grade elevation for the proposed BBNPP is set to 674 ft (205.4 m) msl, which provides an elevation difference of approximately 3.0 ft (0.9 m) between the BBNPP safety related structures, systems, and components and estimated PMF water level at Walker Run.

Section 2.4.3.1 through Section 2.4.3.7 are added as a supplement to the U.S. EPR FSAR.

2.4.3.1 Probable Maximum Precipitation (PMP)

The PMP was developed according to procedures outlined in the Hydrometeorological Report (HMR) Numbers 51 and 52 (NOAA, 1978; NOAA,1982). The PMP depths obtained from the isohyetal charts in the HMR-51 are presented in Table 2.4-23. The PMP hyetograph has been estimated based on the size, shape, and geographic location of the Walker Run watershed in accordance with the procedures outlined in the HMR-52 (USACE, 1984). The Walker Run watershed covers an area of 4.10 mi^2 (10.61 km^2). The delineation of the watershed was manually digitized and is shown in Figure 2.4-24. The watershed was divided into three sub-basins (A1, A2, and A3) for the runoff computation model created in the Hydrologic Engineering Center's Hydrologic Modeling System Version 3.1.0 (HEC-HMS 3.1.0) (USACE, 2006a). The model is divided at the confluence of an unnamed drainage area and Walker Run just southeast of the site. Sub-basin A3 represents the drainage area of the Unnamed Tributary. Ground cover for all sub-basins primarily consists of woods and agricultural land. The drainage area for each sub-basin is listed in Table 2.4-24. A schematic of the HEC-HMS model setup is shown in Figure 2.4-24.

The distribution of the PMP storm was estimated using the procedures in HMR Numbers 51 and 52 (NOAA, 1978; NOAA,1982). Precipitation depth data is obtained from isohyetal charts presented in the HMR-51. This data, along with the watershed boundary coordinates and other parameters from the HMR-52 (i.e. storm orientation and rainfall duration data), were input into the HMR-52 computer model (USACE, 1984) and the PMP was computed. In determining the hyetograph for the site, HMR-52 composes 5-minute incremental precipitation depths for the input depth-duration curves and then arranges them in a pre-selected order. The maximum incremental depth is placed at the middle of the storm duration, with the remaining incremental depths arranged in descending order, alternating before and after the central incremental depth.

The HEC-HMS 3.1.0 model, developed by the USACE (USACE, 2006a), was used to simulate the routing of increased stream flow generated by the PMP in the Walker Run watershed. Only maximum all-season PMP distributions were considered, i.e., maximum fair weather, rainfall only distributions. The site is located within the 4.10 mi^2 (10.61 km^2) Walker Run watershed, so the short-duration intense summer rainfall storms would govern maximum runoff

considerations. Table 2.4-24 (Walker run PMP Peak Flow Rates) provides all relevant information regarding the PMF runoff hydrograph since it points out all critical points (peak discharges and the time to peak) on the routed Walker run PMF hydrograph. In addition, the PMF hydrographs corresponding to hydrologic elements identified in Table 2.4-24 are shown in Figure 2.4-25 through Figure 2.4-29. Typically, snowmelt floods are critical for very large watersheds of thousands of square miles. Based on the historical snowfall information for the BBNPP site region in Section 2.3, snowmelt does not make a significant contribution to flooding situations. Therefore, antecedent snow-pack conditions have not been considered in the PMF analysis.

2.4.3.2 Precipitation Losses

Precipitation losses for the Walker Run watershed are determined using the Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service (SCS), runoff methodology (USDA, 1986). For this method, a composite runoff curve number (CN) is assigned to each sub-basin in the watershed. The CN is used to describe the sub-basin's capacity to absorb and retain precipitation or produce runoff. Runoff curve numbers range from about 30 to 100, with higher numbers producing more runoff and lower numbers producing more infiltration. Each composite CN is determined based on the sub-basin's surface soils, land cover, and antecedent moisture condition (dry, average, or wet).

The Walker Run watershed consists primarily of hydrologic group C soils and the cover conditions consist of wooded and agricultural areas. For the Walker Run watershed, an average CN of 76 was selected from the published values for the given soil and land cover conditions (USDA, 1986). Percentages of impervious areas were selected based on cover conditions. Impervious areas include open water bodies, roads, buildings, and the BBNPP site.

2.4.3.3 Runoff and Stream Course Models

A schematic of the HEC-HMS computer model for the Walker Run watershed is shown in Figure 2.4-24. The Clark unit hydrograph method (Clark, 1945)(Straub 2000) was used to transform rainfall to runoff by calculating discharge hydrographs for each sub-basin. There are no stream gages located within the watershed, so the methods of Straub (Straub, 2000) were used to estimate the Clark parameters for all sub-basin hydrographs.

There are no historical records available to verify the results of the runoff analysis. However, the Clark unit hydrograph method is accepted in many regions of the United States, including the Mid-Atlantic Region, to estimate basin runoff and peak discharges from precipitation events.

The 8-point Muskingum-Cunge Method was used for stream/floodplain routing through the stream network to the watershed outlet (Miller, 1975) (Ponce 1978). Base flow in Walker Run, which is on the order of 1 to 10 cfs (0.03 to 0.30 m^3/s), is considered negligible for these calculations.

2.4.3.4 Probable Maximum Flood Flow

The PMP peak discharge rates as calculated in HEC-HMS are summarized in Table 2.4-24. Runoff hydrographs for each junction and sub-basin are shown in Figure 2.4-25 through Figure 2.4-29.

As shown in Table 2.4-24, the peak flow rates for the various sub-basins occur at different times. The estimated flow rates for each sub-basin were used in the HEC-RAS 3.1.3 model (USACE, 2005a) to determine stream flood profiles and water surface elevations.

2.4.3.5 Water Level Determination

Maximum water levels along Walker Run were determined utilizing the standard step backwater method for natural channels as implemented in the HEC-RAS Version 3.1.3 (HEC-RAS) computer program developed by the U.S. Army Corps of Engineers (USACE, 2005a). Required input for HEC-RAS includes geometric cross section data, flow rates, roughness data, and boundary conditions.

The cross-section data was obtained from topographic maps developed for the site and U.S. Geological Survey (USGS) topographic maps (USGS, 1989a). The HEC-RAS computer model cross section locations for Walker Run are shown on Figure 2.4-30 to Figure 2.4-32.

Manning's roughness coefficients for the stream channel and floodplain were estimated based on visual observations and procedures outlined by the USGS (USGS, 1990). Roughness coefficient values of 0.035 for the main channel upstream and downstream of the plant, 0.06 for the main channel through the project area, and 0.1 for the floodplain areas were used in the HEC-RAS model. A weir coefficient of 2.6 was used for all bridges and culverts. The bridges were modeled using the culvert function within HEC-RAS due to the curvature of the bridge opening. However, after the bridges overtop, the bridge deck is considered to be a weir and a weir coefficient is necessary.

The downstream control point for the HEC-RAS computer model was defined as the Susquehanna River.

Using HEC-GeoRAS Version 4.1.1, the cross section cut lines were drawn through the stream centerline (USACE, 2005b). The cross sections were then developed from the USGS 30-meter Digital Elevation Map and selected at approximate 100 to 200 ft (30 to 61 m) increments throughout the length of the waterbody (USGS, 1989b).

A known water surface, representing the PMF elevation of the North Branch Susquehanna River, was used as the downstream boundary condition at the first cross section. A sensitivity analysis indicated that water levels within the BBNPP site are unaffected by differing water levels at the downstream control point. The sensitivity study performed consisted of increasing the downstream boundary condition (the Susquehanna River surface water elevation) in one foot increments until it reached ten feet above the SSES Units 1 & 2 PMF study and re-running the model at each increment to observe PMF water elevation changes within the BBNPP site.

The PMF flow rates for the Walker Run profiles listed in Table 2.4-25 are input into the HEC RAS model at the indicated cross section locations. The entire length of Walker Run was modeled in HEC-RAS (Figure 2.4-30 to Figure 2.4-32). The mixed flow option, which computes both sub-critical and super-critical flow regimes, was used to model the flood profiles.

The computed water surface elevations for each profile are summarized in Table 2.4-25. The maximum PMF water surface elevation for each cross section is presented in Table 2.4-25. The Walker Run surface water profile is shown in Figure 2.4-33.

From Table 2..4-24, the maximum water level in the area of the proposed BBNPP site during the PMF event from Walker Run is elevation 670.96 ft (204.51 m) msl at Cross Section 12,715. This is approximately 3 ft (1 m) below the plant grade elevation of 674 ft (205.4 m) msl.

2.4.3.6 Coincident Wind Wave Activity

Due to the high flow velocity of Walker Run perpendicular to the direction of the wind activity and the relatively short duration of high water elevation during a PMF event, the wind wave activity is negligble. Wind wave activity calculations are typical for standing water and are not applicable for relatively shallow, moving water with a short fetch. Thus, wave height estimation was not performed during the PMF evaluation of Walker Run.

2.4.3.7 References

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2.4.4 Potential Dam Failures

The U.S. EPR FSAR includes the following COL Item for Section 2.4.4:

> A COL applicant that references the U.S. EPR design certification will verify that the site-specific potential hazards to safety-related facilities due to the failure of upstream and downstream water control structures are within the hydrogeologic design basis.

This COL Item is addressed as follows:

{References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD 29), unless stated otherwise.

The proposed Bell Bend Nuclear Power Plant (BBNPP) site is located in Salem Township, Luzerne County, Pennsylvania to the northwest of the NBSR as shown in Figure 2.4-23. Potential flooding at the proposed BBNPP site due to local intense precipitation falling directly onto the site and the resulting Probable Maximum Flood (PMF), as well as the PMF of nearby

Walker Run, were discussed in Section 2.4.2 and Section 2.4.3 respectively. The safety risks associated with the potential dam failures upstream in the NBSR Basin must also be assessed. This section discusses the water control structures within the Susquehanna River Basin and potential impacts to the safety-related facilities on site that would occur in the event of simultaneous dam failures.

The site sits on a relatively flat upland area, with plant grade elevation 174 ft (53 m) above the Susquehanna River nominal water level. The BBNPP Intake Structure is approximately 22 mi (35 km) downstream of Wilkes-Barre, PA and approximately 5 mi (8 km) upstream of Berwick, PA. The BBNPP site is situated in the Walker Run watershed, which has a drainage area of 4.10 mi^2 (10.6 km^2). All watershed and sub-basin areas that are referred to in this section, as well as all upstream and downstream distances taken relative to the BBNPP site, were obtained using ArcGIS software (ESRI, 2007; SRBC, 2006a; SRBC, 2006b; NID, 2008; USGS, 1984). Walker Run flows along the western side of the BBNPP site. An "Unnamed Tributary No. 1" (see Figure 2.4-3) to Walker Run flows along the eastern and southern site boundaries and enters Walker Run on the southwest side of the site.

All safety-related facilities for BBNPP are located at approximately elevation 674 ft (205.4 m) msl. The most significant flood event on record is the 1972 flood which resulted from Hurricane Agnes and occurred throughout the Mid-Atlantic region of the United States. It generated peak stream flows of 345,000 cfs (9,769 m^3/s) at Wilkes-Barre on June 24th 1972 and 363,000 cfs (10,279 m^3/s) at Danville on June 25th, 1972. (USGS, 2008a)(USGS,2008b) On June 25, 1972 a river crest of 517.35 ft (157.69 m) msl was observed near the SSES Units 1 and 2 intake structure (Ecology III, 1986). This is approximately 157 ft (48 m) below the plant grade elevation 674 ft (205.4 m) msl.

Only one stream, Walker Run, was judged to be near enough to the BBNPP site to be analyzed for the PMF. Walker Run flows towards the south until it converges with the Susquehanna River at approximately river mile 164 (264 km). Walker Run collects runoff from the area surrounding the plant site and also areas north, west, and southwest of the plant site. The total drainage area of the Walker Run watershed is approximately 4.10 mi^2 (10.61 km^2). From Figure 2.4-25, the maximum water level in the area of the proposed BBNPP site during the PMF event from Walker Run is elevation 670.96 ft (204.51 m) msl at Cross Section 12,715. This is approximately 3 ft (1 m) below the plant grade elevation 674 ft (205.4 m) msl.

The Susquehanna River Basin has a delineated area of 27,501 mi^2 (71,227 km^2) (SRBC, 2006a). The location and extent of the Susquehanna River Basin and its six sub-basins are shown in Figure 2.4-34. Although many water control structures are located within the Susquehanna River Basin upstream from the site, several multipurpose dams are positioned on tributaries within the Susquehanna River Basin. There are no dams on the main stem of the Susquehanna River upstream from the BBNPP site. Only select upstream dams identified in Figure 2.4-15 were considered in this section regarding potential dam failures. There are no significant dams that provide flood control storage capacity on the Susquehanna River upstream from the BBNPP site. All available information in reference to the selected upstream dams, including pool elevations and storage volumes, is presented in Table 2.4-12.

Stillwater Dam is the only significant multipurpose water control structure that provides flood protection within the Middle Susquehanna Sub-basin. The Middle Susquehanna Sub-basin covers an area of 3,771 mi^2 (9,763 km^2) (SRBC, 2006b). Stillwater Dam is located approximately 65 mi (105 km) upstream from the BBNPP site. The flood control storage volume for the Stillwater Dam is approximately 5.23E8 ft^3 (1.48E7 m^3) (USGS, 2008d).

All other significant upstream dams are located in different sub-basins relative to the BBNPP site: the Cowanesque, Hammond and Tioga Dams are located within the Pennsylvania portion of the Chemung Sub-basin, Almond Dam is in the New York portion of the sub-basin; all other dams are located in New York in the Upper Susquehanna Sub-basin (Figure 2.4-15). Among all the dams in the Chemung Sub-basin, the Cowanesque Dam is closest to the site with an approximate distance of 164 mi (264 km) upstream. Whitney Point Dam is the closest from the Upper Susquehanna Sub-basin with an approximate distance of 176 mi (283 km) upstream from the BBNPP site.

A simplified and conservative estimation of the discharge required by simultaneous upstream dam failures to raise the WSE near the BBNPP site to plant grade El. 674 ft (205 m) msl was conducted using HEC-HMS.

Impact of a simultaneous failure of the major dams located upstream of the BBNPP site was evaluated. This calculation estimates the outflow hydrographs resulting from the failure of 31 dams (Figure 2.4-15) and the subsequent effects of routing the hydrographs through the river network to a location on a Susquehanna River near the BBNPP site. HEC-HMS version 3.3 was used to model the effect of the potential dam breaks routed through tributaries and down the Susquehanna River past the BBNPP site. HEC-HMS is capable of modeling dam breaches and calculating an outflow hydrograph from a breached reservoir according to various parameters, and routing the flow through reaches of a defined geometry. The inclusion of such features such as spillway and dam top overflow, dam break simulation, and reach routing, make this software suitable for this calculation. A simplified routing technique, 8-point Muskinghum-Cunge, is used; therefore, the model is only reliable for estimating river flows at selected points in the network and is not intended for any accurate estimation of flood rise elevations or inundation delineation.

For these analyses, the dam failure is considered to be triggered by a seismic event that instantaneously fails all the dams. As such, there is no rainfall specified, and a fair weather or "sunny day" breach scenario is analyzed. The reaches were delineated based on the significance of the channel. Only reaches of the main channel and its significant branches were delineated as separate sub-basins. In several cases, a single reach was split into multiple reaches in order to accurately route the reservoir discharge to the appropriate junction. For all reaches, the Muskingum-Cunge routing method with an 8-point geometry (channel with floodplains) was used. No rainfall modeling is performed; however, drainage areas are delineated for defining base flow to the primary river reaches in this model.

The reservoirs included in the model were chosed based on their ability to generate large dam break outflow hydrographs that could produce an appreciable impact at the Susquehanns River near the site. The criteria used were dams over 50 feet (15.2m) in height and over 1000 acre-feet (1.23E6 m^3) in volume.

A stage-discharge curve for the Susquehanna River near the BBNPP site was developed through interpolation using data from the Wilkes-Barre (USGS 01536500) and Danville (USGS 01540500) gauge stations (upstream and downstream from the BBNPP site, respectively). The peak discharges in the Susquehanns River near the BBNPP site were interpolated on a drainage area basis using the upstream and downstream gauge drainage areas as established by the USGS (for details on the discharge rating curve, see FSAR 2.4.3).

The peak flow the dam break discharges in the Susquehanna River near the project site is estimated to be 244,000 cfs (6,909 m^3/s). Elevation for flow rate of 244,000 cfs (6909 m^3/s)

(based on the interpolated discharge curve) is 509.8 ft (155.4 m) msl, resulting in a water level from the simultaneous failure of upstream dams of 164.2 ft (50.0 m) below the plant grade elevation of 674 ft (205.4 m) msl. The estimated flow of 244,000 cfs (6909 m^3/s) will not impact the Bell Bend NPP site.

There are no dams within the Walker Run watershed. Although many water control structures are located within the Susquehanna River Basin upstream from the site, several multipurpose dams are positioned on tributaries within the Susquehanna River Basin. Since all of these dams are far upstream relative to the BBNPP site (see Figure 2.4-15), there will be no impacts due to sedimention at the BBNPP Intake Structure following a simultaneous dam failure event. Since the plant site is located above the floodplain of the Susquehanna River, the safety-related structures and functions would not be affected by sedimentation.

Since there will be a significant amount of freeboard between the BBNPP site and the maximum dam failure water level, no flooding will occur at the site.

The ESWEMS Retention Pond and Stormwater Pond #1 are the only waterbodies located near the Power Block. The ESWEMS Retention Pond and Stormwater Pond #1 will be excavated such that the required water volume is below site grade. Therefore, dam break analysis is not necessary. Flooding resulting from the failure of these storage structures will not impact the safety-related structures.

The first dam downstream from the BBNPP site on the Susquehanna River is the Adam T. Bower Memorial Dam, which is a temporary (or seasonal) inflatable dam that is used for recreational purposes. Failure of the Adam T. Bower Memorial Dam would not affect the water supply at the BBNPP site upstream since it does not have a large storage capacity.

2.4.4.1 References

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2.4.5 Probable Maximum Surge and Seiche Flooding

The U.S. EPR FSAR includes the following COL Item for Section 2.4.5:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information on the probable maximum surge and seiche flooding and determine the extent to which safety-related plant systems require protection. The applicant will also verify that the site-specific characteristic envelope is within the design maximum flood level, including consideration of wind effects.

This COL Item is addressed as follows:

{References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD 29), unless stated otherwise.

Sections 2.4.5.1 through 2.4.5.6 are added as a supplement to the U.S. EPR FSAR.

2.4.5.1 Probable Maximum Winds and Associated Meteorological Parameters

The BBNPP site is located in Salem Township, Luzerne County, northeastern Pennsylvania. It lies on a relatively flat upland terrace, approximately 1.4 miles (2.3 km) west of the NBSR. The plant grade elevation will be 674 ft (205 m) msl (FSAR Section 2.5.4). The elevation of the Susquehanna River 100-yr floodplain, near the BBNPP Intake Structure, is approximately 513 ft (156 m) msl (Federal Emergency management Agency (FEMA, 2008). The nominal water level of the Susquehanna River is 500 ft (152 m) msl. Thus, the BBNPP site is approximately 161 ft (49 m) above the Susquehanna River 100-yr floodplain and 174 ft (53 m) above the nominal Susquehanna River level (Figure 2.4-2). There are no major water bodies (e.g., greater than 10 acres (4 hectares) directly adjacent to or on the BBNPP site.

Site-specific characteristics of the regional climatology, including wind speeds and wind direction, are discussed in FSAR Section 2.3.

The BBNPP site lies approximately 107 mi (172 km) inland from the Chesapeake Bay, which is downstream from the BBNPP Intake Structure. Because the plant site is more than 100 mi (161 km) from the nearest coast, and the elevation of the plant site is 161 ft (49 m) above the 100-yr floodplain of the Susquehanna River, and there are no major water bodies adjacent to the BBNPP site, potential storm surges or seiche flooding are not applicable considerations for this site and are not factors which could cause flooding.

Between 1851 and 2005, there have been 281 reported hurricanes that reached landfall on the continental U.S. (NOAA, 2007). The 1972 (June 21-24) flood that occurred throughout the Mid-Atlantic region as a result of Hurricane Agnes is known to be one of the most significant floods in recorded history of the area. The critical factor affecting the record flooding was the near continuous nature of rainfall during Hurricane Agnes. From June 21-25, an average of 6-10 inches (15-25 cm) of rain fell over the Mid-Atlantic region (NOAA, 2008). These high rainfalls produced record flooding on the Susquehanna River, equaling or exceeding flood recurrence intervals of 100 years along portions of the Susquehanna River (NOAA, 2008). Hurricane Agnes generated peak stream flows of 345,000 cfs (9,769 m^3/s) at Wilkes-Barre on June 24th and 363,000 cfs (10,279 m^3/s) at Danville on June 25th (USGS, 2008a)(USGS, 2008b). On June 25, 1972 a river crest of 517.35 ft (157.7 m) msl and mean daily flow of 329,837 cfs (9,340 m^3/s) was recorded near the SSES Units 1 and 2 Intake Structure (Ecology III, 1986). Potential flooding caused by hurricane and major storm events (i.e., flooding caused by heavy rainfall and runoff) is discussed in FSAR Section 2.4.2.

2.4.5.2 Surge and Seiche Water Levels

2.4.5.2.1 Historical Surges

Two hundred and eighty one hurricanes have been reported to reach the coast of the continental U.S. between 1851 and 2005 (NOAA, 2007). Because the BBNPP site is located approximately 107 mi (172 km) inland from the Chesapeake Bay, recorded storm surge and seiche water levels are not a factor which could cause flooding at the porposed BBNPP site.

2.4.5.2.2 Estimation of Probable Maximum Storm Surge

The probable maximum storm surge (PMSS) at the BBNPP site can be estimated by considering the most severe combination of the components of primary surge height, cross wind effects, 10 percent exceedance high tide, and sea level anomaly.

In the U. S. Army Corps of Engineers (USACE) 1986 computation of wind waves over the continental shelf from the entrance to the Chesapeake Bay has been reported. In this

computation, the water depths were also assumed to include the storm surge and astronomical tide over the shelf area.

USACE, 1986 wave computations show that at the entrance to the Chesapeake Bay, the wave height is computed to be 11.6 ft (3.5 m). Assuming the highest computed wave height of 52.7 ft (16.1 m) (located at a disance of 65 nautical miles from the Chesapeake Bay) travels the 107 miles to the BBNPP site, the elevation is still 108.3 ft (33.0 m) above the computed wave height (USACE, 1986).

Based on the USACE calculations, it is safe to conclude that due to the disance of 107 miles (172 km) inland from the nearest coast and the elevation of the plant site of 161 ft (49 m) above the 100-yr floodplain, storm surges of seiche flooding are not applicable considerations for this site.

2.4.5.3 Wave Action

The only body of water on the BBNPP site is the Essential Service Water Emergency Makeup System (ESWEMS) Retention Pond. The BBNPP ESWEMS Retention Pond at normal water level of 669 ft (204 m) msl, has a volume of about 76.6 acre-feet (98,823 m^3). An unisolatable overflow spillway has a crest at elevation of 672 ft (204.8 m) msl. The graded ground elevation around the ESWEMS Retention Pond provides a 4-ft (1.2 m) minimum freeboard at normal pond water level. In addition, the plant yard is graded away from the pond to prevent site runoff from entering the pond. The excavated pond slopes are covered with riprap for protection against wave action (Black & Veatch, 2008). The ESWEMS Retention Pond is a small body of water and is not subject to significant surge and seiches. Regulatory Guide 1.59 (NRC, 1977) defines the design basis considerations, with respect to flooding, for the ESWEMS Retention Pond. The derivation of probable maximum winds and wave runup are evaluated in FSAR Section 2.4.8.

2.4.5.4 Resonance

The BBNPP site lies approximately 107 mi (172 km) inland from the Chesapeake Bay , which is downstream from the BBNPP site. Because the plant site is more than 100 mi (161 km) from the nearest coast, and the elvevation of the plant site is 161 ft (49 m) above the 100-yr floodplain of the Susquehanna River, and there are no major water bodies adjacent to the BBNPP site, potential storm surges or seiche flooding are not applicable considerations for this site and are not factors which could cause flooding. Resonance of seiche oscillation will not occur because a seiche is not an applicable consideration at the BBNPP site.

2.4.5.5 Protective Structure

Flood protection measures for the ESWEMS pumphouse are discussed in FSAR Section 2.4.10.

Because the BBNPP site is located on an elevated river terrace, approximately 161 ft (49 m) above the Susquehanna River floodplain and approximately 1.4 miles (2.3 km) west of the floodplain, progressive floodplain erosion will have no impact on the BBNPP site.

Erosion has occurred throughout the Susquehanna River basin over the past 13,000 years (i.e. since the last glacial advance) and will continue to happen.

2.4.5.6 References

Black and Veatch, 2008. Black and Veatch Drawing, 161642-1EMS-S1102, Plant Arrangement ESWEMS Pond Sections and Details, Revision 0, 2008.

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USGS, 2008j. River Observatories for Management Applications (ROMA) Project, Website: http://chesapeake.usgs.gov/ROMA/#Susquehanna, Date accessed August 22, 2008.}

2.4.6 Probable Maximum Tsunami Flooding

The U.S. EPR FSAR includes the following COL Item in Section 2.4.6:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information and determine the extent to which the plant safety-related facilities require protection from tsunami effects, including Probable Maximum Tsunami Flooding.

This COL Item is addressed as follows:

{This section develops the geohydrological design basis to ensure that any potential hazards to the structures, systems, and components important to safety due to the effects of a probable maximum tsunami are considered in the plant design.

Section 2.4.6.1 through Section 2.4.6.8 are added as a supplement to the U.S. EPR FSAR.

2.4.6.1 Probable Maximum Tsunami

The BBNPP site is located in Salem Township, Luzerne County, northeastern Pennsylvania. It lies on a relatively flat upland terrace, approximately 1.4 miles (2.3 km) west of the NBSR. The plant grade elevation will be 674 ft (205 m) msl (FSAR Section 2.5.4). The elevation of the Susquehanna River 100-yr floodplain, near the BBNPP Intake Structure, is approximately 513 ft (156 m) msl (FEMA, 2008). The nominal water level of the Susquehanna River is 500 ft (152 m) msl. Thus, the BBNPP site is approximately 161 ft (49 m) above the Susquehanna River 100-yr floodplain and 174 ft (53 m) above the nominal Susquehanna River level (Figure 2.4-5). There are no major water bodies (e.g., greater tha 10 acres (4 hectares in area) directly adjacent to or on the BBNPP site. The BBNPP site lies approximately 107 mi (172 km) inland from the Chesapeake Bay, which is downstream from the BBNPP site.

Because the plant site is more than 100 mi from the nearest coast, the elevation of the plant site is 161 feet above the 100-yr floodplain of the Susquehanna River, and there are no major water bodies adjacent to the BBNPP site, potential tsunami events are not applicable considerations for this site and are not factors which could cause flooding.

The potential that tsunami events, caused by local or distant seismic activities, could affect the BBNPP site is negligible.

2.4.6.2 Historical Tsunami Record

A review of the National Geophysical Data Center (NGDC), indicates there are no records of major tsunamis in the USA with significant flooding impacts.

2.4.6.3 Tsunami Source Generators Characteristics

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.4 Tsunami Analysis

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.5 Tsunami Water Levels

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.6 Hydrography and Harbor or Breakwater Influences on Tsunami

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.7 Effects on Safety Related Facilities

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.8 Hydrostatic and Hydrodynamic Forces

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.9 Debris and Water-Borne Projectiles

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.10 Effects of Sediment Erosion and Deposition

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.11 Consideration of other Site-Related Evaluation Criteria

This section is not applicable as there is no risk of tsunami flooding at the site.

2.4.6.12 References

FEMA, 2008. Flood Insurance Rate Map, Luzerne County. Website: http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1, Date accessed: March 27, 2008.}

2.4.7 Ice Effects

The U.S. EPR FSAR includes the following COL Items for Section 2.4.7:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information regarding ice effects and design criteria for protecting safety-related facilities from ice-produced effects and forces with respect to adjacent water bodies.
>
> A COL applicant that references the U.S. EPR design certification will evaluate the potential for freezing temperatures that may affect the performance of the ultimate heat sink makeup, including the potential for frazil and anchor ice, maximum ice thickness, and maximum cumulative degree-days below freezing.

These COL Items are addressed as follows:

{As discussed in Section 2.4.1, the BBNPP site is located in Northeast Pennsylvania near Berwick, PA in the township of Salem. The Susquehanna River lies about 1.3 miles (2.1 km) south and 1.7 miles (2.7 km) east of BBNPP site. Figure 2.4-2 indicates the location of the site.

Reference to elevation values in this section are based of the National Geodetic Vertical Datum of 1929 (NGVD), values unless otherwise stated.

2.4.7.1 Ice Conditions

Ice at a nuclear power plant site could occur in any one of the following forms:

- Surface ice and its associated forces
- Anchor ice formation on components
- Frazil ice that could clog intake flow passages
- Ice jams that could affect flow path to the water supply intake
- Breach of ice jams causing flooding at site
- Ice accumulation on roofs of safety-related structures and components
- Ice blockage of the drainage system causing flooding
- Ice accumulation causing reduction in water storage volume

Historical data characterizing ice conditions at the BBNPP site have been collected and the effects evaluated for the operation of BBNPP. These data include ice cover and thickness observations in the Susquehanna River, ice jam records, and air temperature measurements

from the SSES Units 1 and 2 meteorological tower. There are no safety-related structures facilities that could be affected by ice-induced low flow of the Susquehanna River.

To assure the BBNPP safety-related Essential Service Water Emergency Makeup System (ESWEMS) would not be affected by surface ice, the possibility of ice jam formation and the potential for frazil ice were examined by estimating the maximum surface ice thickness that could form during the worst icing condition expected at the site. Ice-induced forces are accounted for in the design of the BBNPP Intake Structure.

The storage capacity of the pond has been sized to accommodate more than the 27-day minimum requirement of makeup water including a conservative evaluation for water loss to ice cover. As a result, ice formation on the ESWEMS Retention Pond surface has been accounted for in determining, the minimum volume required during emergency.

2.4.7.2 Description of the Cooling Water Systems

The BBNPP Circulating Water System (CWS) is a closed-cycle using natural draft cooling towers for the heat sink. Makeup water to the cooling tower basins will be supplied from the BBNPP Intake Structure located along the Susquehanna River east of the BBNPP site. BBNPP cooling tower blowdown effluent is delivered to the Susquehanna River through a permitted discharge line.

The BBNPP also has a safety-related Essential Service Water System (ESWS) to provide cooling water to the Component Cooling Water System heat exchangers and to the emergency diesel generator heat exchangers to dissipate heat. The ESWS is a closed-cycle system that uses mechanical draft cooling towers for heat removal. These cooling towers provide the Ultimate Heat Sink (UHS) function.

The basins of the ESWS cooling towers are sized to provide sufficient water to permit the ESWS to perform its safety-related heat removal function for up to 3 days (72 hours) post accident under the worst anticipated environmental conditions without replenishment. Beyond the 72 hour post accident period, makeup water is supplied from the ESWEMS Retention Pond, a safety related structure located northeast of the Nuclear Island. Blowdown from the ESWS cooling towers is routed to the Combined Waste Water Retention Pond via discharge lines connected to the natural draft cooling towers common blowdown effluent line. Water in the Combined Waste Water Retention Pond is released to the Susquehanna River via an overflow weir.

2.4.7.3 Intake and Discharge Structures

The CWS Makeup Water System will supply makeup water to the natural draft cooling tower basins for the non-safety-related CWS. The Raw Water Supply Systen (RWSS) supplies makeup water to the safety-related ESWEMS Retention Pond. Both systems are housed in the BBNPP Intake Structure.

River gauge records show that freezing on the Susquehanna River between Wilkes-Barre and Danville gauging stations can be expected during winter months. However, is not anticipated to cause ice flooding to exceed the probable maximum high water elevation of 525 ft (160 m) msl established for final design of the BBNPP Intake Structure.

Plant effluent going back to the Susquehanna River from BBNPP consists of cooling tower blowdown from the CWS cooling towers and the ESWS cooling towers, and miscellaneous low volume wastewater streams from the Power Block. The blowdown line extends approximately

310 ft (95 m) into the Susquehanna River below the design minimum water level of 484 ft (148 m) msl. Ice or ice flooding will be unlikely to occur at the discharge structure, as the warm discharge water will serve to keep the outfall open.

2.4.7.4 Historical Ice Formation

The climate of Pennsylvania is generally considered to be a humid continental type of climate. Daily air temperatures measured at the SSES Units 1 and 2 meteorological tower indicate that below freezing temperatures occur typically between the months of November and March. However, maximum accumulated freezing degree-days, as defined in Section 2.4.7.6, occur mostly in December, January and February.

Based on air temperature data summaries collected at the SSES Units 1 and 2 meteorological tower from 2001 through 2007, the monthly average air temperature in the region ranges from about 28.6°F (-2°C) in January to 71.3°F (22°C) in July, while the monthly average minimum air temperature for December is 16.9°F (-8°C), January is 12.6°F (-11°C) and for February is 15.3°F (-9°C). In the recent years (2001-2007) the minimum average temperature during winter months (December, January, and February) has been around 14.9°F (-10°C).

Flooding due to ice break-up that results in ice jams can be a problem during the winter months. A search of the "Ice Jam Database" maintained by the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL) reveals 13 recorded instances of ice jams near Wilkes-Barre in the Susquehanna River. Figure 2.4-38 illustrates ice jams within a 50-mile (80 km) radius of the BBNPP site. The most recent ice movement and ice jamming occurred on March 3, 2004 in the vicinity of Wilkes-Barre. Approximately 4.0 ft (1.2 m) of backwater was observed at the Wilkes-Barre USGS gauging station (USACE, 2008).

Ice accumulation on the transmission towers and switchyard of existing SSES Units 1 and 2 has sporadically occurred during freezing rainfall. To date, events such as these have not affected the operation of SSES Units 1 and 2 and ice accumulation on transmission towers is not anticipated to affect operation of BBNPP.

2.4.7.5 Frazil Ice

Research on the properties of frazil ice indicates that the nature and quantities of ice produced depend on the rate of cooling within a critical temperature range. Frazil ice forms when the water temperature is below 32°F (0°C), the rate of super cooling is greater than 0.018°F (-17.8°C) per hour in turbulent flows, and there is no surface ice sheet to prevent the cooling (USACE, 1991) (Griffen, 1973). This type of ice, which is in the shape of discoids and spicules (Griffen, 1973), typically forms in shallow flowing water, such as in rivers and lakes, when the flow velocity is approximately 2 ft/s (0.6 m/s) or higher (IAHR, 1970).

Under the unlikely scenario that frazil ice forms in the ESWEMS pond, analysis focused on the potential for mixing of frazil ice crystals formed at the surface to sufficient depths to cause a concern for the ESWEMS intake system. In this analysis, the mixing depth was calculated based on several wind speed recurrence intervals. The mixing depth was estimated by calculating a wave base which can be defined as the depth below the mean water surface where the fluid motion as a result of the waves is considered negligible.

Based upon the calculated wave base, the maximum mixing depth as a result of the 1,000-yr recurrence wind speed (118 mph; 52.8 m/s) is limited to 3.7 ft (1.13 m). The ESWEMS water intake system is approximately 30 ft deep (9.14 m), therefore under the most extreme wind

recurrence interval, the sustained speeds are not sufficient to provide a deep enough mixing zone to mix frazil ice to the depth of the ESWEMS intake system.

The ESWEMS Retention Pond arrangement with pump intakes approximately 30 ft (9 m) below the surface prevents any interruption of emergency water supply to the ESWS.

Furthermore, neither frazil ice nor anchor ice have been observed in the intake structure of the existing SSES Units 1 and 2 since the start of operation. There is no public record of frazil or anchor ice obstructing other water intakes in the Susquehanna River. As a result, frazil ice or anchor ice is unlikely to occur to an extent that will affect the function of the makeup water intakes. The operating floor of the BBNPP Intake Structure is at elevation 528 ft (161 m) msl. Therefore, formation of frazil and anchor ice is not expected to impact operation of the intake system.

2.4.7.6 Surface Ice Sheet

Ice may form on the surface of the BBNPP ESWEMS Retention Pond during severe winter periods. Ice formation, however, does not affect the operation of the ESWEMS Retention Pond for the following reason: water from the pond is withdrawn at a point approximately 24.5 ft (7.5 m) below the ice formation. Sufficient water volume is provided in the pond to preclude ice from reaching the pump intake during post-accident operation. This arrangement prevents any interruption of emergency water supply to the ESWS. Thus, there is no possibility for pump blockage by ice.

Plant Technical Specifications in COLA Part 4, defines surveillance requirements (SR) regarding the ESWEMS Retention pond. Plant Technical Specifications include a surveillance on a 24-hour basis to assure that the average water tempreature of the ESWEMS Retention Pond is less than or equal to 95F. In addition, Plant Technical Specifications include a surveillance on a 24-hour basis to verify water level of the ESWEMS Retention Pond is greater than or equal to 644 ft msl. Both of these surveillance requirements will ensure that the ESWEMS Retention Pond remains operable.

The pond structures at the water surface are in contact with surface ice that can form during prolonged subfreezing periods. Ice expansion and wind drag on the ice surface exert forces on these structures. The following sections address the approach used in evaluating the ice thickness and the forces on the ESWEMS Pumphouse and the pond outlet structure caused by the presence of ice.

Determination of the ice thickness in the ESWEMS Retention Pond is based on the analysis of monthly Accumulated Freezing Degree-Days (AFDD), defined as the summation of the difference between 32°F (0°C) and all recorded daily air temperatures below freezing (or the average daily temperature obtained from hourly data on record) for the months of December, January, and February.

Because the pump intakes are located approximately 3 ft (1 m) below the high water level of 525 ft (160 m) msl, the Susquehanna BBNPP Intake Structure will not be impacted by surface ice formation. Detailed information about the layout of the BBNPP Intake Structure is provided in Section 10.4.5.

The maximum ice thickness that could form in the Susquehanna River and the ESWEMS Retention Pond was estimated using historic air temperature data from the nearby SSES Unit 1 and 2 meteorological tower for the period of 2001 through 2007.

Surface ice thickness (t_i) can be estimated as a function of Accumulated Freezing Degree-Days (AFDD) using the modified Stefan equation (USACE, 2004), where C is a coefficient, usually ranging between 0.3 and 0.6 and AFDD is in °F days. For the Susquehanna River, a coefficient of 0.15 was used to provide a conservative estimation of the ice thickness ("Average River with Snow Condition;" Table 1; USACE, 2004). A value of 0.7 was used to estimate the ice thickness in the ESWEMS Retention Pond ("Average Lake with Snow Condition;" Table 1; USACE, 2004).

$t_i = C\,(AFDD)^{0.5}$

Accumulated Freezing Degree-Days are obtained for each winter month (December, January, and February) by summing the Freezing Degree-Days (FDD) for each month, which is the difference between the freezing point (32°F (0°C)) and the average daily air temperature (T_a):

$FDD = (32 - T_a)$

Table 2.4-27 summarizes the average accumulated Freezing Degree-Days for each winter month and the corresponding ice thickness estimate from 2001 to 2007 for the Susquehanna River. Table 2.4-28 summarizes the AFDD and estimated ice thickness from 2001 to 2007 for the ESWEMS Retention Pond. As indicated in Table 2.4-27, the monthly average AFDD is 190.4°F occurring in January with the corresponding ice thickness estimated to be 2.07 in (5.26 cm). Table 2.4-28 shows that the ESWEMS Retention Pond average ice thickness occurring in January is estimated to be 9.66 in (24.54 cm).

Effects of surface ice on Walker Run will not impact operation of the BBNPP, as Walker Run is not used a source of water for the plant.

To assure the BBNPP safety-related ESWEMS would not be affected by surface ice, the possibility of ice jam formation and the potential for frazil ice were examined by estimating the maximum surface ice thickness that could form during the worst icing condition expected at the site. The surface ice layer, when present, insulates and provides protection against the formation of frazil ice.

2.4.7.7 Ice Accumulation on the BBNPP Intake Structure and ESWS Cooling Tower Basins and Preventive Measures

The BBNPP Intake Structure and water discharge structures on the Susquehanna River are not safety-related structures. Even though the Susquehanna River is subject to ice formation during winter months, the BBNPP Intake Structure is not impacted. The CWS Makeup Water pumps are located approximately at 3 ft (1 m) above the designed high water level of 525 ft (160 m) msl established for final design of the BBNPP Intake Structure. This design would not be subject to ice blockage or ice formed in the Susquehanna River.

Ice will not affect the discharge structure, as the warm discharge water will keep the outfall open.

For the ESWS cooling tower basins, measures will be taken to ensure that the basins underneath the cooling tower cells have a minimum of 72 hours water supply without the need for any makeup water during a design basis accident. As indicated in Section 2.4.7.2, any makeup water to the basin needed beyond the 72 hour, post accident period will be supplied from the BBNPP ESWEMS. In order to assure the availability of a minimum of 72 hours water supply in the ESWS cooling tower basins, the minimum volume in each basin will be established considering: (a) losses due to evaporation and drift under design basis accident

conditions and design environmental conditions; (b) minimum submergence to avoid formation of harmful vortices at the pump suction; and (c) the operational range for basin water levels. During extreme cold weather conditions, operational controls will be implemented, as required, to assure the availability of the required volume. Tower operations during cold weather will mitigate ice buildup consistent with vendor recommendations (e.g., periodic fan operation in the reverse direction). Therefore, operational controls, together with system design features, will prevent ice formation in the ESWS Cooling Tower Basins as discussed in Section 9.2.5.

2.4.7.8 Effect of Ice on High and Low Water Levels and Potential for Ice Jam

Because the operating floor of the ESWEMS Pumphouse is at elevation 674.5 ft (205.6 m) msl, 5.5 ft (1.7 m) above the design normal water level of 669 ft (204 m) msl, and because the water will be drawn 0.5 ft (0.2 m) above finish grade of elevation 651.5 ft (198.6 m) msl, ice-induced low and high water levels will not affect the operation of the ESWEMS Pumphouse. The impacts of ice in the ESWEMS Retention Pond is described in Section 2.4.7.6 and the ESWS cooling tower basins are discussed in Section 2.4.7.7.

In addition, BBNPP surface runoff from the site vicinity drains into small streams which discharge into the Susquehanna River. Streams close to the site have small drainage areas and would not pose the potential of ice flooding at the site.

2.4.7.9 Effect of Ice and Snow Accumulation on Site Drainage

Air temperature measurements at the SSES Units 1 and 2 meteorological station indicate that mean daily temperatures at the site had periodically fallen below freezing for multiple consecutive days in winter. This introduces the possibility of ice blockage of small catch basins, storm drains, culverts and roof drains. The flood protection design of the BBNPP safety-related facilities assumes that all catch basins, storm drains, and culverts are blocked by ice, snow or other obstructions, rendering them inoperative during a local probable maximum precipitation (PMP) event; This is conservative in so far as a PMP is unlikely to occur during freezing condition. Details of the local PMP analyses and flood protection requirements for the site are discussed in Section 2.4.2 and Section 2.4.10. Therefore, temporary blockage of site drainage areas due to ice will not affect the operation of safety-related facilities.

2.4.7.10 Ice and Snow Roof Loads on Safety Related Structures

Acceptable roofing structure performance for each safety-related roof is described in Section 2.3.1.

2.4.7.11 References

Griffen, 1973. The Occurrence and Prevention of Frazil Ice at Water Supply Intakes, Research Branch Publication Number W43, Toronto Ministry of the Environment, A. Griffen, 1973.

IAHR, 1970. International Association of Hydraulic Engineering and Research, ICE Symposium, Heat Exchange and Frazil Formation, Reykjavik, T. Carstens, 1970.

USACE, 1991. Cold Regions Research and Engineering Laboratory, Frazil Ice Blockage of Intake Trash Racks, Technical Digest Number 91-1, U.S. Army Corps of Engineers, S. Daly, March 1991.

USACE, 2004. Method to Estimate River Ice Thickness Based on Meteorological Data, ERDC/CRREL Technical Note 04-3, U.S. Army Corps of Engineers, June 2004. http://www.crrel.usace.army.mil/library/technicalnotes/TN04-3.pdf

USACE, 2008. Ice Jam Database, Cold Regions Research and Engineering Laboratory (CRREL). Website: https://rsgis.crrel/usace.army.mil/icejam/ Date accessed: December 26, 2007.}

2.4.8 Cooling Water Canals and Reservoirs

The U.S. EPR FSAR includes the following COL Item for Section 2.4.8:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information and describe the design basis for cooling water canals and reservoirs used for makeup to the UHS cooling tower basins.

This COL Item is addressed as follows:

{References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD 29), unless otherwise stated.

Section 2.4.8.1 through Section 2.4.8.3 are added as a supplement to the U.S. EPR FSAR.

2.4.8.1 Cooling Water Design

BBNPP does not include any safety-related canals used to transport water. The non-safety-related BBNPP Intake Structure is located on the North Branch of the Susquehanna River and water is conveyed to the BBNPP power block via pipeline. The safety-related Essential Service Water Emergency Makeup System (ESWEMS) for BBNPP will be located in the Walker Run watershed within the power block area.

The volume of liquid water stored in the ESWEMS Retention Pond that comprises part of the UHS should be sufficient to meet all safety-related water supply requirements after accounting for loss in storage capacity due to seepage, sedimentation, evaporation, ice sheet formation, and other causes. The makeup to the ESWEMS Retention Pond is from the filtered Raw Water Supply System, therefore, sedimentation is not a problem. In addition, the pond will be below site grade and only precipitation or pumped in water will fill the ESWEMS Retention Pond, so sedimentation is not expected to be a problem. The slopes are protected with rip-rap; therefore, erosion is not expected to be a problem. The volume of water required with associated margins for losses is discussed in Section 9.2.5 and U.S. EPR FSAR Section 9.2.5.

The natural soils are granular, therefore, cohesive fill will be utilized for the ESWEMS Retention Pond to hold water. Geotechnical properties of the fill are discussed in Section 2.5.4. The original design assumed the pond bottom would consist of a compacted clay liner of approximately 3 ft (1 m). The cohesive fill will actually go down to bedrock. Thus, a 3 ft (1 m) thickness is a conservative assumption.

The ability of the cohesive fill to hold water will be confirmed during construction when the permeability of the cohesive fill used to construct the pond can be determined. Assumed seepage losses have been considered in the water volume calculations.

The ESWEMS Retention Pond will be excavated such that the required water volume is below site grade. Although the required volume will be below site grade and a slope failure will not

present a hazard to downstream residents, a slope failure may rupture the clay liner, resulting in loss of the ESWEMS Retention Pond.

Therefore, the ESWEMS Retention Pond slopes will have adequate safety factors for end of construction, steady state seepage, sudden drawdown, and earthquake loading conditions, as discussed in Section 2.5.5.

The ESWEMS Retention Pond design must ensure that the capability to perform their safety-related function is maintained during the most severe credible natural phenomena in combination with normal operations, anticipated operational occurrences, or accident condition. With respect to the most severe natural occurrences, design with respect to storm surges and seiches is discussed in Section 2.4.5, design with respect to tsunami hazards is discussed in Section 2.4.6, and design with respect to ice hazards is discussed in Section 2.4.7.

2.4.8.2 Reservoirs

The ESWEMS Retention Pond is the only proposed reservoir on the site. In the event of a design basis accident, the ESWEMS Retention Pond provides water for the post-accident period beyond the first 72 hours. The ESWEMS Retention Pond is excavated to a total depth of 22.5 ft (6.9 m) with side slopes of 3 horizontal to 1 vertical. The storage capacity of the pond at the normal water level of elevation 669 ft (204 m) msl is 76.6 acre-feet (98,823 m^3). During post accident conditions, the ESWEMS Retention Pond is utilized to supply makeup water to the ESWS cooling towers. Figure 2.4-39 shows the schematic layout of the ESWEMS Retention Pond.

A description of the BBNPP ESWEMS Retention Pond is provided in Section 9.2.5 and Section 3.8. Hydrologic conditions during PMP and coincident wind wave activities are discussed in Section 2.4.8.2.1. Consideration of probable maximum wind is discussed in Section 2.4.8.2.2. These conditions were evaluated at a water level corresponding to elevation 669 ft (204 m) msl to minimize the possibility of inadvertent discharges through the outlet structure.

2.4.8.2.1 Probable Maximum Flood Design Considerations

Site grading at the ESWEMS Retention Pond will prevent surface water from outside of the ESWEMS Retention Pond from entering the ESWEMS Retention Pond; therefore, the ESWEMS Retention Pond spillway discharge capacity and freeboard will be designed for the PMP as provided in Section 2.4.2. For the ESWEMS Retention Pond with a water level of elevation 669 ft (204 m) msl, the probable maximum water level due to a 72-hour PMP on the ESWEMS Retention Pond and outflow over the 6-foot (2 m) wide, broad-crested weir spillway reaches elevation 672.13 ft (204.87 m) msl. This is delineated in Table 2.4-29, as discussed in Section 2.4.8.2.2 (NOAA, 1978). Several wind scenarios were analyzed (Table 2.4-30) coincident with the maximum probable water level of elevation 672.13 ft (204.87 m) msl to ensure that the ESWEMS Retention Pond does not overtop. Results of these scenarios are presented in Table 2.4-31. The highest annual wind speed of 57 mph (92 km/hr) results in a freeboard requirement of 0.59 ft (0.18 m), which brings the ESWEMS water level to elevation 672.72 ft (205.05 m) msl. For the 1,000 yr recurrence interval, the freeboard requirement is 1.30 ft (0.40 m) bringing the water level at the ESWEMS Retention Pond to elevation 673.43 ft (205.26 m) msl, as discussed in Section 2.4.8.2.1.2

2.4.8.2.2 Water Level Determination

The ESWEMS Retention Pond's hydrologic design is controlled by the PMP and its associated water level. The 72-hour PMP on the ESWEMS Retention Pond is distributed as shown in Table 2.4-29, utilizing Hydrometeorological Report Number 52 (NOAA, 1984). The resulting

rainfall is converted to equivalent inflow to the pond to determine the maximum resulting water level. The outlet structure, which is a 6.0 ft (1.8 m) wide broad-crested spillway, has a crest elevation of 672 ft (205 m) msl. The discharge coefficient used in the weir equation is 2.65 (Brater, 1976). Flood routing indicates that the probable maximum water level in the pond, during the 72-hr PMP, will reach elevation 672.13 ft (204.87 m) msl with a peak outflow of about 0.71 cfs (0.020 m^3/s) based upon an initial water level corresponding to 669 ft (204 m) msl.

The water level in the ESWEMS Retention Pond resulting from the 72-hr PMP event is greater when compared to rise in water levels resulting from a 1-hr PMP. Since the 1-hr PMP event generates maximum runoff over the BBNPP site, the corresponding data was used to develop the BBNPP site drainage model in Section 2.4.2. However, the 72-hr PMP data was used in this section to evaluate the wave runup in the ESWEMS Retention Pond since its results produces higher water surface elevations when compared to the 1-hr PMP event.

2.4.8.2.2.1 Coincident Wind Wave Activity

Discussion of wind wave activities is limited to the ESWEMS Retention Pond as the only safety-related hydrologic element at the site which is subject to wind wave activity.

As a conservative approach, the highest wind speeds with a mean recurrence interval of 2, 10, 25, 50, 100, and 1,000 years were taken into account as occurring coincidentally with the probable maximum water level at its peak elevation (Thom, 1968). At this evaluated water level of 672.13 ft (204.87 m) msl, the ESWEMS Retention Pond has a water surface length of 688.78 ft (209.94 m), a width of 388.78 ft (118.50 m), and a depth of 20.6 ft (6.3 m). The designed BBNPP ESWEMS Retention Pond has a total depth of 22.5 ft (6.9 m) with side slopes of 3 horizontal to 1 vertical and surface dimensions of 700 ft (213 m) by 400 ft (122 m).

Wind setup is calculated by following U.S. Army Corps of Engineers (USACE,1997) guidance.

$$S = \frac{U^2 F}{1400D}$$ Equation 2.4.8-1

Where U is average wind velocity in miles per hour, F is wind tide fetch in miles, and D is the average depth in feet. The wind tide fetch F is usually taken to be twice the distance of the maximum effective fetch F_e, which is the distance over which wind can travel unobstructed across a body of water. F_e was estimated to be the maximum water surface length of 688.78 ft (209.94 m). The maximum fetch distance was doubled to obtain the wind tide fetch F. Table 2.4-30 shows the wind speed, effective fetch, wind tide fetch, average depth and wind setup for each of the scenarios.

Several hydrometeorological events were considered in the analysis occurring coincidentally with the probable maximum water level at elevation 672.13 ft (204.87 m) msl.

The calculation of wave runup involves finding the significant wave height and period based on fetch length and wind speed. Then, the determination of the wave runup is based on the characteristics of the wave and embankment slope. Coastal Engineering Manual, EM 1110-2-1100, (USACE, 2006) provides guidance for this process. EM 1110-2-1100 describes the following procedure for calculation of shallow water wave heights and periods:

1. Determine the straight line fetch and over water wind speed;

2. Using the fetch and wind speed from (1), estimate the wave height and period from deepwater nomograms;

3. Compare the predicted wave period from (2) to the shallow water limit as per:

$$T_p \approx 9.78\left(\frac{d}{g}\right)^{\frac{1}{2}} \qquad \text{Equation 2.4.8-2}$$

Where, T_p is the wave period, d is the average depth of the ESWEMS Retention Pond, and g is the gravitational constant (9.81 m/s)

a. If the predicted wave is greater than the limiting value, reduce the predicted wave period to the limiting value. The wave height may be found by noting the dimensionless fetch associated with the limiting wave period and substituting this fetch for the actual fetch in the wave growth calculation.

b. If the predicted wave period is less than the limiting value, retain the deepwater values from (2).

1. If the wave height exceeds 0.6 times the depth, the wave height should be limited to 0.6 times the depth.

Wave runup was then calculated using equations and suggested coefficients from EM 1110-2-1100 (USACE, 2006). Table 2.4-31 shows the resulting wind setup, wave runup and freeboard requirement values.

The freeboard requirement is defined as the height above the still water surface that the wind setup combined with the wave runup will impact. Note that $R_{u2\%}$ is the wave runup that 2 percent of the waves will exceed, which is the most conservative value that can be calculated using EM 1110-2-1100 (USACE, 2006).

Based on the results shown in Table 2.4-31, the overflow protection is adequate during the PMP and wave action does not adversely affect the ESWEMS Retention Pond embankments.

2.4.8.2.3 Probable Maximum Wind Design Considerations

2.4.8.2.3.1 Probable Maximum Winds

Using the method of Thom (Thom, 1968), the annual highest wind speed at the BBNPP site at different recurrence intervals is indicated in Table 2.4-32. The annual highest wind speeds are computed at 30 ft (9 m) above ground level. The Thom method assumes that:

a. Surface friction is uniform for a fetch of 25 mi (40 km);

b. Extreme winds result only from extratropical cyclones or thunderstorms; and

c. Extreme winds from tornados are not included in this analysis.

Maximum winds in the site area are associated mainly with thunderstorms and squall lines rather than hurricanes or other cyclonic storms. Although these winds are usually considered local in nature, they can cause wind setup and generate large waves in water bodies.

The probable maximum wind was determined based on the method of Thom (Thom, 1968). Thom used meteorological data collected over a 21-year period from 150 monitoring stations to provide isotachs of the 0.50, 0.10, 0.04, 0.02, and 0.01 quantiles for the annual highest wind speed for the United States. Thom then provides an empirical method to use these data to determine the highest wind speed for other quantiles at any U.S. location. This method was used to determine the highest wind speed likely to occur at the 0.001 quantile, or the 1,000-year mean recurrence interval. Table 2.4-32 shows the highest mile wind speed at different recurrence intervals obtained from Thom (Thom, 1968).

A wind speed with a return period of 1,000 years constitutes a conservative design basis for safety related elements. Based on Thom's model, this design wind speed applicable to the site was computed to be 118 mph (190 km/hr) with duration of 1-minute.

Thom's isotachs and statistics are based on a specific 21-year database, more recent data can not be taken into account, except as a comparison of actual extreme wind speeds with those predicted by Thom (Thom, 1968).

The highest wind of 57 mph (92 km/hr) was recorded in 2006, at Susquehanna Steam Electric Station (SSES) Units 1 & 2 meteorological tower, based on available data from 2001 to 2007.

As an example, this 57 mph (92 km/hr) compares with Table 2.4-32 values determined from Thom's method of 60 mph (97 km/hr) (10-year recurrence interval) and 70 mph (113 km/hr) (25-yr recurrence interval).

2.4.8.2.3.2 Wave Action

To ensure that the ESWEMS Retention Pond does not overtop, several recurrence intervals were considered coincident with the maximum probable water level of elevation 672.13 ft (204.87 m) msl. Results of these scenarios are presented in Table 2.4-31.

In the analysis of wave action, an extreme wind speed with a 1,000-year recurrence interval occurring coincidentally with the maximum probable water level corresponding to an elevation of 672.13 ft (204.87 m) msl is considered to be a conservatively postulated combination of hydrometeorological events. The nominal surface level of water in the pond is elevation 669 ft (204 m) msl. This design wind for a 1,000 year return interval, as discussed in Section 2.4.8.2.2.1, has the highest wind speed of 118 mph (190 km/hr).

Wave runup results using the methods described in Section 2.4.8.2.2.1 are shown in Table 2.4-31. At the 1,000 year wind event and for a rip-rapped slope of 3 horizontal to 1 vertical designed to resist this wave action, the maximum wave runup ($R_{u2\%}$) is calculated to be 1.17 ft (0.36 m). Including the wind setup value (S) of 0.13 ft (0.04 m), the total runup ($S + R_{u2\%}$) would be 1.30 ft (0.40 m) and would reach elevation 673.43 ft (205.26 m) msl. The rip-rap design is also based on the wave runup analysis.

2.4.8.2.3.3 Design Basis for ESWEMS Retention Pond

Based on the regional climatology and the 1,000 yr recurrence maximum wave runup result of 1.3 ft (0.4 m), wind generated waves at the normal water level will not exceed 4 ft (1 m); therefore, the rip-rap has been sized for a 4 ft (1 m) wave.

The rip-rap and bedding design configuration for the pond slope is shown in Figure 3E-6. The rip-rap stone layer thickness is 18 in (46 cm). The double bedding thickness is 12 in (30 cm) consisting of 6 in (15 cm) of fine bedding and 6 in (15 cm) of coarse bedding. The protection extends from the top of the slope to elevation 662 ft (202 m) msl. The side slopes are 3 horizontal to 1 vertical.

The rip-rap consists of dumped stone - hard, durable, and angular in shape. The specification for the stone requires a percentage loss of not more than 40 after 500 revolutions as tested by ASTM C 535, Resistance to Abrasion of Large Size Coarse Aggregate by Use of the Los Angeles Machine (ASTM, 2003a). The stone sizes vary from a maximum of approximately 18 in (46 cm) to a minimum of 1 in (3 cm) (to fill voids), and have a 50-percent size of 12 in (30 cm). The maximum stone weight is 500 lbs (227 kg), and the specific gravity is greater than 2.60.

The fine bedding layer is placed on the prepared embankment slope in a single lift. The fine bedding gradation discussed in Section 2.4.5 or 2.4.4 satisfies the requirements of ASTM C 33, Concrete Aggregates (ASTM, 2007).

The coarse bedding layer is placed in a single lift on top of the finished fine bedding layer, which has a surface free from mounds or windrows. The coarse bedding gradation shown on Section 9.2.5 satisfies the requirements of ASTM D 448, Standard Sizes of Coarse Aggregate for Highway Construction, Size No. 467 (ASTM, 2003b).

Stone for rip-rap is placed on the surface of the finished coarse aggregate bedding layer in a manner which produces a reasonably well-graded mass of stone with the minimum practicable percentage of voids. Rip-rap is placed to its full course thickness in one operation to avoid displacing the underlying material. All material comprising the rip-rap is placed and distributed such that there are no large accumulations of either the larger or smaller sizes of stone.

The BBNPP ESWEMS Retention Pond is the source of water for the ESWS. The plant water requirements discussed in Section 2.4.11 are supplied from the Susquehanna River. The low flow conditions discussed in Section 2.4.11 do not influence the dependability of the ESWEMS Retention Pond. Following the first 72 hours of an accident and assuming minimum required initial level the ESWEMS Retention Pond is designed to provide 27 days water supply with a greater than 10 percent margin without makeup during the worst 30 days of evaporation.

2.4.8.2.3.4 Resonance

At the evaluated level of elevation 669 ft (204 m) msl, the ESWEMS Retention Pond has an approximate length of 700 ft (213 m) and an average depth of 22.5 ft (6.9 m). The ESWEMS Retention Pond side slopes are covered with rip-rap which acts as a wave energy absorber. For these reasons, resonance of the pond is not anticipated.

2.4.8.3 References

ASTM, 2003a. Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine, American Society of Testing and Materials International, West Conshohocken, PA, 2003.

ASTM, 2003b. Standard Classification for Sizes of Aggregate for Road and Bridge Construction, American Society of Testing and Materials International, West Conshohocken, PA, 2003.

ASTM, 2007. Standard Specification for Concrete Aggregates, American Society of Testing and Materials International, West Conshohocken, PA, 2007.

Brater, 1976. Handbook of Hydraulics, E.F. Brater and H.W. King, McGraw-Hill, New York 5th Edition.

NOAA, 1978. Probable Maximum Precipitation Estimates, United States East of the 105th Meridian, Hydrometeorological Report No. 51 (HMR-51), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, June 1978.

NOAA, 1984. Probable Maximum Storm (Eastern U.S.), Hydrometeorological Report No. 52 (HMR-52), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, March 1984.

Thom, 1968. New Distribution of Extreme Winds in the United States, ASCE Journal of Structural Division, H.C.S Thom, Volume 94, Number ST7, pp 1787-1801, July 1968.

USACE, 1997. EM 1110-2-1420, U.S. Army Corps of Engineers, Engineering and Design - Hydrologic Engineering Requirements for Reservoirs, 1997.

USACE, 2006. EM 1110-2-1100, U.S. Army Corps of Engineers, Coastal and Hydraulics Laboratory - Engineer Research and Development Center, Waterways Experiment Station - Vicksburg, Mississippi (2006).}

2.4.9 Channel Diversions

The U.S. EPR FSAR includes the following COL Item for Section 2.4.9:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information and demonstrate that in the event of diversion or rerouting of the source of cooling water, alternate water supplies will be available to safety-related equipment.

This COL Item is addressed as follows:

{References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD 29), unless stated otherwise.

BBNPP is located adjacent to the NBSR. The geology of the Susquehanna River Basin, from its headwaters in Cooperstown, New York to its mouth in the Chesapeake Bay, changes as you proceed south. The river is approximately 444 mi (715 km) long, making it the longest river on the East Coast of the United States, and flows through New York, Pennsylvania and Maryland. From the headwaters to southern New York, the geology of the land surrounding the river is mostly glacial till underlain by sandstones and shales. Glacial till is a mixture of all sizes of sediments from boulders (glacial erratic) to silt and clay (very fine) sized sediments. In Pennsylvania, the glacial debris ends and sedimentary rocks are the predominant bedrock. The sedimentary rocks include sandstones and shales and also include carbonates such as limestones. Farther south from the BBNPP site, towards the Chesapeake Bay, sedimentary rocks are dominant, however, metasedimentary rocks, such as schists and slates, are also present. The BBNPP site and surrounding areas are shown in Figure 2.4-2. Section 2.4.9.1 through Section 2.4.9.8 are added as a supplement to the U.S. EPR FSAR.

2.4.9.1 Historical Channel Diversions

Section 2.5.1 provides further description and discussion of geological processes that lead to the formation of the Susquehanna River. This section briefly describes the formation of the Susquehanna River.

The Susquehanna River will be used to supply makeup water to the safety-related ESWEMS and non-safety-related Circulating Water System (CWS) as described in Section 2.4.1.1. Municipal water provided by the PA American Water Company (PAW) will be used to satisfy the demands of potable, sanitary and miscellaneous plant systems. The Susquehanna River is described as "an extremely ancient river, the existence of which can be traced back (at least) to the opening of the Atlantic following the Late Triassic/Jurassic rifting of eastern North America from NW Africa. During its long history, the Susquehanna has incised many hundreds of meters into the folded structure of the Appalachians, creating spectacular examples of superimposed drainage. Early studies of this landscape also revealed a number of 'peneplains', some of which are now known to be capped by fluvial deposits of the Susquehanna that pre-date this river's relatively recent entrenchment into its present narrow gorge" (Westaway, 2007). The Susquehanna River has also been subjected to multiple periods of glaciation. Four main periods of continental glaciation occurred in Pennsylvania with three glacial periods directly impacting the BBNPP site region. These glacial events occurred in the following order from oldest to youngest; Early Pleistocene, Early Middle Pleistocene, Middle Pleistocene, and Late Pleistocene. The oldest glaciation extended the farthest south, with each subsequent glacial event never advancing past the previous one, as shown on Figure 2.4-40. These older glacial advances are more difficult to identify due to the eroding attributes of more recent glaciers. The area south of the Late Pleistocene glacial limit is characterized by extensive colluvial deposits and other features of periglacial origin (Braun, 2004) including frost riving and congelifluction (Sevon, 1999). The limit of the Late Pleistocene glacial event, also known as the Late Wisconsinan (17,000-22,000 years), is marked by heads-of-outwash in the valleys with an 'indistinct' moraine on adjacent hillsides (Braun, 2004) and is labeled as Olean Till on Figure 2.4-40. The overall trend of the late Wisconsinan margin across northeastern Pennsylvania is N60°W. Hilltop striae on the Appalachian and Pocono Plateaus, within 30 miles (48 km) of the margin, indicate a regional ice flow direction of North-South to S20 °W (Braun, 1988). The Late Illinoian (132,000-198,000 years) glacial event advanced only a few miles from the more recent Late Wisconsinan event, as shown in Figure 2.4-40, and is identified by heads-of-outwash in the valleys and discontinuous patches of till or colluvium derived from till (Braun, 1988). Pre-Illinoian glaciations advanced approximatley 20-40 mi (32-64 km) beyond the Late Illinoian limit, as shown on Figure 2.4-40. Glacial lake sediments and two belts of ”markedly thicker glacial deposits” suggest that Pre-Illinoian era northeastern Pennsylvania was subjected to two glacial events (Braun, 2004). (Westaway, 2007) reports that during periods of Pleistocene Glaciation, the Susquehanna River flowed an additional approximate 248 mi (399 km), 186 mi (299 km) of which is now submerged beneath the Chesapeake Bay and another 62 miles (100 km) flowed over the continental shelf. During glacial retreats, large volumes of glacial melt-waters formed broad, high energy streams including the Susquehanna River, and other neighboring rivers such as the Delaware and Potomac Rivers that incised deep canyons into the continental shelf.

Approximately 7.5 mi (12 km) northeast of the BBNPP site, is the location of one of the largest landslides in Pennsylvania. Approximately 4 Ka ago, a rock block landslide on the south side of Schickshinny Mountain in which 20,260,000-27,450,000 yd^3 (15,490,000-21,000,000 m^3) moved 1,250 ft (381 m) onto the Susquehanna River floodplain and extended in, and partially diverted, the Susquehanna River (Inners, 1988). A rock block slide is "a translational slide in which the moving mass consists of a single unit that is not greatly deformed" (Varnes, 1978).

Another, much smaller, landslide was witnessed in 1947 in which rainfall, that deposited 6 inches (15 cm) of rain within 2 hours, likely caused approximately 122,000 yd^3 (93,300 m^3) to move downslope within a minute or two (Inners, 1988). Including the aforementioned landslides, thirteen rock block slides have been mapped between Nanticoke, Pennsylvania and Shickshinny, Pennsylvania (a distance of approximately 9 mi (14.5 km)) along the south side of Schickshinny Mountain, with a total volume of about 56,000,000 yd^3 (42,800,000 m^3) (Inners, 1988). All of these landslides, with the exception of the 1947 landslide, are prehistoric, having a maximum age of approximately 11 Ka, and were the likely results of a combination of the dipslope of Shickshinny Mountain being ultimately underlain by a weak mudstone, a relatively low dipping angle of the rock beds on the slope (approximately 20°), and the undercutting of the sandstone-mudstone bedding planes by the Susquehanna River. Even though porewater pressure, as a result of high moisture conditions in the area, was the most likely cause of many of these historic rock block slides, the larger landslides probably required a longer 'wet' season and/or multiple year high-moisture conditions. (Inners, 1988)

The highest land feature within a 5 mi (8 km) radius of the site is Nescopeck Mountain, to the southeast of the site, which reaches an elevation of about 2,368 ft (722 m) msl. The Susquehanna River elbows around the BBNPP site area to the east and south and is approximately 7,000 ft (2,134 m) from the site (at the closest point). Its floodplain, on average, is about 0.75 mi (1.2 km) wide, with an average surface elevation of about 513 ft (156.4 m) msl. The BBNPP onsite emergency supply will sit at elevation 674 ft (205.4 m) msl.

Given the seismic, topographical, and geologic evidence in the region (Section 2.5.1 and Section 2.5.2), and despite the historic landslides of the region mentioned above, the limited potential for upstream diversion or rerouting of the Susquehanna River (due to channel migration, river cutoffs, or subsidence) could not adversely impact safety-related facilities at the BBNPP site.

2.4.9.2 Regional Topographic Evidence

The BBNPP does not rely on the Susquehanna River for safe shutdown since the ESWEMS contains sufficient storage volume under emergency condition. The non-safety-related CWS water intake for BBNPP will be located on the Susquehanna River, about 300 ft (100 m) south of the existing SSES Units 1 and 2 intake structure. The Susquehanna River is channeled by two ridges, Lee Mountain and Shickshinny Mountain, northeast of the site while Nescopeck Mountain borders the south side of the Susquehanna River south and southeast of the BBNPP site. Within the 5 mi (8 km) radius of the site, the Susquehanna River flows over very competent bedrock, thus limiting erosion of the riverbed. Erosional deposits of stratified drift on the river banks, typically sand and gravel (as shown in Figure 2.4-40), were primarily deposited during deglaciation of the site area, but continues today at a significantly decreased rate.

The BBNPP site lies within the Middle Susquehanna Subbasin portion of the Susquehanna River Basin, which drains an area of approximately 3,755 mi^2 (9,725 km^2) (SRBC, 2008c). Water usage, throughout the entire Susquehanna River Basin, is closely governed and regulated by the SRBC in connection with varying other government agencies, as stated above. This includes the monitoring and maintenance of the fourteen major dams along the Susquehanna River and its adjoining tributaries. More information on the dams and reservoirs of the Susquehanna River Basin is provided in Section 2.4.4. Because the Susquehanna River is regulated, the possibility of river diversions is very unlikely.

2.4.9.3 Diversions Caused By Ice

A review of the Pleistocene history of the Susquehanna River shows the river underwent significant changes. During the Pleistocene pre-historic period, the Susquehanna River flowed several hundreds of miles longer, through the current day Chesapeake Bay and down the continental slope (Westaway, 2007). During the pre-historic Pre-Illinoian cold stage, part of the Susquehanna River, mainly the West Branch, was dammed near Montoursville, Pennsylvania by ice and resulted in the flooding and overflowing of the West Branch of the Susquehanna River into a nearby tributary, the Juniata River (Westaway, 2007). The approximate location of this ice dam is over 40 mi (64.4 km) west from the BBNPP site. Due to the distance from the site and intense cold conditions during this occurrence that are no longer experienced within the state (Sevon, 1999), a similar ice damming is highly unlikely to adversely affect the safety related structures at the site.

Even though the Susquehanna River is subject to varying amounts of floating ice during the winter months, the BBNPP Intake Structure, a non-safety related structure, is not impacted. The CWS Makeup Water pumps are located approximately 3 ft (0.9 m) below the design high water level of 525 ft (160 m) msl established for final design of the BBNPP Intake Structure. This design would not be subject to ice blockage or ice formed in the Susquehanna River.

Furthermore, the Susquehanna River freezing is not anticipated to cause ice flooding, because the probable 200-year high water elevation of 525 ft (160 m) msl was considered in the final design of the intake system. Ice, or ice flooding, will not cause a problem at the plant discharge, as the warm discharge water will keep the outfall open. A further discussion on the formation of surface ice and the potential for an ice jam is provided in Section 2.4.7.

Flooding due to ice jams as a result of ice break-up can be a problem during the winter months. For instance, jamming may occur at locations where floating ice is retained at bridges. There are 13 recorded instances of ice jams near Wilkes-Barre in the Susquehanna River based on a search of the "Ice Jam Database" maintained by the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL). Figure 2.4.7-1 illustrates ice jams within a 50-mile (80 km) radius. The most recent ice movement and ice jamming occurred on March 3, 2004 in the vicinity of Wilkes-Barre. Approximately 4.0 ft (1.2 m) of backwater was observed at the Wilkes-Barre USGS gauging station (USACE, 2008).

2.4.9.4 Site Flooding Due to Channel Diversion

Site flooding as a result of channel diversion does not affect the BBNPP site. However, the design basis flood elevation for the BBNPP site is determined by considering a number of different flooding possibilities. The possibilities applicable and investigated for the site include the probable maximum flood (PMF) on streams and rivers, potential dam failures, probable maximum surge and seiche flooding, probable maximum tsunami, and ice effect flooding. Each of these flooding scenarios was investigated in conjunction with other flooding and meteorological events, such as wind generated waves, as required in accordance with guidelines presented in Regulatory Guide 1.59 (NRC, 1977). Detailed discussions on each of these flooding events and how they were estimated are found in Section 2.4.2 through Section 2.4.7. Adequate drainage capacity will be provided to prevent flooding of safety-related facilities and to convey flood waters on the roofs and the buildings away from the plant site area.

All safety-related facilities for BBNPP are located at elevation 674 ft (205 m) msl. The highest flood on record of the Susquehanna River was the 1972 flood that occurred throughout the Mideast as a result of Hurricane Agnes. This 1972 flood recorded a peak stream flow of about

345,000 cfs (9,769 m^3/s) at Wilkes-Barre and 363,000 cfs (10,279 m^3/s) at Danville. Based on statistical analysis, a flood of this discharge is estimated to reach elevation 538 ft (164 m) msl near the plant site at the Susquehanna River under present channel conditions (USGS, 2008a) and (USGS, 2008b).

Because BBNPP is located at elevation 674 ft (205 m) msl, it is anticipated that the Susquehanna River flooding does not affect the plant. The plant site is dry with respect to major flooding on the Susquehanna River, and only a localized probable maximum precipitation (PMP) storm was considered for flood design protection of safety-related facilities.

The results of the analysis indicate that near the BBNPP site the maximum PMF water surface elevation of 670.66 ft (204.42 m) msl will occur at Walker Run. As a result, the plant site is 3 ft (1 m) above the Walker Run PMF.

The maximum water level due to local intense precipitation or the local PMP is estimated and discussed in Section 2.4.3.2. The maximum water level in the BBNPP power block area, due to a local PMP, is elevation 670.66 ft (204.52 m) msl. This water level becomes the design basis flood elevation for all safety-related facilities in the power block area. All safety-related building entrances in the power block are located above this elevation. Potential local flooding, even from extremely heavy rainfall, will be controlled by the plant site drainage system, as discussed in Section 2.4.3.2.

As discussed in Section 2.4.2, the maximum PMP water level in the ESWEMS Retention Pond is elevation 672.13 ft (204.87 m) msl, which is 1.87 ft (0.57 m) below the top of the dike at elevation 674 (205 m) msl. Flood protection measures are not required for the BBNPP ESWEMS. The grade level at the ESWEMS retention pond location is at elevation 674 (205 m) msl and elevation 674.5 (205.6 m) msl for the ESWEMS Pumphouse. The ESWEMS Pumphouse is 2.37 ft (0.72 m) above the peak estimated PMP water level. Therefore, flood protection measures are not required for these structures.

Section 2.4.2 anaysis shows that all safety-related facility entrances are located above peak PMP water levels and collection ditches prevent PMP sheet flows from reaching safety-related entrances. Futhermore. No dams or obstructions on the Susquehanna River or Walker Run would be permitted to be constructed by the PADEP and USACE that would create a flooding or problems for BBNPP without adequate redress.

2.4.9.5 Human-Induced Channel Flooding

Human-induced channel flooding of the Susquehanna River is not anticipated because the Susquehanna River flooding is monitored and controlled by the SRBC and the U.S. Army Corps of Engineers. There are no reported federal projects to channel or dam any portion of the Susquehanna River. FSAR Section 2.4.3 discusses the PMF on streams and rivers as a result of the PMP over the watershed. On Walker Run, no dams or obstructions would be permitted to be constructed that would cause flooding at the BBNPP site.

There are no dams within the Walker Run watershed. Although several water control structures are located within the Susquehanna River Basin upstream from the site, only eleven (11) dams are positioned on significant tributaries that drain into the Susquehanna River (Figure 2.4-15). During an upstream (from the proposed BBNPP Intake Structure) dam failure event, flooding resulting from the failure of these storage structures will not impact the safety-related structures. Section 2.4.4 discusses in depth the dam failure analysis.

Human induced, temporary flow cut off can occur on the Susquehanna River due to coffer damming for construction of a new bridge for example. Under these circumstances, the BBNPP emergency water supply would continue to be effective until river flow could be restored.

2.4.9.6 Alternate Water Sources

An alternate water source is not required for the BBNPP design. Following a postulated accident, the emergency safety-related water supply to the ESW System is initially supplied from basins that are located beneath each of the four ESWS cooling towers. Each of the four cooling tower basins holds sufficient volume of water to supply the ESW System for 72 hours. After the initial 72 hours, the ESWEMS Retention Pond supplies makeup water to the ESWS cooling tower basins for use by the ESWS during the following 27 days of the postulated accident duration. There is no potential of blockage of the safety-related ESWEMS Pumphouse due to channel diversions. Non-safety related water sources, such as water from the non-safety related CWS Makeup Water System, Raw Water Supply System, and municipal water system are also available, if needed.

2.4.9.7 Other Site-Related Evaluation Criteria

The potential for channel diversion from seismic or severe weather events is not considered to result in a loss of cooling water supply. Seismic Category I structures are designed for a seismic event and will be situated approximately 109 ft (33.22 m) above the highest flood on record for the Susquehanna River. Due to the limited likelihood of a seismic event at or within the site area and because the sides of the new forebay will be protected by vertical sheet pile walls, no additional measures are necessary to protect against a potential channel diversion due to seismic events. A collapse of the shoreline to the northeast and east of the BBNPP site during a seismic or severe weather event is assumed to not result in silt depositing in the forebay to such an extent that it would cause a loss of cooling water supply. A seismic event would result in the bulk of the collapsed material being deposited at the shoreline location of the failure. Normal waves and flow of the river would disperse this material slowly over a wide area. A severe storm could relocate shoreline sands and soils but is, again, dispersed over a wide area. A severe storm or collapse of nearby shoreline may result in the need for maintenance dredging of the Susquehanna River.

2.4.9.8 References

Braun, 1988. Glacial Geology of the Anthracite and North Branch Susquehanna Lowland Regiosn, p 1-25, D.Braun, 1988.

Braun, 2004. Late Wisconsin Deglaciation of the Great Bend-Tunkhannock Region of Northeastern Pennsylvania, Guidebook for the 67th Annual Reunion of the Friends of the Pleistocene, p 1-26, D. Braun, 2004.

Inners, 1988. Bedrock and Glacial Geology of the North Branch Susquehanna Lowland and the Eastern Middle Anthracite Field, 53rd Annual Field Conference of Pennsylvania Geologists, J.D. Inners Ed., p 120-123, J.D. Inners, October 1988.

NRC, 1977. Nuclear Regulatory Guide 1.59, Design Basis Floods for Nuclear Power Plants, Revision 2, U.S. Nuclear Regulatory Commission, August 1977.

Sevon, 1999. Pennsylvania and the Ice Age, Pennsylvania Geological Survey, 4th Series, Educational Series 6, W.D. Sevon and G.M. Fleeger, 1999.

SRBC, 2008c. Subbasin Information: Susquehanna River Basin Commission, Website: http://www.srbc.net/subbasin/middlsus.htm, Date accessed: May 22, 2008.

USACE, 2008. Ice Jam Database, Cold Regions Research and Engineering Laboratory (CRREL). Website: https://rsgis.crrel/usace.army.mil/icejam/ Date accessed: December 26, 2007.

Varnes, 1978. Slope Movement Types and Processes, in Schuster, R.L., and Krizek, R.J., eds., Landslides-Analysis and control: National Research Council, Washington, D.C., Transportation Research Board, Special Report 176, p 11-33, R.L. Schuster and R.J. Krizek, 1978.

Westaway, 2007. Late Cenozoic Uplift of the Eastern United States Revealed By Fluvial Sequences of the Susquehanna and Ohio Systems: Coupling Between Surface Process and Lower-Crustal Flow, Quaternary Science Reviews, Number 26, p 2823-2843, R. Westaway, 2007.}

2.4.10 Flooding Protection Requirements

The U.S. EPR FSAR includes the following COL Item in Section 2.4.10:

> A COL applicant that references the U.S. EPR design certification will use site-specific information to compare the location and elevations of safety-related facilities, and of structures and components required for protection of safety-related facilities, with the estimated static and dynamic effects of the design basis flood conditions.

This COL Item is addressed as follows:

{References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD 29), unless stated otherwise.

This section discusses the locations and elevations of safety-related facilities to identify the structures and components exposed to flooding. The safety-related facilities are compared to design basis flood conditions to determine if flood effects need to be considered in plant design or in emergency procedures.

The safety-related facilities for BBNPP are located at a minimum elevation 674 ft (205.4 m) msl. The highest flood of record on the Susquehanna River took place in 1972 during Hurricane Agnes. This 1972 flood recorded a peak stream flow of about 345,000 cfs (9,769 m^3/s) at Wilkes-Barre, PA on June 24th, 1972 and 363,000 cfs (10,279 m^3/s) at Danville on June 25th, 1972 (USGS, 2008a) (USGS, 2008b). On June 25, 1972 a river crest of 517.36 ft (157.7 m) msl and mean daily flow of 329,837 cfs (9,340 m^3/s) was recorded near the SSES intake structure (Ecology III, 1986).

The BBNPP site is approximately 157 ft (48 m) higher than the June 25, 1972 river crest at the SSES Intake Structure, therefore it is anticipated that the Susquehanna River flooding will not affect the plant. The BBNPP site is dry with respect to major flooding on the Susquehanna River, and only a localized Probable Maximum Precipitation (PMP) storm was considered for flood design protection of safety-related facilities.

The results of the analysis in Section 2.4.3 indicate that near BBNPP the maximum Probable Maximum Flood (PMF) water surface elevation is 670.96 ft (204.51 m) msl for the Walker Run.

Thus, the BBNPP site safety-related structures are approximately 3 ft (1 m) above Walker Run PMF. As a result, the plant site is not impacted due to major flooding on the Walker Run.

The PMF evaluation for SSES Units 1 and 2 shows that the PMF elevation on the Susquehanna River would reach an elevation of 548 ft (167 m) msl. The site elevation for SSES Units 1 and 2 is 670 ft (204 m) msl; with a 122 ft (37 m) difference in elevation for the existing PMF evaluation and the site grade. BBNPP site elevation is 674 ft (205 m) msl. This is 126 ft (38 m) higher than the PMF for SSES Units 1 and 2.

Grading in the power block area around the safety-related facilities is such that all grades slope away from the structures at a minimum of 1% towards collection ditches.

The safety-related ESWEMS Retention Pond is located on the east of the power block area, as shown on Figure 2.4-39, and is described in Section 2.4.8. Grading around the ESWEMS Retention Pond is sloped to keep surface stormwater from entering the pond. To prevent an overflow caused by malfunction of the makeup system or by rainfall accumulation in the ESWEMS Retention Pond, an outlet structure and spillway are provided to drain excess storage when the water surface in the pond exceeds the outlet crest elevation of 672 ft (205 m). Additional information related to potential flooding from the ESWEMS Retention Pond is provided in Section 2.4.8.

Additionally, the maximum estimated water surface elevations resulting from all design basis flood considerations, as discussed in Section 2.4.2 through Section 2.4.7, are well below the entrance and grade slab elevations for the power block safety-related facilities. Therefore, flood protection measures are not required in the BBNPP power block area.

A general arrangement figure of the ESWEMS area, a plan view figure of the intake, and a section view figure of the ESWEMS are provided in Figure 2.4-39. Flood protection measures are not required for BBNPP ESWEMS. The grade level at ESWEMS Retention Pond is elevation 674 ft (205.4 m) msl and 674 ft (205.4 m) msl for the ESWEMS pumphouse. The pumphouse is 2.37 ft (0.7 m) above the estimated PMP.

In addition to structural protection against static, dynamic, and erosive forces, the ESWEMS will be designed to remain free from flooding and from the intrusion of water.

The BBNPP Intake Structure at the Susquehanna River is not a safety-related facility. However, the BBNPP Intake Structure will be designed to take into account the flood elevation of 525 ft (160 m) msl.

In summary, the safety-related facilities are designed to withstand the combination of flooding conditions and wave-run up, including both static and dynamic flooding forces, associated with the flooding events discussed in Section 2.4.2 through Section 2.4.8.

2.4.10.1 References

Ecology III, 1986. Pre-Operational Studies of the Susquehanna River in the Vicinity of the Susquehanna Steam Electric Station, 1971-1982. December 1986.

USGS, 2008a. Peak Streamflow for Pennsylvania USGS 01540500 Susquehanna River at Danville, PA. Website: http://nwis.waterdata.usgs.gov/pa/nwis/peak?site_no=01540500&agency_cd=USGS&format=html, Date accessed: February, 2008.

USGS, 2008b. Peak Streamflow for Pennsylvania USGS 01536500 Susquehanna River at Wilkes-Barre, PA. Website: http://nwis.waterdata.usgs.gov/pa/nwis/peak?site_no=01536500&agency_cd=USGS&format=html, Date accessed: February, 2008.}

2.4.11 Low Water Considerations

The U.S. EPR FSAR includes the following COL Item in Section 2.4.11:

> A COL applicant that references the U.S. EPR design certification will identify natural events that may reduce or limit the available cooling water supply, and will verify that an adequate water supply exists for operation or shutdown of the plant in normal operation, anticipated operational occurrences, and in low water conditions.

This COL Item is addressed as follows:

{This section investigates natural events that may reduce or limit the available cooling water supply to ensure that an adequate water supply exists to shut down the plant under conditions requiring safety-related cooling. Specifically, any issues due to a low water level in the Susquehanna River are investigated in this section.

References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD 29), unless stated otherwise.

Section 2.4.11.1 through Section 2.4.11.7 are added as a supplement to the U.S. EPR FSAR.

2.4.11.1 Low Flow in Rivers and Streams

The BBNPP site sits on a relatively flat upland area, with the plant grade above the nominal Susquehanna River level. Figure 2.4-2 shows the location of the BBNPP site in relation to the existing SSES Units 1 and 2, the Susquehanna River, and Walker Run. The BBNPP site and is approximately 214 mi (38.6 km) downstream of the U.S. Geological Service (USGS) gauge located at Wilkes-Barre, and approximately 5 mi (8 km) upstream of Berwick.

BBNPP relies on the Susquehanna River to supply water for safety-related and non-safety-related purposes. BBNPP does not draw water from any streams or creeks located in the vicinity of the site; thus, low water conditions resulting from the low flow in these water bodies have no adverse impact on BBNPP.

The BBNPP discharge pipe extends approximately 310 ft (95 m) into the Susquehanna River (Figure 2.4-10). As a conservative approach, the probable minimum flow of 532 cfs (15 m^3/s) recorded at Wilkes-Barre was used as the design basis. The flow of 532 cfs (15 m^3/s) will bring the water level near the discharge line to approximately elevation 485.3 ft (147.9 m) msl (Soya, 1991). The BBNPP Intake Structure design will accommodate river levels as low as 484 ft (148 m) msl. The centerline of the discharge line is at elevation of 476 ft (145 m) msl, approximately 9 ft (3 m) below the estimated water level near the discharge line and 8 ft (2 m) below the established design low water level for the CWS intake; thus low water levels will not uncover the discharge pipe or affect the non-safety-related makeup water supplies.

2.4.11.2 Low Water Resulting from Surges, Seiches, Tsunamis, or Ice Effects

Since the effect from seiches and tsunamis on the site are negligible, as described in Section 2.4.5 and Section 2.4.6 respectively, these effects are not taken into account for the low water consideration. Section 2.4.7 includes a description of cases of ice formation or

ice-jams that may result in low water level. However, as concluded in Section 2.4.7, the possibility of ice jam formation on the Susquehanna River will not adversely affect the ability of the safety related Essential Service Water Emergency Makeup System (ESWEMS) to function properly.

2.4.11.2.1 Storm Surge Effect

Since the plant grade elevation of BBNPP is approximately 161 ft (49 m) above the 100-yr floodplain of the Susquehanna River, there are no effects due to storm surges or seiche flooding that would impact the site's safety-related facilities. Details of the storm surge effects are given in Section 2.4.5.

2.4.11.2.2 Tsunami Effect

Any effect from a tsunami-like wave is not credible. Details of the tsunami effects are given in Section 2.4.6.

2.4.11.3 Historical Low Water

Table 2.4-34 lists the location and period of record for USGS gauging stations at Wilkes-Barre and Danville located upstream and downstream of BBNPP site in the Susquehanna River (USGS, 2008a) (USGS, 2008b). The minimum annual water levels in the Susquehanna River and their corresponding stages on the Susquehanna River at Wilkes-Barre and Danville are listed in Table 2.4-34 and Table 2.4-35. These tables show the low flow statistics for Wilkes-Barre and Danville USGS gauging stations for almost 106 years of observed flow data.

Figure 2.4-42 shows the monthly minimum flow variations for Wilkes-Barre and Danville gauging stations. The minimum water level in the Susquehanna River at Wilkes-Barre was 509.13 ft (155.18 m) msl in 1964 (USGS, 2008f). The lowest river stage observed at Danville was 432.89 ft (132 m) msl in 1900 (USGS, 2008e). The minimum daily discharge in the Susquehanna River was 532 cfs (15 m^3/s) at Wilkes-Barre and 558 cfs (16 m^3/s) at Danville, both in September 1964. These flows may be considered as the probable minimum flows in the Susquehanna River at these respective stations.

Regulatory Guide 1.206 (NRC, 2007) does not mention the specific return period for the extreme low water level, but mentions the use of the 100-year drought as a design basis for non-safety related facilities. The 100-year low water level is the appropriate design level for the non-safety-related makeup water intake for the Circulating Water System (CWS). As a conservative approach, the probable minimum flow at the BBNPP site is selected as the design basis. The probable minimum flow is based on the Wilkes-Barre station, located upstream from the BBNPP site. The probable minimum flow of 532 cfs (15 m^3/s) recorded at Wilkes-Barre will bring the water level near the BBNPP Intake Structure to approximately elevation 485.3 ft (147.9 m) msl (Soya, 1991). Soya (Soya, 1991) also reports that flows ranging from 380 to 600 cfs (11 to 17 m^3/s) brings the water level near the SSES Ecology III lab, which is located approximately 1,620 ft (402 m) up river from the existing SSES river intake, to about elevation 485.1 to 485.5 ft (147.9 to 148.0 m) msl (Soya, 1991). These water levels are higher than the design CWS Makeup Water Intake low water level of 484 ft (148 m) msl and thus will not impact withdrawal of water from the Susquehanna River.

The low water levels recorded along the Susquehanna River near the BBNPP site were evaluated further using statistical methods to determine the recurrence interval associated with such low flow events (Linsley, 1992). Frequency analysis methods such as Weilbull, Gumbel and Log Pearson Type III distributions are common techniques used to estimate flood frequency events. However, by adjusting the procedure slightly to accommodate low flow

events when calculating the Weilbull recurrence intervals to establish an estimated frequency distribution, and by calculating the probability that the flow is less than (as opposed to greater than or equal to) a flow event of a given magnitude, all three (3) methods mentioned above can be used effectively to estimate the frequencies of low flow events.

The raw flow data from Wilkes-Barre and Danville gauging stations were analyzed using the: Weilbull, Gumbel and Log Pearson Type III distributions (Linsley, 1992) and (USGS, 2008g). These three probability distributions were considered before selecting the probability distribution that best fits the data. The equations for each probability density distribution is available (Linsley, 1992). Plots comparing the three (3) calculated frequency distributions, as well as the extrapolation of log Pearson Type III distributions at the Danville and Wilkes-Barre gage stations, can be found in Figure 2.4-42 and Figure 2.4-43, respectively.

Table 2.4-37 summarizes the recurrence intervals calculated for the record low flows at Wilkes-Barre and Danville gauging stations. Figure 2.4-44 and Figure 2.4-45 illustrate the discharge curves for Danville and Wilkes-Barre, respectively.

Using the drainage area ratio transfer method as suggested by the Pennsylvania Department of Environmental Protection (PADEP), low flow statistics were interpolated for the ungaged water supply intake located at Susquehanna River Mile 165 based on statistics that were developed using the data recorded at the upstream (Wilkes-Barre) and downstream (Danville) gauging stations (PADEP, 2008). When applying this method using the low flow statistics calculated at the Wilkes-Barre gage station, the 1-day, 10-year average low flow (Q1,10) was estimated as 818 cfs (23 m^3/s) (Table 2.4-36). The 7-day, 10-year low flow condition (Q7,10) estimated at Wilkes-Barre as the design low flow condition is 850 cfs (24 m^3/s).

Susquehanna River Basin Drought

The PADEP is responsible for the drought monitoring and management. The PADEP uses drought indicators (i.e. stream flow, soil moisture and precipitation) to provide timely identification of developing drought conditions. Stream flows have been widely used as an indicator of a developing drought. For this evaluation, 30-day average stream flow values computed by the USGS (USGS, 2008c) (USGS,2008d) were used to evaluate drought status based on stream flow percentiles. Figure 2.4-47 and Figure 2.4-48 shows the 30-day moving average for 2007 and 2008 stream flow for Danville and Wilkes-Barre USGS gauging station, respectively. For stream flows, the 25, 10 and 5 percentile color bands are used as indicators for drought watch, warning, and emergency, respectively.

When drought conditions occur, the SRBC commission has the authority to release water from the Cowanesque Reservoir to augment the Susquehanna River flow. Currently, this release is initiated by a flow of less or equal to 868 cfs (25 m^3/s) at the USGS Wilkes-Barre gauging station (Soya, 1991).

2.4.11.4 Future Controls

There are no future controls that could create or exacerbate low flow condition on that could affect the ability of potential BBNPP safety-related facilities to function adequately.

2.4.11.5 Plant Requirements

2.4.11.5.1 Minimum Safety-Related Cooling Water Flow

In terms of plant requirements, the ESWS provides flow for normal operating conditions, for shutdown/cool down and for Design Basis Accident (DBA) conditions. The ESWS pump in each

train obtains water from the ESWS cooling tower basin of that train and circulates the water through the ESWS. Heated cooling water returns to the ESWS cooling tower to dissipate its heat load to the environment. Makeup water is required to compensate for ESWS cooling tower water inventory losses due to evaporation, drift, and blowdown associated with cooling tower operation. Water to the ESWS cooling tower basins under normal operating is provided by the Raw Water Supply System. During shutdown/cool down conditions, makeup water is provided by the Essential Service Water Emergency Makeup System (ESWEMS). Water is stored in the ESWS cooling tower basin, which provides at least 72 hours of makeup water for the ESWS cooling tower following a DBA. After 72 hours have elapsed under DBA conditions, emergency makeup water to the tower basins is provided by the safety-related ESWEMS Retention Pond.

Under normal operating and normal shutdown/cooldown conditions, the ESWS cooling tower basins will be supplied with non-safety related makeup water pumped from the Raw Water Supply System (RWSS) at an average rate of 1,713 gpm (7,124 lpm). The makeup water serves to replenish water losses due to cooling tower evaporation and drift at an average rate of 1,142 gpm (4,322 lpm) and 2 gpm (8 lpm), respectively. The remaining water is released to the Susquehanna River as ESWS cooling tower blowdown at an average rate 569 gpm (2,154 lpm).

During normal plant shutdown/cool down operation, when all four trains of the ESWS are operating assuming a maximum makeup flow rate of 856 gpm (3,242 lpm) for each ESWS cooling tower.

Following a postulated accident, the ESWS cooling tower basins contain sufficient water to accommodate 72 hours of operation without makeup. Four trains of ESWS are assumed to be in operation to respond to an accident. After 72 hours of post-accident operatin, makeup flow is required to be supplied to the four operating ESWS cooling tower bains. The required makeup flow rate will reduce over time as heat loads get lower. The maximum requires makeup rate from the ESWEMS Retention Pond will be 856 gpm (3,242 lpm) to each ESWS cooling tower basin for 27 days, which combined with the initial three day inventory in the ESWS cooling tower basins will fulfill the 30-day post-accident ESWS requirement. Post-accident makeup to the ESWS cooling tower basins is pumped from the ESWEMS Retention Pond using pumps located in the safety-related ESWEMS Pumphouse. There are no low flow or low water conditions that could affect the ability of the ESWEMS to function properly.

2.4.11.5.2 Minimum Normal Operating Water Flow

Plant Requirements

The normal BBNPP plant water demand will be approximately 25,729 gpm (97,384 lpm). This water will be drawn from the Susquehanna River through the BBNPP Intake Structure.

2.4.11.5.2.1 Susquehanna River Flow

Water Supply Intake and Pumphouse Structure

The minimum daily flow of 532 cfs (15 m^3/s) recorded at the Wilkes-Barre gage station upstream from the BBNPP Intake Structure will bring the water level near the intake to approximately elevation 485.3 ft (147.9 m) msl (Soya, 1991). Therefore, the river intake system will accommodate river levels as low as 484 ft (148 m) msl, which is the low water level used for the intake design.

Water treatment will be required for both influent and effluent water streams. The Circulating Water Treatment System provides treated water for the CWS and consists of three phases: makeup treatment, internal circulating water treatment and blowdown treatment. The RWSS Water Treatment System provides treated water for the ESWS and power plant makeup. Detailed information regarding the water treatment process is described in ER Section 3.3.2

Circulating Water System

Under normal plant operating conditions, BBNPP uses the CWS to dissipate heat from the turbine condenser and Closed Cooling Water System. A closed-cycle, wet cooling system is used for BBNPP similar to the existing SSES cooling system. Makeup water for the CWS will be pumped from the Susquehanna River at an average makeup rate to the CWS of 23,808 gpm (90,113 lpm). Makeup water to the CWS cooling tower is required due to evaporation, drift and blowdown.

2.4.11.5.3 Plant Water Effluent

The plant water effluent will consist mainly of the blowdown from the CWS and ESWS cooling towers. The blowdown from the CWS and ESWS cooling towers and miscellaneous low volume waste are directed to the Combined Waste Water Retention Pond. The discharge velocity will be sufficient to mix the effluent with the river water for a 7-day, 10-year low flow condition estimated at Wilkes-Barre as the design low flow condition (850 cfs (24 m^3/s)), in order to minimize thermal effects. These anticipated discharge conditions meet the existing Pennsylvania Water Quality standards.

2.4.11.6 Heat Sink Dependability Requirements

The normal source of water for the CWS and ESWS is the BBNPP Intake Structure on the Susquehanna River. The ESWEMS Retention Pond will be the emergency source of water for the ESWS. The low flow conditions in the Susquehanna River do not influence the dependability of the ESWEMS Retention Pond since the ESWEMS Retention Pond is designed to provide a 27 day supply of water.

Design basis heat loads for various plant modes are provided in Section 9.2.5 and U.S. EPR FSAR Section 9.2.5.

2.4.11.7 References

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25 Pa. Code PAR 93.7. Specific Water Quality Criteria, The Pennsylvania Code (July 19, 2008)?}

2.4.12 GroundWater

The U.S. EPR FSAR includes the following COL Item in Section 2.4.12:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information to identify local and regional groundwater reservoirs, subsurface pathways, onsite use, monitoring or safeguard measures, and to establish the effects of groundwater on plant structures.

This COL Item is addressed as follows:

{This section provides a description of the hydrogeologic conditions present at, and in the vicinity of the BBNPP site. This section describes the regional and local groundwater resources that could be affected by the construction and operation of BBNPP. The regional and site-specific data on the physical and hydrologic characteristics of these ground water resources are summarized to provide the basic data for an evaluation of potential impacts on the aquifers of the area.

Section 2.4.12.1 through Section 2.4.12.6 are added as a supplement to the U. S. EPR FSAR.

2.4.12.1 Description and Use

2.4.12.1.1 Hydrogeologic Setting

The BBNPP site covers an area of 424 ac (172 ha) within the Owner Controlled Area of 882 acres (357 hectares). It is located on a flat upland terrace above the North Branch of the Susquehanna River (NBSR) in Luzerne County, Pennsylvania, approximately 3.0 miles (4.8 km) northeast of Berwick (Figure 2.4-2). The climate of the site area is primarily temperate, with warm, humid summers and cold winters. The topography of the site is gently rolling with an east-west trending set of ridges located north of the site. At the BBNPP, ground elevations range from 650 ft (198 m) above mean sea level (msl) along Walker Run in the southwest corner of the site up to elevations of approximately 800 ft (244 m) msl on the hilltop located just north of the power block (USGS, 1989). North of Beach Grove Road, the elevation rises sharply upward to elevations of 1,100 to 1,150 ft (335 to 351 m) msl along the crest of the ridge (Figure 2.4-3). Thus, total topographic relief in the immediate vicinity of BBNPP is approximately 500 ft (150 m).

The BBNPP site lies toward the northeastern end of the Ridge and Valley Province in northeastern Pennsylvania (Figure 2.5-8). The site is only 8 miles (13 km) south of the Appalachian Plateaus Province. Within the Ridge and Valley Province, the site lies in the Susquehanna Lowland Section (Figure 2.5-8), close to the NBSR. In the vicinity of the BBNPP site, the total thickness of Paleozoic sedimentary rocks overlying the Precambrian crystalline basement is approximately 33,000 ft (10,058 m), as described in Section 2.5.1.1.3.1.1. The Paleozoic sedimentary rocks form a wedge that is thickest in eastern Pennsylvania and gradually thins to the north and west across the state. The sedimentary rocks include sandstone, siltstone, shale, and limestone units, with lesser amounts of coal and conglomerate of Cambrian to Pennsylvanian age. The coal and conglomerate units are generally limited to the Mississippian- and Pennsylvanian-age rock formations (i.e., the uppermost Paleozoic formations). See Section 2.5.1 for additional details regarding stratigraphy and structural geology.

Ground water in the bedrock formations is present primarily in secondary openings, including fractures, joints, and bedding plane separations. Solution of calcareous material, especially along fractures and bedding planes, greatly increases the secondary porosity and permeability of the carbonate rock units. Primary porosity and permeability of bedrock is typically very low. As a result, the ability of the non-carbonate bedrock to store ground water or yield water to wells is typically less than the carbonate formations.

In the northeastern and northwestern corners of Pennsylvania, the bedrock is overlain by a variable thickness of glacial till, outwash, colluvium, kame, and kame terrace deposits of Pleistocene age (Figure 2.4-40). A large percentage of these surficial glacial materials were deposited during the last major glacial advance (Wisconsinan Stage; 17,000 to 22,000 years before present). The BBNPP site lies at the edge of where the Wisconsinan glacier made its farthest advance (Figure 2.4-40). As a result, end moraine deposits have been mapped at the BBNPP site (Crowl, 1980).

Extensive amounts of outwash sand and gravel were deposited in major stream valleys as the Illinoian and Wisconsinan Stage glaciers advanced and retreated. These outwash and kame terrace deposits constitute some of the most permeable aquifers in the region (Lohman, 1937) (Hollowell, 1971) (Taylor, 1984) (Williams, 1987). The outwash deposits in the Susquehanna River valley are especially thick and permeable in some places. In these glacial, alluvial, and other unconsolidated deposits, the porosity and permeability are primary (i.e., intergranular).

Most of Pennsylvania lies in three primary physiographic provinces (Figure 2.5-8). From northwest to southeast, these are:

- Appalachian Plateaus Province,
- Ridge and Valley Province, and
- Piedmont Province

A brief discussion of groundwater within the provinces is included below to provide an introduction to Pennsylvania's hydrogeologic regimes.

2.4.12.1.1.1 Appalachian Plateaus Physiographic Province

The Appalachian Plateaus Province extends over most of West Virginia, more than one-half of Pennsylvania, and small parts of westernmost Virginia and Maryland. The province lies approximately 8 miles (13 km) north and west of the BBNPP site. It is bounded on the east and southeast by the Ridge and Valley Province. The Appalachian Plateaus Province is underlain by Cambrian- to Permian-age (i.e., Paleozoic) rocks that are continuous with those of the Ridge and Valley Province, but in the Appalachian Plateaus Province the sedimentary rocks are nearly flat-lying, rather than being intensively folded and faulted (Trapp, 1997).

The Appalachian Plateau aquifers are contained in Paleozoic sedimentary rocks consisting mostly of shale, sandstone, conglomerate, and limestone. Coal beds are found in rocks of Pennsylvanian age. The water-yielding characteristics of these aquifers vary significantly due to local variations in lithology and thickness of the geologic units. Most of the productive aquifers lie within sandstones or conglomerates, but many limestone formations can also yield significant volumes of water (Trapp, 1997).

Sand and gravel deposits derived from glacial outwash, kame terrace, and ground moraine also form a very productive aquifer (Glacial Overburden aquifer) in this province.

2.4.12.1.1.2 Ridge and Valley Physiographic Province

The northeast-southwest trending Ridge and Valley Physiographic Province extends from West Virginia and Maryland to northeastern Pennsylvania, and covers approximately one quarter of Pennsylvania. This Ridge and Valley Province is bounded to the north and west by the Appalachian Plateaus Province and to the southeast by the Piedmont Province (Figure 2.5-8). the Ridge and Valley Province is characterized by layered Paleozoic sedimentary rocks that have been complexly faulted and folded. These rocks range in age from Cambrian to Pennsylvanian. Elongated mountain ridges are formed by well-cemented sandstones and conglomerates that are resistant to weathering. These ridges typically are the remnant flanks of breached anticlines. Limestone, dolomite, and shale are more easily weathered and eroded and, as a result, form the intervening valleys between the ridges.

The principal aquifers in the Ridge and Valley Province are carbonate rocks (limestone and dolomite) and sandstones that range in age from early to late Paleozoic Era. Most of the more productive aquifers are composed of carbonate rocks, primarily limestone, and are found primarily in the valleys. However, the water-yielding character of the carbonate rocks depends upon the degree of fracturing and development of solution cavities in the rock. Sandstone formations can also yield large volumes of water where these rocks are well fractured. Generally, the carbonate aquifers occur in early Paleozoic rocks; whereas, the sandstone aquifers are more frequently found in late Paleozoic rocks (Trapp, 1997).

Sand and gravel deposits derived from glacial outwash, kame terrace, and ground moraine also form a very productive aquifer (Glacial Overburden aquifer) in this province.

2.4.12.1.1.3 Piedmont Physiographic Province

The Piedmont Physiographic Province lies southeast of the Great Valley Section of the Ridge and Valley Province (Figure 2.5-8). The Piedmont Province is bounded on the east by the Fall Line. The Fall Line is a zone of rapids that marks the position where streams flow from Piedmont Province's consolidated rocks to the Coastal Plain's unconsolidated sediments. The Piedmont Province is about 60 miles (97 km) wide in southeastern Pennsylvania.

In Pennsylvania, the Piedmont Province is divided into the Piedmont Lowland Section, the Gettysburg-Newark Lowland Section, and the Piedmont Upland Section (Figure 2.5-8). With the exception of the Piedmont Lowland Section, the majority of the Piedmont Province consists mainly of rolling low hills and valleys developed on red sedimentary rock (DCNR, 2007a). Almost all of the underlying sedimentary rock dips to the north or northwest with relatively low relief. The Piedmont Lowland Section consists of broad, moderately dissected valleys separated by broad low hills and is developed primarily on limestone and dolomite rock highly susceptible to karst topography (DCNR, 2007b).

The Gettysburg-Newark Lowland Section runs adjacent to the Great Valley Section of the Ridge and Valley Province as shown in Figure 2.5-8. The Gettysburg-Newark Section consists mainly of rolling low hills and valleys developed on red sedimentary fluvial and lacustrine clastic rock deposits (Root, 1999). These sedimentary basins formed within early Mesozoic crustal rift zones and contain shale, sandstone, and conglomerate, interbedded locally with basalt lava flows and minor coal beds. In some places, these rocks are intruded by diabase dikes and sills (Trapp, 1997).

The Piedmont Upland section is underlain primarily by metamorphosed and complexly deformed sedimentary, volcanic, and plutonic rocks (Crawford, 1999). In this section, metacarbonate rocks of Cambrian and Ordovician age are located on the western side and Mesozoic clastic sedimentary rocks are located on the eastern side (Crawford, 1999). Elevation in the Piedmont Province ranges from 20 to 1,355 ft (6 to 413 m) msl (DCNR, 2007a) (DCNR, 2007b).

Aquifers in the Piedmont Province lie predominantly in the shallow, fractured igneous and metamorphic rocks. In topographically low areas, aquifers also exist within the carbonate rocks and sandstones (Trapp, 1997).

2.4.12.1.2 Regional Hydrogeologic Description

In the Ridge and Valley Province of Pennsylvania, groundwater is found in and produced from almost all of the rock formations, including shales and clay shales. This is partially due to the fact that they have been folded, faulted, and fractured. As a result, there are no extensive aquitards in the vicinity of BBNPP. In the clastic sedimentary rocks (mainly sandstones, siltstones, and shales), the ability of the rock to store and transmit groundwater is greatly affected by the degree of fracturing, the separation (aperture) or open space within the fractures, and the degree of cementation or infilling of the fractures and joints.

The bedrock stratigraphic units cropping out within and surrounding the BBNPP site are shown on Figure 2.4-49 and Figure 2.4-50. The BBNPP site is located on the north limb of the Berwick Anticlinorium, a moderately complex, first-order fold which trends in a northeast-southwest direction (N76°E) and plunges to the east-northeast at 2 to 4 degrees

(Inners, 1978). The fold is slightly asymmetrical within the Berwick quadrangle. Dips average about 35° on the south limb and 40° on the north limb; however, dip angles greater than 75° have been recorded on the north limb (Inners, 1978). The plan view of the surface bedrock units are shown on Figure 2.4-49 and Figure 2.4-50. A geologic cross section (A-A') oriented perpendicular to the centerline of the anticlinorium is shown in Figure 2.4-50. The Mahantango Formation (Middle Devonian) underlies nearly the entire area south of Beach Grove Road all the way southward to the NBSR, including the BBNPP and SSES sites. The formations that are younger than the Mahantango Formation are located north of the BBNPP site and are completely absent at the site. Formations that are older than the Mahantango Formation (i.e., Catskill Formation and Trimmer Rock Formation) lie deep beneath the BBNPP site and crop out to the west-southwest along the centerline of the anticlinorium (Figure 2.4-49 and Figure 2.4-50).

The bedrock is overlain by a variable thickness of glacial till, outwash, colluvium, kame, and kame terrace deposits of Pleistocene age (Figure 2.4-51). A large percentage of these surficial glacial materials were deposited during the last major glacial advance (Wisconsinan Stage; 17,000 to 22,000 years before present). Extensive amounts of outwash sand and gravel were deposited in major stream valleys as the Illinoian and Wisconsinan glaciers advanced and retreated. These outwash deposits contain some of the thickest, coarsest, best sorted, and most permeable glacial deposits in the region. As a consequence, the glacial overburden deposits, along with recent alluvium, constitute the most productive aquifer in the area (referred to as the Glacial Overburden aquifer).

Glacial overburden deposits and rock formations are described below, in order of youngest to oldest.

2.4.12.1.2.1 Glacial Overburden Aquifer

The Glacial Overburden aquifer unit includes all of the glacial outwash, kame, kame terrace, till, colluvium, alluvium, and other unconsolidated surficial deposits that overlie the bedrock, are saturated, and transmit groundwater (Figure 2.4-51 and Figure 2.4-52). This aquifer can be divided into two parts. The upland aquifer includes all of the unconsolidated deposits located above major stream valleys, including the overburden deposits immediately surrounding BBNPP. The valley aquifers include glacial outwash and recent alluvium contained within the lowland valleys of major streams (e.g., NBSR). These outwash and kame terrace deposits constitute some of the most permeable aquifers in the region (Lohman, 1937) (Hollowell, 1971) (Taylor, 1984). The outwash deposits in the Susquehanna River Valley are especially thick and permeable in places.

2.4.12.1.2.2 Catskill Formation

The Catskill Formation consists of three members: the upper Duncannon Member, the middle Sherman Creek Member, and the lower Irish Valley Member. The Duncannon Member consists of approximately 1,100 ft (335 m) of repetitive, fining-upward cycles of greenish-gray and grayish-red sandstone, siltstone, and shale; each cycle is generally 30 to 65 ft (9 to 20 m) thick (Williams, 1987). The Sherman Creek Member is approximately 2,500 ft (762 m) thick and consists of interbedded grayish-red shale, siltstone, and sandstone. The Irish Valley Member is approximately 1,800 to 2,000 ft (549 to 610 m) thick and also consists of interbedded shale, siltstone, and sandstone. However, this member is primarily greenish-gray to gray. Altogether, the Catskill Formation is approximately 5,400 to 5,600 ft (1,646 to 1,707 m) thick. The Catskill Formation is not present at the BBNPP site. It crops out at the ground surface approximately 1.3 to 2.9 miles (2.1 to 4.7 km) north of the site (Figure 2.4-49). The Duncannon Member is the

most resistant to erosion and forms the steeper southern flank of Lee Mountain (north of the site) and the northern flank of Nescopeck Mountain south of the NBSR (Figure 2.4-50).

2.4.12.1.2.3 Trimmers Rock Formation

The Trimmers Rock Formation consists of medium dark gray, very fine to fine-grained sandstone (25 percent), medium to dark gray siltstone and silty shale (60 percent), and medium dark to dark gray, silty clay shale (15 percent) (Inners, 1978). Sandstone occurs mostly in the upper 2,300 to 2,500 ft (700 to 760 m) in beds 2 in to 5 ft (5 to 152 cm) thick (Inners, 1978). The Trimmers Rock Formation is moderately resistant to erosion, underlies upland terrain of moderate relief, and forms the steep escarpments on the north and south sides of the Susquehanna River Valley (Inners, 1978). The formation thickness is approximately 3,000 ft (915 m) on the north side of the anticlinorium.

2.4.12.1.2.4 Harrell and Mahantango Formations

The Harrell Formation is a dark gray to grayish black clay shale and silty clay shale. It is noncalcareous, locally carbonaceous, pyritic, and frequently jointed. The Formation is about 120 ft (37 m) thick (Inners, 1978).

The Mahantango Formation is approximately 1,500 ft (457 m) thick and consists primarily of dark gray, silty to very silty claystone. The Tully Member (the uppermost section of the Mahantango Formation) is about 50 to 75 ft (15 to 23 m) thick and consists of argillaceous, fine-grained limestone and calcareous clay shale (Inners, 1978). Frequent joints and intense cleavage development causes the claystone to become splintery, chippy, and fragmented upon weathering. The Mahantango Formation has low to moderate resistance to weathering and forms lowland terraine, with knobs and ridges of moderate relief formed by more resistant silty and calcareous beds (Inners, 1978).

2.4.12.1.2.5 Marcellus Formation

The Marcellus Formation is approximately 350 ft (107 m) thick and consists of dark gray to black clay shale (Inners, 1978). It is slightly silty in the upper part, noncalcareous to slightly calcareous, pyritic, and carbonaceous. This formation has low resistance to weathering and forms lowlands, but also forms several knobs on the crest of the anticlinorium east of Berwick (southwest of BBNPP).

2.4.12.1.2.6 Onondaga and Old Port Formations

The Onondaga Formation is approximately 175 ft (53 m) thick and consists of medium dark gray, calcareous shale and gray argillaceous, fine-grained limestone (Inners, 1978).

The Old Port Formation is 100 to 150 ft (30 to 45 m) thick. It consists of dark gray, argillaceous, fine-grained limestone; medium to dark gray, calcareous clay shale; and medium gray, silty, cherty, fine-grained limestone (in descending stratigraphic order). Cleavage is moderately well developed.

2.4.12.1.2.7 Keyser and Tonoloway Formations

The Keyser Formation is composed of gray to bluish gray, thin- to thick-bedded limestone. The limestone is, in part, argillaceous and dolomitic. The Tonoloway Formation consists of laminated, gray to dark gray limestone. Dolostone occurs in the lower part. These two formations are the primary carbonate aquifers in the area.

2.4.12.1.2.8 Water Yielding Characteristics of the Geologic Materials

Domestic and nondomestic wells have been installed in every one of the geologic formations in the area. There are, however, large variations in hydraulic conductivity properties and well yields within each formation, and between formations. Hydraulic conductivities and well yields in the rock formations will be greater if the frequency of fracturing is high, apertures of the fracture openings are large, and the degree of cementation in the fractures is low.

Table 2.4-38 presents physical characteristics data for wells located in the NBSR Basin in Pennsylvania (Taylor, 1984). In general, wells have been installed in all formations and the median depth to water in all formations ranges from 16 to 60 ft (5 to 18 m) below ground surface (bgs). The reported well yields and specific capacities for these wells are listed in Table 2.4-39. Wells screened in alluvium and glacial deposits generally have the highest values of yield and specific capacities, which implies that the hydraulic conductivity of this aquifer is also generally greater than the underlying rock units. According to data in Table 2.4-39, 25 percent of the nondomestic wells screened in alluvium and/or glacial deposits can produce more than 500 gpm (1,893 lpm). Wells screened in the Lower Devonian Onondaga, Old Port, Keyser, and Tonoloway Formations display higher yields and specific capacities than the other rock units and, in some cases, the yields and specific capacities approach those of the alluvium and glacial deposits. The Lower Devonian formations consist of limestone, dolomite, and calcareous shale units. Dissolution along fractures, joints, and bedding planes has enlarged the openings and thereby created a greater number of water-producing zones that more efficiently transmit groundwater. Yields and specific capacities of wells screened in the Mahantango and Marcellus Formations are moderately high; 25 percent of the measured well yields were greater than 175 gpm (662 lpm).

Table 2.4-40 lists specific capacities for wells in a smaller area that includes the BBNPP site. For this set of data, the median and 75th-quartile specific capacities for the alluvium/glacial outwash aquifer were again the highest, followed by the specific capacities of the Lower Devonian formations (Onondaga, Old Port, Keyser, and Tonoloway).

When the well yield and specific capacity data are evaluated based on lithologic characteristics alone and not formation names (Table 2.4-40 and Table 2.4-41), it is clear that the wells screened in sand and gravel (e.g., alluvium, glacial outwash, and kame deposits) and carbonate rocks generally have the highest values of yield and specific capacity. A frequency distribution chart (Figure 2.4-53) shows the general relationships between well yields and lithologic rock type. Even shales have moderate well yields and specific capacities, so they cannot be classified as aquitards.

If well yields are grouped according to topographic setting (Figure 2.4-54), then the valley wells generally have greater well yields and the wells located on ridges and hilltops generally have lower yields. This can be explained by the fact that the carbonate rocks almost always occur at shallow depth in the valley bottoms and the ridges are generally capped by more resistant sandstones and siltstones. Thus, the correlation between well yields and topographic setting is actually a reflection of the relationship between well yields and rock lithologies. In addition, the most permeable sand and gravel deposits are located in the valleys.

Besides the factors of lithology and topographic setting, there are other factors which affect the fracturing of rocks, well yields, and specific capacities of wells. In general, the size and frequency of water-bearing zones decreases with depth, because the confining pressure increases and the fractures close as the weight of rock above increases. In the Berwick area, Williams (1987) has shown this to be true for both carbonate and non-carbonate rock types

(Figure 2.4-55). Thus, the hydraulic conductivities of all rock formations are expected to decrease with depth.

2.4.12.1.2.9 Precipitation, Water Budgets, and Groundwater Recharge

A water budget is a quantitative expression of the major components of the hydrologic cycle. Water that enters a basin as precipitation is balanced against water that leaves a basin as evapotranspiration and streamflow. This balance can be expressed by the following equation:

$$P = R_s + R_g + ET + \Delta S$$

where P = precipitation, R_s = surface or direct runoff, R_g = groundwater discharge to streams and wells, ET = water lost by evaporation and transpiration, and ΔS = change in the amount of water in storage. Total streamflow equals $R_s + R_g$. P, R_s, R_g and ΔS can be measured directly. ET is usually estimated as a residual of the equation.

The annual amount of precipitation in the NBSR Basin is highly variable, spatially and temporally. (Taylor, 1984) used precipitation data collected from eight weather stations in the NBSR Basin and several outside the basin to prepare a contour map showing the distribution of average annual precipitation for the basin (Figure 2.4-56). The data were collected between 1941 and 1970. Relatively low levels of precipitation occurred along the valleys of the Susquehanna and Lackawanna Rivers, and in the northwestern part of the Basin. Based on Figure 2.4-56, the average annual precipitation for the BBNPP site was approximately 38 to 39 in (97 to 99 cm) per year between 1941 and 1970. Average annual precipitation does not reflect the variability that can occur from year to year at a single location. Figure 2.4-57 presents the variability of annual precipitation at two stations in the southern part of the NBSR Basin. The total annual precipitation varied from 25 to 56 in (64 to 142 cm) per year between 1931 and 1980.

(Taylor, 1984) evaluated the water budgets for three drainage basins in the NBSR Basin of Pennsylvania, using data from a 20-year span (1961 - 1980). The locations of these three basins are presented in Figure 2.4-58. Towanda Creek and Tunkhannock Creek basins are both located in the Appalachian Plateaus Province; whereas, the Wapwallopen Creek Basin is located in the Ridge and Valley Province. The Wapwallopen Creek Basin is also located closest to the BBNPP site (approximately 2 miles (3.2 km) southeast from the BBNPP across the NBSR). A summary of the water budget analyses are presented in Table 2.4-42. The average annual rainfall for the Wapwallopen Creek Basin (44 in/yr (112 cm/yr)) was greatest, and so was groundwater discharge (14.2 in/yr (36 cm/yr)). From this table, the high variability in rainfall, surface runoff, and groundwater discharge was observed in all three basins. The rate of evapotranspiration was somewhat less variable. (Taylor,1984) noted that, of the three basins, groundwater recharge rates (approximately equal to groundwater discharge rate) were greatest in the Wapwallopen Creek Basin. He calculated that the average rate of groundwater recharge is approximately 14.2 in/yr (36 cm/yr) over the entire basin, which equates to 32 percent of the average annual precipitation. Figure 2.4-59 presents the variability that was determined for total runoff and groundwater runoff of Wapwallopen Creek Basin over a 60-year period. Annual groundwater discharge (equal to annual groundwater recharge) ranged from approximately 7 in/yr (18 cm/yr) to 22 in/yr (56 cm/yr).

Taylor (Taylor,1984) also calculated groundwater recharge rates per unit area, based on the total area of each watershed. Annual groundwater recharge rates for Wapwallopen Creek Basin ranged from 218 to 721 gpm/mi^2 (319 to 1,054 lpm/km^2) over 20 years, and averaged 469 gpm/mi^2 (685 lpm/km^2). Williams (Williams, 1987) analyzed two other small drainage

basins west of BBNPP (East Branch of Chillisquaque Creek and Fishing Creek) and found similar hydrologic conditions. Data presented in Table 2.4-42 compares a dry period and a wet period for the two basins evaluated by Williams (Williams, 1987). For the two basins evaluated by Williams (Williams, 1987), the annual evapotranspiration rate does not vary significantly between the two periods; however, surface water runoff and groundwater discharge did decline significantly during the dry period (Table 2.4-42).

2.4.12.1.2.10 Fluctuations in Groundwater Elevations

Water contained in aquifers is derived from surface infiltration and recharge processes. The amount of rise and fall in groundwater elevations is reflective of the annual cycles of recharge. During periods of low rainfall and high evapotranspiration, groundwater continues to flow toward streams, ponds, wetlands, wells, and other points of discharge. Low rates of recharge and increased ET (water loss by evaporation and transpiration) will cause groundwater levels to gradually decline. Groundwater elevations typically decline in summer and fall when precipitation rates are at their annual low and evapotranspiration rates are at their greatest.

The effective porosity of the aquifer also affects groundwater elevations. Aquifers with large effective porosities store more water. As a result, more ET or other stresses (such as pumping wells) on these aquifers have less of an effect on the groundwater elevations. Bedrock aquifers with low primary porosity and permeability characteristics do not store a lot of water. As a result, low recharge rates or high rates of groundwater removal will cause water levels in these aquifers to fluctuate more quickly and the magnitude of fluctuations is usually greater.

The USGS monitors groundwater elevations in select monitoring wells across the Commonwealth of Pennsylvania. Hydrographs of several of these monitoring wells located in Luzerne County are presented in Figure 2.4-60 and Figure 2.4-61. Hydrographs for two wells screened in the Catskill Formation (Figure 2.4-60) show that annual fluctuations of water levels were approximately 6 to 8 ft (1.8 to 2.4 m). The highest groundwater levels generally occurred in the winter and spring months each year. Hydrographs for two wells screened in the glacial outwash (Figure 2.4-61) show that annual fluctuations of water levels were approximately 8 to 14 ft (2.4 to 4.3 m). In general, the highest groundwater levels in these two wells also occurred in the winter and spring months each year.

2.4.12.1.3 Local and Site-Specific Hydrogeology and Sources

At the BBNPP, ground elevations range from 650 ft (198 m) above mean sea level (msl) along Walker Run in the southwest corner of the site up to elevations of approximately 800 ft (244 m) msl on the hilltop located just north of the power block (USGS, 1989). North of Beach Grove Road, the elevation rises sharply upward to elevations of 1,100 to 1,150 ft (335 to 350 m) msl along the crest of the ridge (Figure 2.4-3). Thus, total topographic relief in the immediate vicinity of BBNPP is approximately 500 ft (152 m). The creeks, ponds, and wetlands within the area influence the shallow aquifer systems beneath the site, and vice versa.

Geotechnical and hydrogeological investigations have provided information on the BBNPP site to depths of 600 ft (183 m) bgs. Subsurface information was collected from over 73 borings and monitoring wells. A detailed description of the geotechnical subsurface investigation, including the locations of the borings is provided in Section 2.5. Details regarding the depth and geologic materials encountered in these borings are also described in Section 2.5.

Forty-one (41) groundwater observation wells were installed across the site (Table 2.4-43). Twenty-six (26) of these wells were installed as 2 or 4 in (5 or 10 cm) diameter monitoring

wells. The remaining 15 monitoring wells are 1 to 1.5 in (2.5 to 3.8 cm) in diameter and were installed in geotechnical borings once the borings were completed. Table 2.4-43 specifies which monitoring wells were installed in geotechnical borings and which specific boring is associated with each well. Of the 41 monitoring wells installed, 14 of them are screened in the glacial overburden deposits, or Glacial Overburden aquifer ("A" wells), 19 are screened in shallow bedrock ("B" wells, including MW313C, excluding MW302B and MW307B), and 8 are isolated in deeper bedrock which are 175 ft (53 m) bgs or deeper ("C" wells, including MW302B and MW307B, excluding MW313C). Monitoring wells MW302B and MW307B were originally intended to be "B" wells. However, shallow bedrock was very tight with few water-bearing zones. Hence, these two wells were drilled deeper than originally intended and are now grouped with the "C" wells. The total depth of Monitoring Well MW313C was originally intended to be 200 ft (61 m) deep. However, blockage occurred near the bottom of the boring and the well could not be installed down to 200 ft (61 m) bgs. Instead, the bottom portion of the boring was grouted and the well screen was set at a depth of 130 ft (40 m) bgs. Therefore, this well is grouped with the shallow bedrock "B" wells.

The locations of monitoring wells are presented on Figure 2.4-62. 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 site. Well clusters were installed at selected locations to determine vertical gradients. Monthly water levels were measured in monitoring wells from October 2007 through September 2008 (Table 2.4-44). Water level elevations were also measured monthly in four ponds and seven stream locations. The surface water monitoring locations are shown on Figure 2.4-63. Surface water elevation data are tabulated in Table 2.4-45. The water levels in the four ponds are assumed to be continuous with the local water table in the glacial overburden, and have been used to construct the potentiometric surfaces for the Glacial Overburden aquifer.

Figure 2.4-64 shows the locations of two hydrogeologic cross sections, which are presented in Figure 2.4-65 and Figure 2.4-66. They extend through the entire BBNPP site and continue south and east, respectively, to the Susquehanna River. These cross sections are based on the geotechnical borings and monitoring wells installed at the BBNPP site, monitoring wells at the SSES, and domestic wells north and south of BBNPP.

2.4.12.1.3.1 Geohydrology

The elevations, thicknesses, and descriptions of the geological materials comprising the geological strata encountered to depths up to 600 ft (183 m) bgs were determined from BBNPP geotechnical and hydrogeological borings. Geotechnical and geological descriptions of the material encountered are described in Section 2.5.

2.4.12.1.3.1.1 Glacial Overburden Aquifer

The Glacial Overburden aquifer consists almost entirely of sand and gravel deposited during the Pleistocene Epoch. These deposits include stratified kame, kame terrace, and outwash, as well as unstratified ground moraine, end moraine, and colluvial deposits. On the upland terrace occupied by the BBNPP and SSES, the glacial deposits are 0 to 100 ft (0 to 30 m) thick. Figure 2.4-67 presents a map showing the saturated thickness of the glacial overburden for the entire BBNPP site. The greatest thickness of overburden at the BBNPP site (approximately 60 ft (18 m)) occurs along Beach Grove Road on the north side of the site (at monitoring well MW305C) and southeast of the power block area at monitoring well MW313B).

At the SSES, kame and glacial outwash deposits are up to 100 ft (30 m) thick near the north and eastern sides of the Spray Pond. There is an elongated trough of glacial deposits that

trends east-west and parallels Beach Grove Road. This channel thins to the west near the MW303 monitoring well cluster and drops in elevation as it passes eastward through the SSES property. SSES production wells TW-1 and TW-2 are screened in this elongated wedge of glacial sand and gravel. This trough is shown on Figure 2.4-68, which displays the topography of bedrock erosional surface. The "northern trough" probably represents an outwash channel that was deeply eroded by glacial meltwater as the Wisconsinan glacier advanced, and was filled by outwash, kame, and moraine deposits as the glacier overrode the site and then retreated. The northern trough drops in elevation to the east and empties into the Susquehanna River Valley deposit.

A second trough of thick glacial sand and gravel deposits starts near Confers Lane Road (County Road T-438), trends west-southwest, and passes through the southern edge of the BBNPP power block area (Figure 2.4-68 and Figure 2.4-69). As mentioned previously, the greatest thickness of glacial sand and gravel deposits has been measured in the "southern trough" at monitoring well MW313C (Figure 2.4-69).

The northern trough is bounded on the north side by Beach Grove Road and the ridge to the north formed by Trimmers Rock Formation (resistant siltstone and sandstone). The northern trough is separated from the southern trough by a series of hills which represent Mahantango Formation bedrock highs. This series of hills paralleling the bedrock strike represents the more resistant Tully Limestone Member that is found at the top of the Mahantango Shale (described below). These hills include the bedrock high that occurs below the cooling towers at the SSES, the two hills on the northern side of the BBNPP site (location of the CWS Makeup Water cooling towers and apple orchard), and another hill located directly west of the BBNPP cooling tower on the west side of Walker Run. These hills are dissected by small creeks and drainages that run north to south. Walker Run flows through the western notch that separates the hills on the BBNPP site from the hill located west of Walker Run (Figure 2.4-68). A southward-flowing, unnamed creek flows through the eastern notch that separates the two BBNPP hills from the SSES bedrock high. The SSES West Building lies in the bedrock low that separates the SSES bedrock high from the BBNPP bedrock hills (Figure 2.4-68).

Another set of hills (bedrock highs) lie along the southern edge of the BBNPP site and extends westward on the west side of Walker Run and eastward onto SSES property (Figure 2.4-68). Walker Run flows southwestward through a gap between the bedrock hills located halfway between surface water gauging stations G2 and G13 (Figure 2.4-63). Groundwater in the southern trough also discharges to the southwest through this gap.

The thickness of the glacial overburden varies from 12.5 to 62.0 ft (3.8 to 18.9 m) in the vicinity of the power block. With the exception of some loose sand pockets, the overburden consists of over-consolidated, brown silty sand and sand containing gravel and large rounded cobbles and boulders. The presence of the boulders increases with depth.

2.4.12.1.3.1.2 Harrell Shale

The Harrell Shale is approximately 120 ft (37 m) thick, is located along the north edge of the site, and dips to the north beneath the ridge of Trimmers Rock Formation. Because the Harrell Shale is weaker and less resistant to weathering and erosion, the northern trough has formed where the Harrell Shale crops out. Lithologically, the Harrell Shale is similar to the noncalcareous Mahantango shale units. It is believed the hydraulic properties of the Harrell Shale are similar to those of the Mahantango Shale (Section 2.4.12.3.2.2)

2.4.12.1.3.1.3 Mahantango Shale

The Mahantango Shale is approximately 1,500 ft (457 m) thick. The uppermost portion of the formation (Tully Member) crops out in the hills where the BBNPP cooling tower is located (Figure 2.4-49). Shale, calcareous shale, and silty shale units of this formation are the uppermost bedrock southward and eastward from the BBNPP site to the Susquehanna River (Figure 2.4-49). Because the Harrell and Mahantango shales are so similar, they will be treated as a single, continuous bedrock aquifer in the area. The shale aquifer is folded, jointed, and fractured. The degree of fracturing is one of the most important factors that affects the hydraulic conductivity of the Mahantango and Harrell Shales, as discussed in Section 2.4.12.3.2.2. The exact depth to the next formation (Marcellus Shale) is unknown but is believed to be 1,000 to 1,200 ft (300 to 365 m) below the BBNPP ground surface. In addition, because of its depth, the hydraulic conductivity of the Marcellus Formation is expected to be much lower than the hydraulic conductivity of the Mahantango Shale. Therefore, the evaluation of the groundwater flow system does not include the Marcellus Shale or older (deeper) formations.

2.4.12.1.4 BBNPP Groundwater Use Projections

Surface water from the Susquehanna River will provide the cooling water during the operation of the BBNPP. The BBNPP Intake Structure is located 700 ft (213 m) south of the SSES water intake structure. The new cooling water pipelines will travel up the hillside and skirt the southern side of the SSES and enter the BBNPP site on the eastern side.

A separate water line will be installed and will bring potable water from the south to the BBNPP site. The potable water line will be installed along Confers Lane and will bring the potable water from a main supply pipeline located along U.S. Route 11. This water, supplied by a municipal water supplier, will be used as a source of drinking water and other non-cooling purposes during plant operation. No on-site groundwater use is planned during plant operation.

It is currently estimated that a peak water demand of up to 1,200 gpm (4,542 lpm) will be required for BBNPP construction activities (demands include those for construction personnel, concrete manufacturing, dust control, and hydro testing and flushing). Average construction demand will be less. Groundwater extracted from the power block area and the ESWEMS Retention Pond during excavation will be a source of water used during construction. Off site water will be trucked to the site during construction activities, as needed.

Construction activities at the BBNPP should not adversely affect the local or regional groundwater systems. Groundwater will be pumped from the glacial overburden aquifer in order to keep the excavations dry. A slurry wall, diaphragm wall, or other type of subsurface flow barrier will be installed around the power block area before excavation is initiated in order to minimize groundwater intrusion into the excavations, as discussed in Section 2.5.4. Thus, groundwater extraction should be minimal (e.g., less than or equal to 600 gpm (< 2,271 lpm)) during construction.

There are currently no known or projected site discharges that could affect the local groundwater system.

2.4.12.2 Sources

2.4.12.2.1 Regional Groundwater Use

Groundwater is used as a source of water within the Ridge and Valley Province of Pennsylvania. The area is dependent on groundwater for domestic purposes because the major public water supplies are few and generally separated by large distances. Therefore, homes and non-residential buildings often rely on small wells to supply potable water. An objective of this section is to discuss the U.S. Environmental Protection Agency (USEPA) sole source aquifers within the region, to identify and determine impacts to these aquifers due to the construction and operation of the BBNPP, and to describe the following: groundwater use in northeastern Pennsylvania, current users in Luzerne and Columbia counties, current SSES groundwater use, and expected future groundwater demand for Luzerne County.

2.4.12.2.2 Sole Source Aquifers

The Sole Source Aquifer (SSA) Program, which is authorized by the Federal Safe Drinking Water Act, allows for protection when a community is dependent on a single source of drinking water and there is no possibility of a replacement water supply to be found. The USEPA defines a sole or principal source aquifer as one which supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer (USEPA, 2008).

The BBNPP site is located in USEPA Region 3 (Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia). There are six sole source aquifers in this region (Figure 2.4-70). One of these aquifers, the Seven Valleys aquifer, is located in York County, Pennsylvania along the Pennsylvania-Maryland border. A second sole-source aquifer, the New Jersey Coastal Plain aquifer, is located in New Jersey. However, the Delaware River which is located along the Pennsylvania-New Jersey border is considered a source of recharge for the New Jersey Coastal Plain aquifer. The BBNPP site lies approximately 55 miles (89 km) west of the Delaware River and approximately 90 miles (145 km) north of the Seven Valleys aquifer. The other four sole-source aquifers are located in Maryland and Virginia and are more than 100 mile (161 km) distance from the BBNPP site. All six of these sole source aquifers are beyond the surface water and groundwater flow systems of the BBNPP, and will not be impacted by any activities at the site.

2.4.12.2.3 Northeastern Pennsylvania Groundwater Use

Groundwater is used extensively as a source of potable water and other purposes in northeastern Pennsylvania. Groundwater resources in northeastern Pennsylvania have been evaluated since the 1930's by the Pennsylvania Bureau of Topographic and Geologic Survey (PGS) (Lohman, 1937) (Hollowell, 1971) (Taylor, 1984) and more recently by the USGS (Williams, 1987).

The majority of groundwater use is concentrated along the major glacial outwash valleys (e.g., North Branch Susquehanna River, Chemung River, Lackawanna River) and in areas of highest population density. In 1970, the total water use in the NBSR Basin (Pennsylvania portion) was estimated to be approximately 308 MGD (1.16E+09 lpd), as shown in Table 2.4-46. Of this amount, 44.2 MGD (1.67E+08 lpd), or 14.4 percent, was obtained from groundwater. The four largest users of groundwater, in order from largest to smallest users, were public supplies, mineral extraction and processing, domestic supply, and industrial supply. Since 1970, underground mining of coal in the northern and eastern-middle anthracite coal basins has virtually ceased, so the extraction of groundwater by the mineral industry sector has declined drastically since 1970.

In 1995, the USGS estimated use of groundwater in the North Branch Susquehanna River Basin (Pennsylvania portion) was approximately 32 to 50 MGD (1.2E+08 to 1.9E+08 lpd) (Figure 2.4-71), or nearly the same as the estimated groundwater use in 1970. In the smaller portion of the watershed containing the BBNPP (i.e., Middle Susquehanna Basin), groundwater use was approximately 21 to 30 MGD (0.79E+08 to 1.14E+08 lpd)(Figure 2.4-71).

2.4.12.2.4 Luzerne and Columbia Counties Groundwater Use

The Pennsylvania Department of Conservation and Natural Resources (DCNR) maintains a state Ground Water Information System (PaGWIS). This database has been consolidated from numerous sources, including the USGS and the PGS. PaGWIS is designed around a comprehensive modification of the USGS's Ground Water Site Inventory (GWSI) national database, which is part of its WATSTORE system, a national database developed to manage water data. The PaGWIS database contains information on 44,411 wells and 1,538 springs from the GWSI database and is current through July 1998 (DCNR, 2008a).

PaGWIS also contains information regarding 165,827 wells (123,351 of which have latitude and longitude values) from the PGS' Water Well Inventory (WWI), which Pennsylvania uses to manage data supplied to them by water well drillers (DCNR, 2008a). Data submission began in 1966 using paper forms. Latitude and longitude values were determined in the office by interpreting both handwritten directions and a hand-drawn map supplied by the drilling companies. Most of the location and data entry work has been done by temporary employees of the agency, so it is of varying reliability (DCNR, 2008a). No data entry has been done since August of 1994 (DCNR, 2008a).

Data on selected public water supply wells, which was provided by the PADEP, Bureau of Water Supply Management, has also been entered into the PaGWIS database. The PaGWIS contains information regarding 9,067 public water supply wells which were not present in either the WWI or the GWSI (DCNR, 2008a). Many of these wells were constructed prior to the inception of the WWI database.

Data extracted from the PaGWIS for a 25-mile (40-km) radius around the BBNPP are listed in the Environmental Report Table 2.3-33. These wells, for which location coordinates are available, are presented in Figure 2.4-72. The area defined by the 25-mile (40-km) radius includes all of Columbia County, most of Luzerne County, and parts of seven other counties. Data extracted from the PaGWIS for a 5-mile (8-km) radius around the BBNPP are listed in Table 2.4-47. The wells, for which location coordinates are available, are presented in Figure 2.4-73. The wells dislayed in Figure 2.4-72 and Figure 2.4-73 are categorized as public, industrial, domestic, commercial, and other uses (Note: these wells include wells that were installed as monitoring wells). The majority of the wells are categorized as domestic wells. Within the 5-mile (8-km) radius (Figure 2.4-73), there are a total of 16 public supply wells (Table 2.4-47). Three of these are located in Columbia County (in Berwick) and 13 are located in Luzerne County.

The PADEP maintains a second database containing information on Pennsylvania groundwater wells (PADEP, 2008d). Data entries extracted from the PADEP database for 25-mile (40-km) and 5-mile (8-km) radii are listed in Table 2.4-48 and Table 2.4-49, respectively. The locations of these wells are presented on Figure 2.4-74 and Figure 2.4-75, respectively. This database has fewer entries than the PaGWIS. Most of the wells within the 25-mile (40-km) radius (Figure 2.4-74) and all 13 of the wells present within a 5-mile (8-km) radius (Figure 2.4-75) are categorized as "industrial use" wells.

A third list of well users is maintained by the PADEP, Division of Drinking Water Management, and is referred to as the Drinking Water Reporting System (PADEP, 2008b). The wells listed in this database provide public supply and can be searched by county and size. The wells listed for Columbia and Luzerne counties are presented in Table 2.4-50. The largest water supply system in these two counties using groundwater is the Pennsylvania American Water Company-Berwick District, which serves a population of about 16,000 people through approximately 6,300 connections in five municipalities. Raw water is obtained from four wells located at the company's Canal Street pumping station in Berwick. These wells are screened in bedrock, approximately 87 to 180 ft (27 to 55 m) below ground surface on the north bank of the Susquehanna River. The combined potential yield of the four wells is approximately 4.60 MGD (1.74E+07 lpd). The average production rate is 1.74 MGD (6.58E+06 lpd) and the maximum daily production rate is 2.48 MGD (9.39E+06 lpd)(PPL, 2006).

2.4.12.2.5 Susquehanna SES Units 1 and 2 Groundwater Use

The SSES provides potable water for drinking, pump seal cooling, sanitation, and fire protection through its own on-site groundwater well system. This system consists of two wells (TW-1 and TW-2) which are located approximately 1,200 ft (366 m) northeast of the reactor building (Figure 2.4-76). Both of these wells are screened in the glacial overburden deposits (sand and gravel) and are approximately 75 ft (23 m) deep (CRA, 2007). The potential production capacitities of TW-1 and TW-2 are approximately 50 and 150 gpm (189 and 568 lpm), respectively (PPL, 1989). TW-2 is the primary well for water supply; TW-1 is the back-up well.

Three additional wells provide water for drinking and/or sanitary use for SSES-owned buildings adjacent to the plant site on an intermittent basis. They are located at the West Building (former Emergency Operations Facility), Energy Information Center (EIC), and Riverlands Recreation Area (Figure 2.4-76). These five wells are screened in the glacial overburden and/or Susquehanna River alluvium. There are other SSES wells, but they are used infrequently or not at all.

2.4.12.2.6 Northeastern Pennsylvania Groundwater Demands

The PADEP, along with the Statewide Water Resources Committees, and six Regional Water Resources Committees, is currently developing a new State Water Plan in response to the Water Resources Planning Act (Act 220 of 2002). This Act calls for the State Water Plan to be prepared by March 2008, and updated every 5 years thereafter (PADEP, 2008c). This State Water Plan replaces the last plan that was developed between 1975 and 1983. When completed, this updated Plan will provide goals and recommendations to attain sustainable water use over a 30-year planning horizon. The Plan includes inventories of water availability, an assessment of current and future water use demands, assessments of resource management alternatives, and proposed methods of implementing recommended actions. One of the actions proposed in the new Plan is to identify and evaluate Critical Water Planning Areas, where the water demand exceeds, or threatens to exceed, water availability.

In June 2005, the SRBC published a "Groundwater Management Plan for the Susquehanna River Basin" (SRBC, 2005). The goals of the SRBC Plan are similar to the Pennsylvania Plan, namely monitor and manage the water resources in order to attain long-term sustainable use of the resource. The SRBC has identified several geographic areas in the Susquehanna River Basin where existing or projected groundwater withdrawals and uses are anticipated to exceed long-term sustainability or cause frequent conflicts between users. Areas where demand will exceed sustainable resources are termed Potentially Stressed Areas (PSAs) by the SRBC. Areas where the permeabilities of the rocks are low and the available groundwater

resource is small are termed Water Challenged Areas (WCAs) (SRBC, 2005). SRBC-defined PSAs and WCAs are shown on Figure 2.4-77. To date, the SRBC has classified eight areas as PSAs and two areas as WCAs. As observed in Figure 2.4-77, there are no PSAs or WCAs located in or near Luzerne or Columbia counties.

The state projections for population trends predicts that Luzerne County will have a 7 percent decrease in population between 2000 and 2030 (PADEP, 2008a). This suggests that the demand for groundwater will also decline over the next 20 to 30 years. The abundant supply of groundwater and the declining demand for groundwater use in Luzerne and Columbia counties means that groundwater supplies will not be overdrafted in the two counties, and demand will not surpass available supplies in the future.

2.4.12.3 Subsurface Pathways

2.4.12.3.1 Observation Well Data

Water level data measured from groundwater observation wells and surface staff gauges installed for the BBNPP site were used to:

- develop groundwater potentiometric surface maps,
- determine groundwater flow directions (horizontal and vertical) and hydraulic gradients,
- evaluate short-term and seasonal changes in surface water and groundwater elevations and gradients,
- identify areas of potential groundwater recharge and discharge, and
- calculate flow velocities of groundwater.

A total of 41 observation wells with depths extending to 400 ft (120 m) bgs were installed in September and October 2007 (except MW301C, which was installed in May 2008). Observation wells were installed in three different groundwater-bearing intervals (Table 2.4-43):

- 14 wells were screened in the Glacial Overburden aquifer at depths of 9.2 to 76.0 ft (2.8 to 23.2 m) bgs ("A" wells),
- 19 wells were screened in shallow shale bedrock 50 to 181 ft (15 to 55 m) bgs ("B" wells, including MW313C, and excluding MW302B and MW307B), and
- 8 wells were screened in the Deep Shale Bedrock aquifer at 170 to 400 ft (52 to 122 m) bgs ("C" wells, excluding MW313C, and including MW302B and MW307B).

The Glacial Overburden 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 groundwater 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 the division between the "Shallow" and "Deep" Bedrock aquifers.

Monitoring well locations are shown in Figure 2.4-62. 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 monitoring 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, vertical hydraulic gradients, and vertical differences in hydraulic conductivity.

Water level measurements in monitoring well MW311C indicate that the well is very slow to recover after the initial installation and development. The water level measurements from this well indicate that the water level is rising very slowly and do not correspond to other water levels measured in the vicinity. Accordingly, the groundwater elevation maps, flow directions, and flow rates presented below do not consider data from this well.

The geotechnical borehole (B301) corresponding to Monitoring Well MW301C was drilled in September 2007, but was left as an open borehole until geophysical testing could be completed. The well (MW301C) was not installed until May 2008. As a result, measurements of water levels in this well became available starting in May 2008.

Between October 2007 and September 2008, water levels in the monitoring wells were measured monthly to characterize seasonal trends in groundwater levels, flow directions, and hydraulic gradients for the BBNPP site. In addition, pressure transducers were installed in six monitoring wells and two surface water monitoring stations between April and September 2008 to evaluated short-term fluctuations in water level. The following groundwater potentiometric surfaces, hydraulic gradients, and temporal trends are based on these data.

2.4.12.3.1.1 Glacial Overburden Aquifer

Surface water and groundwater flows from north to south through the notches between the hills located on the south side of Beach Grove Road. Walker Run flows southward through the "western notch" and the unnamed tributary of Walker Run flows through the ”eastern notch” (Figure 2.4-68). Groundwater elevations measured in the Glacial Overburden aquifer are tabulated in Table 2.4-44. In addition, elevations of four ponds (Table 2.4-45) have been used to map the water table surface in the Glacial Overburden aquifer.

The data exhibit temporal variability in groundwater elevations during the observation period (October 2007 to September 2008). Groundwater elevations versus time for the ten well clusters are plotted in Figure 2.4-78 through Figure 2.4-84. A seasonal influence during this monitoring period was observed: lower groundwater elevation generally occurred in fall (October and November 2007), followed by gradually increasing levels in winter, peak groundwater elevations in February and March 2008, and decreasing groundwater elevations in April through September 2008.

For the Glacial Overburden monitoring wells, the lowest elevations generally occurred in October 2007 and the highest elevations occurred in February and March 2008. The differences between the annual high and low elevations for each well ranged from 1.67 to 6.31 ft (0.51 to 1.92 m). The greatest annual variations occurred in the MW302 cluster and MW309A. Less than 5 ft (1.5 m) of variation occurred in each of the other Glacial Overburden wells.

The monthly groundwater elevation data (Table 2.4-44) and the monthly surface water elevation data for four ponds (Table 2.4-45) were used to develop groundwater elevation contour maps for the Glacial Overburden aquifer. These maps are presented for October 2007 (fall), January 2008 (winter), March 2008 (spring), and July 2008 (summer) (Figure 2.4-85 through Figure 2.4-88, respectively).

Groundwater levels measured in MW303A are the highest measured anywhere in the Glacial Overburden aquifer. MW303A is located near a surface water and groundwater divide in the northern trough of the Glacial Overburden aquifer (Figure 2.4-85 through Figure 2.4-88). Groundwater in the glacial overburden near this point flows either westward toward Walker Run or flows eastward toward the SSES Spray Pond area. Some groundwater in the northern trough along with surface water in the unnamed tributary flows southward through the eastern bedrock notch and enters the southern trough.

In the southern trough (where the BBNPP power block is located), groundwater in the glacial overburden is flowing from east to west and then southwest (Figure 2.4-85 through Figure 2.4-88). In October 2007 (month of lowest groundwater levels), the highest groundwater level in the southern trough (668.74 ft (203.83 m) msl) was measured in well MW304A. The lowest water level (653.86 ft (199.30 m) msl) was measured in Pond G8. Thus, a total head loss of nearly 15 ft (4.6 m) occurred across the southern trough in October 2007 (Figure 2.4-85). Between October 2007 and March 2008, the groundwater levels in all wells increased approximately 3.4 to 5.5 ft (1.0 to 1.7 m). In March 2008 (month of highest groundwater levels), the highest groundwater level in the southern trough was again located in MW304A (672.16 ft (204.87 m) msl) and the lowest level was again recorded in Pond G8 (654.30 ft (199.43 m) msl) (Figure 2.4-87). In March 2008, the total head loss across the southern trough (from MW304A to Pond G8) was approximately 18 ft (5.5 m).

A ridge of bedrock separates the southern trough from monitoring wells MW307A and MW309A. Groundwater in the Glacial Overburden aquifer in this area belongs to a separate flow system, which flows south and southeast and discharges to Unnamed Tributary 3, a drainage system altogether separate from the Walker Run watershed (Figure 2.4-72 through Figure 2.4-75).

Horizontal hydraulic gradients have been calculated for several flowpaths in the Glacial Overburden aquifer (Table 2.4-51). Flowpath GO1 goes from MW304A to MW302A1; Flowpath GO2 goes from MW302A1 to MW301A, and Flowpath GO3 goes from MW301A to Pond G8. Together, these three flowline segments represent a flowline down the center of the southern trough, from east to west. Segment GO3 represents the horizontal flowline between the center of the power block and Pond G8. The horizontal hydraulic gradients computed for the southern bedrock trough are listed in Table 2.4-51 for fall (October 2007), winter (January 2008), spring (March 2008), and summer (July 2008) conditions. The largest gradients (0.0030 to 0.0112 ft/ft) generally occurred in March 2008 (spring) when the groundwater elevations were highest. The gradient between the power block and Pond G8 (Pathline GO3) was lowest in October 2007 (0.0041 ft/ft) and highest in March 2008 (0.0112 ft/ft).

The Glacial Overburden aquifer discharges as springs and seeps into Pond G8, the wetlands along the southern border of the BBNPP site, and into Walker Run. In February 2008, the surface of Ponds G6, G7, and G9 were all frozen with a layer of 2 to 3 in (0.05 to 0.08 m) of ice. However, no ice was present on the surface of Pond G8, indicating that warm groundwater was discharging into the pond during winter. In addition, Pond G8 discharges water all year long, even in the extremely dry summer and fall months, which also indicates that groundwater discharges in this area. As the southern bedrock trough approaches Pond G8 and surface water gauging stations G2 and G13 on Walker Run (Figure 2.4-63), the trough constricts and the glacial overburden thins considerably. As a consequence, groundwater flowing southeastward is forced to the surface in various locations near Pond G8 and the wetlands south and southwest of Pond G8. This area is considered a groundwater discharge area for the Glacial Overburden aquifer.

2.4.12.3.1.2 Shallow Bedrock Aquifer

Groundwater elevation data for the Shallow Bedrock aquifer are listed in Table 2.4-44. Variation of groundwater levels versus time in the Shallow Bedrock aquifer are presented in Figure 2.4-78 through Figure 2.4-84. These graphs show that the seasonal variations in groundwater elevations in the shallow bedrock are approximately the same as the magnitude of variation encountered in the Glacial Overburden wells. The rise and fall of groundwater elevations in the shallow bedrock also seem to generally coincide in time with variations in water levels in the Glacial Overburden aquifer. The highest groundwater elevations in the Shallow Bedrock aquifer were generally present in February and March 2008. The lowest groundwater elevations measured in the Shallow Bedrock aquifer generally occurred in October 2007 and September 2008.

The groundwater elevation data tabulated in Table 2.4-44 and graphed in Figure 2.4-78 through Figure 2.4-82 were used to develop groundwater potentiometric surface maps for the Shallow Bedrock aquifer. These maps are presented for October 2007 (fall), January 2008 (winter), March 2008 (spring), and summer (July 2008) in Figure 2.4-89 through Figure 2.4-92, respectively.

For each quarter, the spatial trends of the potentiometric surface and the horizontal hydraulic gradients are similar, although elevations in March 2008 are greater. Potentiometric contours in the Shallow Bedrock aquifer generally reflect surface topography. For example, the contours circle around the two hills on the northern side of the BBNPP site. Overall, lateral flow in the Shallow Bedrock is to the south and southwest, as shown on Figure 2.4-89 through Figure 2.4-92.

Horizontal hydraulic gradients have been calculated for six flowpath segments in the Shallow Bedrock aquifer (Table 2.4-51). The points defining each flowpath segment are listed in Table 2.4-51. Together, these six flowline segments represent the range of flow directions and gradients that exist beneath the power block and surrounding areas. The horizontal hydraulic gradients computed for the Shallow Bedrock aquifer are listed in Table 2.4-51 for fall (October 2007), winter (January 2008), spring (March 2008), and summer (July 2008) conditions. The largest horizontal gradients (0.0081 to 0.1188 ft/ft) generally occurred in March 2008 (spring) when the groundwater elevations were highest. The lowest gradients (0.0079 to 0.0963 ft/ft) generally occurred in January 2008 (Table 2.4-51).

2.4.12.3.1.3 Deep Bedrock Aquifer

Groundwater elevation data for the Deep Bedrock aquifer are tabulated in Table 2.4-44. Variation of groundwater levels versus time in the Deep Bedrock aquifer are presented in Figure 2.4-78 through Figure 2.4-84. These graphs show that the seasonal variations in groundwater elevations in the eight Deep Bedrock wells are usually of the same magnitude of variation encountered in the Shallow Bedrock and the Glacial Overburden wells. A very large seasonal variation in groundwater elevations observed in Well MW307B was an exception; water levels rose almost 26 ft (7.9 m) between October 2007 and March 2008. The rise and fall of groundwater elevations in the deep bedrock also seem to generally coincide in time with variations in water levels in the other two units. The highest groundwater elevations in the Deep Bedrock aquifer were generally present in winter (February and March 2008). The lowest groundwater elevations in the Deep Bedrock aquifer were generally present in fall (October 2007 and September 2008).

The groundwater elevation data tabulated in Table 2.4-44 and graphed in Figure 2.4-78 through Figure 2.4-82 were used to develop groundwater potentiometric surface maps for the

Deep Bedrock aquifer. These maps are presented for October 2007 (fall), January 2008 (winter), March 2008 (spring), and July 2008 (summer) in Figure 2.4-93 through Figure 2.4-96, respectively.

For each quarter, the spatial trends of the potentiometric surface and the horizontal hydraulic gradients are similar, although elevations in March 2008 are slightly greater. Potentiometric contours in the Deep Bedrock aquifer generally reflect surface topography. The contours bend somewhat around and encompass the two hills on the northern side of the BBNPP site. The overall flow direction in the Deep Bedrock is to the south, southeast, and probably the southwest, as shown on Figure 2.4-93 through Figure 2.4-96.

Horizontal hydraulic gradients have been calculated for two flowpath segments in the Deep Bedrock aquifer (Table 2.4-51). The points defining each flowpath segment are listed in Table 2.4-51. Together, these two flowline segments represent the range of flow directions and gradients that exist beneath the power block and surrounding areas. The horizontal hydraulic gradients computed for the Deep Bedrock aquifer are listed for fall (October 2007), winter (January 2008), spring (March 2008), and summer (July 2008) conditions. The calculated horizontal gradients in the Deep Bedrock aquifer ranged from 0.0154 to 0.0228 ft/ft, which are considerably lower than the gradients calculated for the Shallow Bedrock, but slightly higher than the gradients determined for the Glacial Overburden aquifer. Unlike the other two hydrogeologic units, the horizontal hydraulic gradients in the Deep Bedrock seem to be largest in the fall when groundwater levels were lowest. The lowest gradients (0.0079 to 0.0964 ft/ft) generally occurred in March 2008 (Table 2.4-51).

2.4.12.3.1.4 Vertical Hydraulic Gradients and Vertical Flow Directions

A total of twelve well clusters were installed around the BBNPP site. Each cluster has two or more wells intersecting two or three of the hydrogeologic units. Differences in hydraulic heads between wells screened in different intervals indicate that vertical gradients exist and that vertical flow of groundwater (either upward or downward) is likely occurring. Vertical head differences do not necessarily imply that a continuous or discontinuous aquitard separates two aquifer units; it simply means that vertical flow can occur.

For each well cluster, the wells were identified as belonging to the Glacial Overburden (A), Shallow Bedrock (B), or Deep Bedrock (C) aquifers (note: three wells, MW302B, MW307B, and MW313C, have suffixes different than the aquifer in which they are screened, for reasons previously discussed). Vertical gradients have been calculated by taking the difference in hydraulic heads between two wells and divide by the vertical distance between the midpoints of the two well screens. The calculated vertical gradients for four different seasons are listed in Table 2.4-52. The well pairs with positive vertical gradients indicate that the direction of groundwater flow is downward; negative gradients indicate an upward direction of groundwater flow.

For gradients calculated between the Glacial Overburden and the Shallow Bedrock, upward flow (negative gradient) was detected at 3 out of 8 well clusters (MW301, MW303, and MW310). For gradients calculated between the Glacial Overburden and the Deep Bedrock, upward flow was determined at 3 out of 6 clusters (MW302, MW306, and MW310). Based on these results, upward flow of groundwater from the bedrock is apparent in roughly half of the well clusters. The clusters that indicate upward flow include the MW301, MW302, MW303, MW306, and MW310 clusters (Table 2.4-52). The largest gradients for upward flow were found at clusters MW301, MW302, MW303, and MW310. In three of these locations, artesian pressure was encountered in bedrock wells MW301B4, MW302B, MW310C and geotechnical boring

B302. Artesian pressure was also detected in monitoring wells MW312B and MW313C, located in the wetlands on the south side of the power block. Figure 2.4-97 displays the areas where upward-flowing groundwater from the bedrock may be occurring. Upward-flowing groundwater from the bedrock was not visually observed anywhere at the BBNPP site. If upward flow from bedrock is occurring, it will discharge to and dissipate within the Glacial Overburden aquifer. Therefore, the locations of bedrock discharge and the rate of groundwater discharge to the Glacial Overburden aquifer is difficult to estimate. As shown in Figure 2.4-97, there are two areas of suspected upward flow from bedrock. The first area lies along Beach Grove Road in the northwest corner of the site, west of well MW305B, and extends to Walker Run. The second area covers a large portion of the southern bedrock trough, including all of the wetlands and the BBNPP power block.

Although vertical gradients suggest that upward groundwater flow is occurring, the exact areas where upward flow takes place, the overall rate of flow, and the temporal changes in flow rate, are not known with any degree of certainty.

2.4.12.3.2 Hydrogeologic Properties

The hydraulic properties of the geologic materials present at the BBNPP site were characterized by several means:

- Fourteen (14) Glacial Overburden wells and 11 bedrock wells were slug tested (falling head and rising head tests). The results are presented in Table 2.4-53.

- Two (2) pumping tests were performed. One test was performed in the glacial overburden at well cluster MW302 and the other was performed in shale bedrock at well cluster MW301 (center of nuclear island). Each test consisted of a 24-hour pumping test and 12-hour recovery test. For the Glacial Overburden test, monitoring wells MW302A2, MW302A3 and MW302A4 were used as observation wells for pumping well MW302A1. For the Bedrock test, monitoring wells MW301B2, MW301B3 and MW301B4 were used as observation wells for pumping well MW301B1. Prior to each pumping test, a step-drawdown test was conducted in the two pumping wells. Target pumping rates of 60 gpm (227 lpm) and 6 gpm (23 lpm) were selected for wells MW302A1 and MW301B1, respectively, for the extended pumping tests. At these pumping rates, it was expected that pumping would stress the aquifer as much as possible without drawing the water levels in the pumping wells below the tops of their screens. Results of the pumping tests are presented in Table 2.4-54.

- Optical and acoustic televiewers were used to observe and quantify the nature, vertical distribution, and orientation of fractures in five open boreholes before monitoring wells were installed. Results of the televiewer surveys for Monitoring Wells MW301C and MW310C are presented in Figure 2.4-98 to Figure 2.4-103.

- Packer tests were performed on 56 intervals within 5 open-hole bedrock borings, which were later converted into monitoring wells MW301C, MW304C, MW306C, MW310C, and MW313C. Results of the packer tests are presented in Table 2.4-55.

In addition, a large number of slug tests, pumping tests, packer tests, and other tests have been performed previously at the SSES site. The results of these tests are summarized in Table 2.4-56.

2.4.12.3.2.1 Glacial Overburden Aquifer

Slug tests were performed on all 14 BBNPP glacial overburden monitoring wells. The horizontal hydraulic conductivity (Kh) values calculated from these tests ranged from 3.38E-02 ft/day (1.19E-05 cm/s) in MW307A to 9.63E+01 ft/day (3.40E-02 cm/s) in MW306A (Table 2.4-53). Thus, a range of three orders of magnitude was found in these values. The lowest values occurred in the three wells located on the north side of the site (MW303A, MW305A1, and MW305A2) and the three wells located on the far southern end of the site (MW307A, MW308A, and MW309A). In these six wells, the Kh values ranged from 3.38E-02 to 1.51E+01 ft/day (1.19E-05 to 5.33E-03 cm/s). In the other eight glacial overburden wells, located across the central portion of the site (i.e., the southern bedrock trough), the Kh values ranged from 23.8 to 96.3 ft/day (8.40E-03 to 3.40E-02 cm/s). The overall geometric mean of Kh was 10.3 ft/day (3.63E-03 cm/s). The geometric mean Kh for the eight wells located across the central portion of the site was 52.5 ft/day (1.85E-02 cm/s). For two slug tests performed previously at SSES, Kh values of 1.8 and 6.6 ft/day (6.35E-04 to 2.33E-03 cm/s) were determined.

The long-term pumping test performed at the MW302 well cluster yielded a Kh value (geometric mean) of 168 ft/day (5.93E-02 cm/s)(Table 2.4-51). Six pumping tests performed previously at SSES (Table 2.4-56) yielded Kh values that ranged from 3.3 to 200 ft/day (1.16E-03 to 7.06E-02 cm/s). The two SSES pumping tests (Wells C and CPW) that yielded the highest Kh values were based on specific capacity data, and are rough estimates of Kh.

Overall, the MW302 cluster pumping test yielded a Kh value 168 ft/day (5.93E-02 cm/s), which appears to fall within the range of the slug tests, open-end tests performed at SSES, and the other pumping tests performed at the SSES. This value is higher than the average and geometric mean of all other tests; however, it was determined using a long-term test that significantly stressed the aquifer and was performed immediately upgradient of and in close proximity to the BBNPP power block area. Therefore, a Kh value of 168 ft/day (5.93E-02 cm/s) has been chosen to represent the Glacial Overburden aquifer in the vicinity of the BBNPP power block area.

Based on the pumping test conducted in the glacial overburden at the MW302 well cluster, the median specific yield of the aquifer was determined to be approximately 0.322 (Table 2.4-54). For sand and gravel deposits, the specific yield is nearly the same as effective porosity. For the purpose of flow calculations and modeling, an effective porosity for the Glacial Overburden aquifer is estimated to be 0.322.

2.4.12.3.2.2 Shale Bedrock Aquifers

The hydraulic properties of the Shallow and the Deep Bedrock (shale) aquifers are presented in this section, and not separately, because the results of hydraulic testing do not conclusively support the hypothesis that there is a significant difference between the Kh values of the Shallow and Deep Bedrock.

Slug tests were performed on six shallow bedrock wells. The Kh values calculated from these tests ranged from 1.05 ft/day (3.70E-04 cm/s) in MW301B1 to 38.5 ft/day (1.36E-02 cm/s) in MW304B (Table 2.4-53). The overall geometric mean of Kh was 4.01 ft/day (1.41E-03 cm/s). This value is approximately 40 percent of the value determined for the Glacial Overburden aquifer using slug tests.

Slug tests were performed on five Deep Bedrock wells. The Kh values calculated from these tests ranged from 3.25E-02 ft/day (1.15E-05 cm/s) in MW306C to 4.27E+00 ft/day (1.51E-03 cm/

s) in MW307B (Table 2.4-53). The overall geometric mean of Kh for the Deep Bedrock was 3.35E-01 ft/day (1.18E-04 cm/s). This value is approximately one order of magnitude less than the value determined for the Shallow Bedrock aquifer using slug tests (Table 2.4-53).

The long-term pumping test performed at the MW301 well cluster yielded a Kh value (geometric mean) of 0.46 ft/day (1.62E-04 cm/s)(Table 2.4-54). This value is roughly two to three orders of magnitude lower than the value determined for the Glacial Overburden aquifer.

A total of 56 packer tests (constant pressure, pump-in tests), were performed in five open bedrock borings at the BBNPP site. Each test was performed on 20 to 23 ft (6.1 to 7 m) rock intervals. Of these tests, nearly half (26) indicated impermeable rock, which is indicated on Table 2.4-55 as Kh = 0 ft/day. In the other 30 tests, Kh values ranged from 6.78E-04 to 4.63E-01 ft/day (2.39E-07 to 1.63E-04 cm/s). The highest values occurred in MW310C and the lower portions of MW301C and MW313C. The Kh values determined by packer tests were considerably lower than Kh values determined by slug tests and pumping tests.

Over 50 packer tests have been performed in the shale bedrock at the SSES site (Table 2.4-56); the tests yielded Kh values that ranged from 0 to 0.85 ft/day (0 to 3.00E-04 cm/s). The median value for the 41 tests performed by the railway bridge (northeast of SSES site) was 0.22 ft/day (7.76E-05 cm/s). The packer test values encountered at the SSES site were greater than the packer test results encountered at the BBNPP site and generally approached the BBNPP values calculated for the MW301B1 pumping test.

Optical and acoustic televiewers were used to observe and quantify the nature, vertical distribution, and orientation of fractures in five open boreholes before monitoring wells were installed. Results of the televiewer surveys for Monitoring Wells MW301C and MW310C are presented in Figure 2.4-98 through Figure 2.4-101. The vertical distribution of fractures in MW301C is shown in Figure 2.4-98. Fractures were more frequently encountered in depth intervals where the slope on the curve is lowest (e.g., from 47 to 58 ft (14.3 to 17.7 m) and 251 to 261 ft (76.5 to 79.6 m) bgs). These two intervals coincide with intervals where packer tests detected measurable fracture permeabilities (see Table 2.4-55). In MW301C, the primary direction of fracture dips was southward and the primary dip angle was steep (60 to 90°), as shown in Figure 2.4-99 and Figure 2.4-100, respectively. A secondary set of fractures had a relatively low dip angle of 20 to 30° (Figure 2.4-100).

Monitoring Well MW310C is located approximately 400 ft (122 m) north-northwest of MW301C. Based on the televiewer results, the density of fractures detected in MW310C (Figure 2.4-101) was much greater than the density of fractures in MW301C. In MW310C, the fractures density was greatest in three different intervals: 24 to 80 ft (7.3 to 24.4 m), 141 to 145 ft (43.0 to 44.2 m), and 195 to 200 ft (59.4 to 61.0 m) bgs (Figure 2.4-101). These three intervals generally coincide with intervals where packer tests detected measurable fracture permeabilities in MW310C (see Table 2.4-55). Unlike MW301C, the primary direction of fracture dips in MW310C was northward and the dip angle was moderately steep (50 to 60°), as shown in Figure 2.4-102 and Figure 2.4-101, respectively. The density and orientation of fractures does not necessarily coincide with zones that have the greatest hydraulic conductivities; sometimes the fractures are healed or cemented shut with calcite. However, there does seem to be a qualitative correlation between fracture density and hydraulic conductivity.

Based on the slug test results from the BBNPP (Table 2.4-53), the Shallow Bedrock wells appear to have much greater Kh values than the Deep Bedrock. However, the packer test results

suggest that the Kh values of the Deep Bedrock are greater than determined for the Shallow Bedrock (Table 2.4-55). In general, the hydraulic conductivity of the bedrock appears to be highly variable, as expected for a fractured rock mass.

Overall, the Shallow Bedrock is estimated to have a Kh value of approximately 0.46 ft/day (1.62E-04 cm/s), which is the geometric mean value of the MW301B1 pump test and is two to three orders of magnitude less than the Glacial Overburden aquifer.

Based on the pumping test conducted at the MW301 well cluster, the median storage coefficient value for the shale bedrock is approximately 7.9E-05 (Table 2.4-54).

2.4.12.3.3 Groundwater Flow and Transport

The following sections present the most probable groundwater flow direction and travel time from the BBNPP power block area to nearby surface water features. Based on the evaluation summarized in the above sections, only the shallow water-bearing unit (Glacial Overburden aquifer) would be affected by construction and operation of the BBNPP. Groundwater use associated with BBNPP operations is discussed in Section 2.4.12.1.4. Accidental release parameters and pathways for liquid effluents in groundwater and surface water are presented in Section 2.4.13.

The groundwater seepage velocity is defined as distance over time and is calculated as follows:

Velocity = ((hydraulic gradient) x (hydraulic conductivity)) / (effective porosity)

The travel time is defined as rate of groundwater movement for a set distance and is calculated as follows:

Travel Time = (distance) / (velocity)

2.4.12.3.3.1 Glacial Overburden Aquifer

In the vicinity of the BBNPP site, the Glacial Overburden aquifer is the most capable aquifer for transmitting groundwater, and it is the source aquifer for many wells and springs in the county.

The groundwater travel time in the Glacial Overburden aquifer was calculated from Monitoring Well MW301A, located near the center of the BBNPP power block area, to a projected discharge point in the relocated Walker Run that is approximately 1200 ft (366 m) southwest of Monitoring Well MW301A. An average horizontal groundwater velocity of 4.25 ft/day (1.30 m/day) was calculated using a median horizontal hydraulic gradient of 0.0081 ft/ft measured between Monitoring Well MW301A and Pond G8 (Table 2.4-51), a hydraulic conductivity of 168 ft/day (5.93E-02 cm/s), and an effective porosity of 32 percent (Table 2.4-54). Using a travel distance of approximately 1200 ft (370 m) from Monitoring Well MW301A to a projected discharge point in the relocated Walker Run, the groundwater travel time was estimated to be about 282 days. The relocation of Walker Run is discussed in ER Section 4.2.1 and ER Section 4.2.2.

2.4.12.4 Monitoring or Safeguard Requirements

Groundwater monitoring (water level observation) of the BBNPP area is currently being implemented through the use of the groundwater monitoring wells installed in September and October 2007. Some of the existing BBNPP monitoring wells will 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 any existing wells. These data needs will be met by the installation of new monitoring wells. Additionally, the hydrologic properties and groundwater flow regimes of the shallow water-bearing units (Glacial Overburden aquifer, and to a lesser extent, the Shale Bedrock aquifer) 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.

Safeguards will be used to minimize the potential of adverse impacts to the groundwater by construction and operation of BBNPP. These safeguards would include the use of lined containment structures around storage tanks (where appropriate), hazardous materials storage areas, emergency cleanup procedures to capture and remove surface contaminants, and other measures deemed necessary to prevent or minimize adverse impacts to the groundwater beneath the BBNPP site. No groundwater wells are planned for safety-related purposes.

2.4.12.5 Site Characteristics for Subsurface Hydrostatic Loading and Dewatering

2.4.12.5.1 Dewatering During Construction

Groundwater conditions relative to the foundation stability of safety-related facilities and plans for the analysis of seepage and dewatering plans during construction are discussed in Section 2.5.4.6.

2.4.12.5.2 Hydrostatic Loading and Dewatering During Operation

After construction has been completed, the surface grade for the BBNPP power block will be 674 ft (205.4m) msl, which will require cut and fill across the site area. The minimum design depth for the nuclear island basement is currently estimated to be at an approximate elevation of 633 ft (193 m) msl (Section 2.5.4.10). Water-table elevations within the Glacial Overburden aquifer near the power block area range from approximately 653 to 661 ft (199 to 201 m) msl with the highest observed elevations occurring on the north and northeast sides of the power block area (MW310A). Since the current maximum observed Glacial Overburden aquifer groundwater elevation is at 661 ft (201 m) msl in the power block area, the maximum recorded water table elevation lies approximately 28 ft (8.5 m) above the lowest subsurface portions of safety-related structures, systems, and components (i.e., 661 - 633 = 28 ft).

The U.S. EPR FSAR requires that maximum groundwater elevation be at least 3.3 ft (1.0 m) below surface grade for the nuclear island. As indicated above, existing data indicates that the maximum groundwater elevation (661 ft (202 m) msl) is currently 13 ft (4.0 m) below the proposed grade in the nuclear island area (674 ft (205.4 m) msl), which is within the U.S. EPR FSAR design envelope. Maximum groundwater elevations near the ESWEMS Pumphouse are expected to be at least 7.0 ft (2.1m) below grade, which is also within the U.S. EPR FSAR design envelope.

The BBNPP cut and fill operations, site grading, and construction activities will alter the existing ground surface, surface drainage within the power block area, several sections of creeks, and surrounding wetland areas. During construction, the Glacial Overburden aquifer will be removed throughout most of the power block area. Also, a permanent groundwater barrier will be constructed around the power block area which will limit the flow of

groundwater into the area. Large areas will have buildings or pavement over the land surface, which will significantly reduce groundwater recharge from the surface.

Surface drainage modifications will also affect groundwater recharge and groundwater elevations in the glacial overburden aquifer. A portion of the wetland areas will be drained and filled in (including the existing Pond G8 located 500 ft (152 m) southwest of the center of the reactor). Drainage conveyance ditches will be installed to quickly move rainfall and surface water away from the power block area. Unnamed Tributary No. 1 will be partially relocated a slight distance to the south,so that it will pass the power block area on the south side. Walker Run will be moved to a new channel along Market Street (County Road T-436), away from the power block area. All of these actions are intended to keep surface water away from the power plant area and to minimize groundwater recharge in the area.

Because of changes to the drainage system and changes to the land surface (affecting recharge and runoff), the groundwater levels are expected to be lower after construction as compared to the pre-construction groundwater elevations. Therefore, the post-construction potentiometric surface in the glacial overburden aquifer will drop relative to pre-construction groundwater levels. The post-construction water table surface should be more than 13 ft (4.0 m) below the ground surface. As a result, no permanent groundwater dewatering system will be needed for the BBNPP facility.

Groundwater elevations will continue to be monitored, and any observed deviations in groundwater elevations potentially impacting the current design bases will be accounted for to design a dewatering system, if necessary.

2.4.12.6 References

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2.4.13 Pathways of Liquid Effluents in Ground and Surface Waters

The U.S. EPR FSAR includes the following COL Item in Section 2.4.13:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information on the ability of the groundwater and surface water environment to delay, disperse, dilute or concentrate accidental radioactive liquid effluent releases, regarding the effects that such releases might have on existing and known future uses of groundwater and surface water resources.

This COL Item is addressed as follows:

{Sections 2.4.13.1 through 2.4.13.3 are added as a supplement to the U.S. EPR FSAR.

2.4.13.1 Groundwater

This section provides a conservative analysis of a postulated, accidental liquid release of effluents to the groundwater associated with the operation of the BBNPP. The accident scenario is described, and the conceptual model used to evaluate radionuclide transport is presented, along with potential pathways of contamination to water users. The radionuclide concentrations that a water user might be exposed to are compared against the regulatory limits.

2.4.13.1.1 Accident Scenario

This section describes the ability of groundwater and surface water systems to delay, disperse, or dilute a liquid effluent if accidentally released from the site. The U.S. EPR General Arrangement Drawings were reviewed to determine which component in each of the main areas of the nuclear island outside the reactor building could contain the maximum radionuclide concentration/volume. This review also determined that the proposed design includes no buildings, facilities, or tanks containing radionuclides outside of the nuclear island. Components were evaluated based on their respective volumes and whether they could contain reactor coolant activity. Except for the Reactor Building, there is no secondary containment in the nuclear island compartments/buildings. The tanks and components that are designed to contain or process radioactive liquids are within the nuclear island. These components include:

- Reactor Coolant Storage Tanks (total of six, each 4,061 ft^3 (115 m^3)) in the Nuclear Auxiliary Building
- Liquid Waste Storage Tanks (total of five, each approximately 2473 ft^3 (70 m^3)) in the Waste Building
- Volume Control Tank (600 ft^3 (17 m^3)) in the Fuel Building
- LHSI Heat Exchanger (total of four, each 33 ft^3 (0.93 m^3)) in the Safeguards Building

As defined by NUREG-0800, Standard Review Plan 2.4.13 (NRC, 2007a), the source term is determined from a postulated release from a single tank or pipe rupture outside of the containment. The postulated source of the liquid effluent would be a tank rupture in a Reactor Coolant Storage Tank in the Nuclear Auxiliary Building, because these tanks contain the

largest volume of reactor coolant water. An instantaneous release from a tank would discharge the contents faster than from a pipe rupture that is connected to the tank and based on the piping configuration discharge more contents to the environment. The piping configuration may cause more contents to be held up in the tank by the nozzle locations and pipe routing than a tank failure. Therefore, modeling a tank failure will result in a more conservative analysis.

The inventory of radionuclides in reactor coolant water, and their analyzed activities in the Reactor Coolant Storage Tanks are shown on Table 2.4-57 (half-life values provided are consistent with values provided in references NRC, 1992 and ICRP, 1983). The reactor coolant activity levels represent the maximum activity levels without radioactive decay based on a 0.25 percent defective fuel rate, as shown on Table 2.4-57. Reactor coolant activity level values used in this evaluation represent the maximum (most conservative) value observed in two reactor coolant analyses. The 0.25 percent defective fuel rate was selected to be consistent with the fuel failure rate prescribed by the U.S. EPR FSAR. This fuel failure rate is two times the failure rate prescribed by Branch Technical Position 11-6 (0.12 percent) (NRC, 2007b) and provides a conservative bounding estimate of the radionuclide inventory and associated activity levels in the postulated release.

2.4.13.1.2 Groundwater Pathway

The groundwater pathway evaluation includes the components of advection, decay, and retardation. The advective component is discussed in Section 2.4.12.3. A radionuclide assumed to be undergoing purely advective transport travels at the same velocity as groundwater. This approach is conservative because advective flow does not account for hydrodynamic dispersion, which would normally dilute radionuclide concentrations in groundwater through the processes of molecular diffusion and mechanical dispersion. For conservatism, the effects of hydrodynamic dispersion were not considered.

Radionuclides in groundwater flow systems are subject to radioactive decay, the rate of which depends on the half-life of the radionuclide. Table 2.4-57 includes the half-lives of the radionuclides of concern.

Retardation considers chemical interactions between dissolved constituents in the groundwater and the aquifer matrix. Contaminants that react with the aquifer matrix are retarded relative to the groundwater velocity. Reactions with the aquifer matrix include cation/anion exchange, complexation, oxidation-reduction reactions, and surface sorption.

2.4.13.1.3 Conceptual Model

This section describes the conceptual model used to evaluate an accidental release of liquid effluent to groundwater, or to surface water via the groundwater pathway. The conceptual model of the site groundwater system is based on information presented in Section 2.4.12. The key elements and assumptions embodied in the conceptual model are described below.

As previously indicated, a Reactor Coolant Storage Tank with a capacity of 4,061 ft^3 (115 m^3) is assumed to be the source of the release. The tank is located within the Nuclear Auxiliary Building, which has a building slab top depth of approximately 41.5 ft (12.65 m) below grade , at an elevation of approximately 632.5 ft (192.8 m) msl. The Reactor Coolant Storage Tank is postulated to rupture, and 80 percent of its liquid volume (3,248.8 ft^3 (92.0 m^3)) is assumed to be released in accordance with Branch Technical Position 11-6 (NRC, 2007b). Flow from the tank rupture is postulated to flood the building and migrate past the building containment structure and sump collection system and enter the subsurface at the top of the building slab

at an elevation of approximately 632.5 ft (192.8 m) msl. This elevation is approximately 27.5 ft (8.38 m) below the piezometric elevation of the primary water bearing unit of concern (Glacial Overburden aquifer). Thus, a pathway is created that would allow the entire 3,248.8 ft^3 (92.0 m^3) to directly enter the groundwater system instantaneously. This assumption is very conservative because it requires the simultaneous failure of the containment systems and sump pumps.

The site groundwater system potentially impacted consists of the Glacial Overburden aquifer. The unconsolidated sediments comprising the Glacial Overburden aquifer consist primarily of fine-grained to coarse-grained sands, gravel, and boulders. The Glacial Overburden aquifer extends from the current ground surface, at an elevation ranging from approximately 656 to 676 ft msl (200 to 206 m msl), to an elevation ranging from 593 to 656 ft (181 to 200 m) msl at its base. It is absent in some areas of the site just north of the power block where bedrock is exposed at the ground surface. The postulated release point in the Nuclear Auxiliary Building occurs at a depth of approximately 632.5 ft (192.8 m) msl, which places the release within the saturated portion of the Glacial Overburden aquifer.

Transport in the Glacial Overburden aquifer is considered to be the only significant possible pathway in the conceptual release model, because:

- the release occurs in the Glacial Overburden aquifer,
- the Glacial Overburden aquifer is the most permeable geologic aquifer at the site, and
- the potential receptor (Walker Run) intercepts in the Glacial Overburden aquifer.

In most locations downgradient (southwest) of the Nuclear Auxiliary Building, the vertical hydraulic gradients are such that groundwater is flowing upward from the bedrock into the Glacial Overburden aquifer. Therefore, any contaminants released in the Glacial Overburden aquifer should migrate laterally toward the stream and should not migrate vertically downward into the bedrock. As a result, the Bedrock aquifer is not considered in the conceptual release scenario.

With the postulated instantaneous release of the contents of the Reactor Coolant Storage Tank, radionuclides would enter the Glacial Overburden aquifer. The water table elevation within the Glacial Overburden aquifer averages approximately 658 ft (201 m) msl in the center of the nuclear island and the aquifer has a saturated thickness of approximately 50 ft (15 m). The groundwater flow direction from the Nuclear Auxiliary Building release point is southwest, toward the relocated Walker Run (Figure 2.4-102). The postulated accidental release scenario assumes the release immediately enters the Glacial Overburden aquifer and remains within this unit as it flows to the projected discharge point in the relocated Walker Run, approximately 1,200 ft (366 m) downgradient of the release point. Groundwater seepage would enter Walker Run and eventually discharge into the NBSR, approximately 10,410 ft (3,173 m) downstream of BBNPP. There are no users of surface water from Walker Run. The location and identities of users of water from the NBSR are described in Section 2.4.1.2. The travel path considered in this subsection begins at the Nuclear Auxiliary Building and ends at the postulated discharge zone in the relocated Walker Run, approximately 1,200 ft (366 m) southwest of the Nuclear Auxiliary Building.

In the release scenario described above, it is postulated that all contaminated groundwater flows to Walker Run and discharges into the stream. However, it is quite likely that a portion of the contaminated groundwater will not discharge to the stream. Instead, some of this

groundwater may continue flowing southwest and southward parallel to the Walker Run streambed.

2.4.13.1.4 Analysis of Accidental Releases to Groundwater

The analysis of accidental release of liquid effluents to groundwater was accomplished in two steps. The first step was to screen the listing of source term radionuclides in Table 2.4-57, assuming only advective transport and radioactive decay. Radioactive decay data were taken from Table E.1 of NUREG/CR-5512, Vol. 1 (NRC, 1992). Radioactive decay data for some of the shorter-lived radionuclides were taken from International Commission on Radiological Protection (ICRP) Publication 38 (ICRP, 1983). This step allows the screening out of radionuclides that decay to activities below a level of concern before reaching the discharge point in Walker Run. Those radionuclides that remain above activity levels of concern are evaluated considering the added effect of retardation. This analysis accounts for the parent radionuclides expected to be present in the Reactor Coolant Storage Tank plus progeny radionuclides that would be generated during subsequent groundwater transport. The analysis considered all progeny in the decay chain sequences that are important for dosimetric purposes. ICRP Publication 38 (ICRP, 1983) was used to identify the progeny for which the decay chain sequences can be truncated. For several of the radionuclides expected to be present in the Reactor Coolant Storage Tank, consideration of up to three members of the decay chain was required. The derivation of the equations governing the transport of the parent and progeny radionuclides follows.

One-dimensional radionuclide transport along a groundwater pathway is governed by the advection-dispersion-reaction equation (Javandel, 1984), which is given as:

$$R\frac{\partial C}{\partial t} = D\frac{\partial^2 C}{\partial x^2} - v\frac{\partial C}{\partial x} - \lambda R C \qquad \text{(Eq. 2.4.13-1)}$$

where:

C = radionuclide concentration

R = retardation factor

D = coefficient of longitudinal hydrodynamic dispersion

n = average linear groundwater velocity

λ = radioactive decay constant

t = groundwater travel time

x = travel distance

The retardation factor is determined from (Equation 6 of Javendal, 1984):

$$R = 1 + \frac{\rho_b K_d}{n_e} \quad \text{(Eq. 2.4.13-2)}$$

where:

p_b = bulk density (g/cm^3)

K_d = distribution coefficient (cm^3/g or mL/g)

n_e = effective porosity (unitless)

The average linear groundwater velocity (v) is determined using Darcy's law:

$$v = -\frac{K}{n_e}\frac{dh}{dx} \quad \text{(Eq. 2.4.13-3)}$$

where:

K = hydraulic conductivity

dh/dx = hydraulic gradient

n_e = as previously defined

The radioactive decay constant (λ) can be written as:

$$\lambda = \frac{\ln 2}{t_{1/2}} \quad \text{(Eq. 2.4.13-4)}$$

where:

$t_{1/2}$ = radionuclide half-life

A method of characteristics approach can be used on Equation 2.4.13-1 to determine the material derivative of concentration:

$$\frac{dC}{dt} = \frac{\partial C}{\partial t} + \frac{dx}{dt}\frac{\partial C}{\partial x} \quad \text{(Eq. 2.4.13-5)}$$

Conservatively neglecting the coefficient of longitudinal hydrodynamic dispersion, the characteristic equations for Equation 2.4.13-1 can be expressed as follows:

$$\frac{dC}{dt} = -\lambda C \quad \text{(Eq. 2.4.13-6)}$$

$$\frac{dx}{dt} = \frac{v}{R} \qquad \text{(Eq. 2.4.13-7)}$$

The solutions of the system of equations comprising Equations 2.4.13-16 and 2.4.13-7 can be obtained by integration to yield the characteristic curves of Equation 2.4.13-1. For transport of a parent radionuclide, the equations representing the characteristic curves are:

$$C_{P1} = C_{P0}\exp(-\lambda_1 t) \qquad \text{(Eq. 2.4.13-8)}$$

$$t = R_1\frac{L}{v} \qquad \text{(Eq. 2.4.13-9)}$$

where:

C_{P1} = parent radionuclide concentration at time t

C_{P0} = initial bounding parent concentration (Table 2.4-57) λ_1 = radioactive decay constant for parent from Equation 2.4.13-4

t = travel time from source to receptor

R_1= retardation factor for parent radionuclide

L = flow path length from source to receptor

v = average linear groundwater velocity

Similar relationships exist for progeny radionuclides. For the first progeny in the decay chain, the advection-dispersion-reaction equation is:

$$R_2\frac{\partial C_2}{\partial x^2} = D\frac{\partial^2 C_2}{\partial x^2} - v\frac{\partial C_2}{\partial x} + d_{12}\lambda_1 R_1 C_1 - \lambda_2 R_2 C_2 \qquad \text{(Eq. 2.4.13-10)}$$

where:

subscript 2 denotes properties/concentration of first progeny

d_{12} = fraction of parent radionuclide transitions that result in production of progeny

The characteristic equations for Equation 2.4.13-10, conservatively neglecting the coefficient of longitudinal hydrodynamic dispersion, can be derived as:

$$\frac{dC_2}{dt} = d_{12}\lambda_1 C_1 - \lambda_2 C_2 \qquad \text{(Eq. 2.4.13-11)}$$

where:

$$\frac{dx}{dt} = \frac{v}{R_2} \qquad \text{(Eq. 2.4.13-12)}$$

$$\lambda_1 = \lambda_1 \frac{R_1}{R_2}$$

Recognizing that Equation 2.4.13-11 is formally similar to Equation B.43 in NUREG/CR-5512 (NRC, 1992), these equations can be integrated to yield:

$$C_2 = K_1 \exp(-\lambda_1 t) + K_2 \exp(-\lambda_2 t) \qquad \text{(Eq. 2.4.13-13)}$$

for which

$$t = R_2 \frac{L}{v} \qquad \text{(Eq. 2.4.13-14)}$$

$$K_1 = \frac{d_{12}\lambda_2 C_{P0}}{\lambda_2 - \lambda'_1}$$

$$K_2 = C_{20} - \frac{d_{12}\lambda_2 C_{P0}}{\lambda_2 - \lambda'_1}$$

The advection-dispersion-reaction equation for the second progeny in the decay chain is:

$$R_3 \frac{\partial C_3}{\partial t} = D \frac{\partial^2 C_3}{\partial x^2} - v \frac{\partial C_3}{\partial x} + d_{13}\lambda_1 R_1 C_1 + d_{23}\lambda_2 R_2 C_2 - \lambda_3 R_3 C_3 \qquad \text{(Eq. 2.4.13-15)}$$

where:

subscript 3 denotes properties/concentration of second progeny radionuclide

d_{13} = fraction of parent radionuclide transitions that result in production of second progeny

d_{23} = fraction of first progeny transitions that result in production of second progeny

The characteristic equations for Equation 2.4.13-15, conservatively neglecting the coefficient of longitudinal hydrodynamic dispersion, can be derived as:

$$\frac{dC_3}{dt} = d_{13}\lambda'_1 C + d_{23}\lambda'_2 C_2 - \lambda_3 C_3 \quad \text{(Eq. 2.4.13-16)}$$

$$\frac{dx}{dt} = \frac{v}{R_3} \quad \text{(Eq. 2.4.13-17)}$$

where:

$$\lambda'_1 = \lambda_1 \frac{R_1}{R_3}$$

$$\lambda'_2 = \lambda_2 \frac{R_2}{R_3}$$

Considering the formal similarity of Equation 2.4.13-16 to Equation B.54 in NUREG/CR-5512 (NRC,1992), Equations 2.4.13-16 and 2.4.13-17 can be integrated to yield:

$$C_3 = K_1 \exp(-\lambda'_1 t) + K_2 \exp(-\lambda'_2 t) + K_3 \exp(-\lambda_3 t) \quad \text{(Eq. 2.4.13-18)}$$

:

$$t = R_3 \frac{L}{v} \quad \text{(Eq. 2.4.13-19)}$$

for which:

$$K_1 = \frac{d_{13}\lambda_3 C_{P0}}{\lambda_3 - \lambda'_1} + \frac{d_{23}\lambda'_2 d_{12}\lambda_3 C_{P0}}{(\lambda_3 - \lambda'_1)(\lambda'_2 - \lambda'_1)}$$

$$K_2 = \frac{d_{23}\lambda_3 C_{P0}}{\lambda_3 - \lambda'_2} + \frac{d_{23}\lambda'_2 d_{12}\lambda_3 C_{10}}{(\lambda_3 - \lambda'_2)(\lambda'_2 - \lambda'_1)}$$

$$K_3 = C_{30} - \frac{d_{23}\lambda_3 C_{P0}}{\lambda_3 - \lambda'_1} - \frac{d_{23}\lambda_3 C_{20}}{\lambda_3 - \lambda'_2} + \frac{d_{23}\lambda'_2 d_{12}\lambda_3 C_{10}}{(\lambda_3 - \lambda'_1)(\lambda_3 - \lambda'_2)}$$

To estimate the radionuclide concentrations in groundwater, Equations 2.4.13-8, 2.4.13-13, and 2.4.13-18 were applied as appropriate along the groundwater transport pathway

originating at the Nuclear Auxiliary Building at BBNPP. The analysis was performed as described below.

2.4.13.1.4.1 Transport Considering Advection and Radioactive Decay Only

The analysis considered a pathway through the Glacial Overburden aquifer, from the Nuclear Auxiliary Building to the projected discharge point in Walker Run (Figure 2.4-102). A conservative travel time, t, in Equations 2.4.13-8, 2.4.13-13, and 2.4.13-18, was used in this evaluation. The travel time was derived from information presented in Section 2.4.12.3. The calculated travel time, 205 days (0.56 years), represents a conservative (minimum) estimate of travel time using the hydraulic conductivity (168 ft/day (51.2 m/day)) derived from the long-term pumping test performed in the Glacial Overburden aquifer (Table 2.4-54), the largest observed hydraulic gradient (0.0112 ft/ft) in the vicinity of the nuclear island (Table 2.4-51), and a travel distance of 1,200 ft (366 m) between the Nuclear Auxiliary Building and the projected discharge point in Walker Run. The representative travel time presented here differs from the travel time cited in Section 2.4.12.3.3.1 and Section 2.3.1 due to the fact that a larger (more conservative) hydraulic gradient (0.0112 ft/ft) was used for the calculation in this section. The conservative travel time of 205 days is used for all following evaluations.

The equation inputs for calculations are provided in Table 2.4-58 and the results are summarized in Table 2.4-59. The calculated radionuclide activities at the Walker Run discharge point (using the conservative estimate of travel time) were compared with the 10 CFR, Part 20, Appendix B, Table 2, Effluent Concentration Limits (ECLs) (CFR, 2007). The ratio of the groundwater activity concentration to the ECL was used as the screening indicator. Ratios that were greater than or equal to 0.01 (greater than or equal to one percent of the ECL) were retained for further evaluation using retardation. Most of the estimated radionuclide concentrations given in Table 2.4-59 are less than one percent of the respective ECLs and are eliminated from further consideration as their concentrations would be well below their regulatory limits. The predicted results indicate that the following radionuclides exceed one percent of the ECL: H-3, Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Zn-65, Sr-89, Sr-90, Y-90, Zr-95, Ru-103, Ru-106, Ag-110m, Te-127m, I-129, Te-129m, Te-129, I-131, Cs-134, Cs-136, Cs-137, Ce-141, Ce-144, and Pu-239.

2.4.13.1.4.2 Transport Considering Advection, Radioactive Decay, and Retardation

The radionuclides of concern identified by the radioactive decay screening analysis described above were further evaluated considering retardation in addition to radioactive decay. Distribution coefficients for these elements were assigned using both literature-based and site-specific, laboratory-derived values.

Site-specific distribution coefficients (K_d) were used for Mn, Fe, Co, Zn, Sr, Ru, Cs, and Ce (Table 2.4-60). These values were based on the laboratory K_d analysis of 5 soil samples obtained from the Glacial Overburden aquifer at the BBNPP site. ASTM D 4646-03, Standard Test Method for 24-h Batch-Type Measurement of Contaminant Sorption by Soils and Sediments (ASTM, 2003), was used to determine laboratory K_d values using site groundwater. Soil samples were spiked with radioactive (Mn, Co, Zn, Sr, Cs, and Ce) and non-radioactive (Fe and Ru) isotopes for the analytes of concern. Follow on analyses were performed using gamma pulse height analysis for the radioactive isotopes and either inductively-coupled plasma emission spectroscopy (Fe) or inductively-coupled plasma mass spectrometry (Ru) for the non-radioactive isotopes. For each of these analytes, the lowest measured K_d value was used in the transport analysis to ensure conservatism (Table 2.4-60). Distribution coefficients for H and I were taken to be zero, because these elements are not expected to interact with the aquifer matrix based on their chemical characteristics.

Distribution coefficients for Y, Np, and Pu were taken from published values summarized in Attachment C, Table 3.9.1 of NUREG/CR-6697 (NRC, 2000). In the case of Y, no literature data are available from which to estimate a K_d value. Instead, adsorption characteristics for Y were assumed to be similar to that of Sc, as these two elements lie adjacent in the periodic table.

The predicted activities of the radionuclides considering the combined effects of advection, decay, and retardation using a conservative travel time of 205 days (0.56 years) are summarized on Table 2.4-62. From this evaluation, it is seen that H-3, Sr-90, and Y-90 exceed one percent respective ECLs.

2.4.13.1.4.3 Transport Considering Advection, Radioactive Decay, Retardation, and Dilution

No groundwater wells are located between the power block and Walker Run. Walker Run is the most likely receptor of groundwater flow from the power plant. The radionuclides discharging with the groundwater to Walker Run would mix with uncontaminated stream water in Walker Run, leading to further reduction of activity levels due to dilution.

The groundwater discharge rate itself is a function of the Darcy velocity of groundwater and the assumed volume and dimensions of the resulting contaminant slug. In this evaluation, the Darcy velocity was calculated to be 5.84 ft/day (1.78 m/day), using a hydraulic conductivity of 168 ft/day (51.2 m/day) and a maximum measured hydraulic gradient of 0.0112 ft/ft. These values are based on the hydrogeologic characteristics of the Glacial Overburden aquifer that were described previously. The volume of the liquid release has been assumed to be 3,248.8 ft^3 (92.0 m^3), which represents 80 percent of the 4,061 ft^3 (115 m^3) capacity of one Reactor Coolant Storage Tank (Table 2.4-63). Considering the effective porosity of the Glacial Overburden aquifer (0.322), the volume of the saturated material that would be occupied by the release is:

$$V = \frac{V_{release}}{n_e} = \frac{3249}{0.322} = 10{,}090\ ft^3 (286 m^3)$$

The shape of the resulting contaminant slug is assumed to be 10 ft wide, 10 ft tall, and 100.9 ft in length. This results in a plume that is ten times longer than it is wide or tall, which is typical for a plume moving in a highly-permeable porous medium (i.e., a long narrow plume). The cross-sectional area of the contaminant slug normal to the groundwater flow direction would be:

A = 10 ft x 10 ft = 100 ft^2 (9.3 m^2)

The total flow through this area, Q_A, from the Glacial Overburden aquifer to Walker Run is the product of the cross-sectional area and the Darcy velocity:

Q_A = 100 ft^2 x 5.84 ft/day = 584 ft^3/day (16.5 m^3/day) =

= 0.0068 ft^3/s (1.92E-04 m^3/s)

This is the flow rate at which a slug of groundwater hypothetically contaminated with H-3, Sr-90, Y-90, and I-129 would flow to Walker Run.

The minimum flow rate measured in Walker Run in the projected plume discharge area (gauging station G2) is 3.2 ft^3/s (0.091 m^3/s). The corresponding dilution factor would be equal to Q_A/Q_S:

$$Q_A/Q_S = (0.0068\ ft^3/s) / (3.2\ ft^3/s) = 0.0021$$

This dilution factor is applied to the H-3, Sr-90, Y-90, and I-129 activity levels reported in Table 2.4-60. Table 2.4-62 summarizes the resulting activity levels, which would represent the diluted activity levels in the surface water in Walker Run at the point of groundwater discharge from the Glacial Overburden aquifer. Only H-3 and Sr-90 exceed one percent of the ECL at activities of 2.03×10^{-3} $\mu Ci/cm^3$ and 9.22×10^{-9} $\mu Ci/cm^3$, respectively. H-3 is the only radionuclide which exceeds its individual ECL at the discharge point within the controlled site boundary. The ratio of predicted concentration divided by the ECL is 2.03.

2.4.13.1.5 Compliance with 10 CFR Part 20

As previously stated, the Glacial Overburden aquifer is considered the most likely groundwater pathway to be impacted by an accidental release (tank rupture), and Walker Run is the projected surface water discharge point of the hypothetically contaminated Glacial Overburden aquifer. There are no private or municipal water wells that lie between the site and Walker Run. Walker Run and adjacent wetlands have been shown to be a groundwater discharge area. The radionuclide transport analysis presented for the Glacial Overburden aquifer indicates that all radionuclides, except H-3, accidentally released to the groundwater are individually below their ECL in Walker Run prior to discharge offsite. Tritium (H-3) is approximately two times its ECL when diluted in Walker Run.

10 CFR Part 20, Appendix B, Table 2 imposes additional requirements when the identity and activities of each radionuclide in a mixture are known. In this case, the sum of the ratios representing the radionuclide activity level present in the mixture divided by the ECL activities otherwise established in Appendix B for the specified radionuclides not in a mixture may not exceed "1" (i.e., "unity"). The sum of fractions approach has been applied to the radionuclide concentrations conservatively estimated above. Results are summarized in Table 2.4-66. The sum of the mixture ratios in Walker Run at the point of admixture is 2.07, which is above unity. Therefore, it is concluded that an accidental liquid release of effluents to groundwater might exceed 10 CFR Part 20 limits in Walker Run within the restricted area of the BBNPP site. The radionuclide mixture ratios used in this analysis represent the minimum calculated value observed for each radionuclide as they are carried through the advection/decay retardation/dilution screening process. Individual radionuclides are carried through subsequent screening steps if their calculated values exceed one percent of the ECL.

If individual radionuclide concentrations do not exceed one percent of their respective ECLs, the screening process stops and that calculated value is used in the sum of the fractions evaluation. This approach adds an additional level of conservatism since most radionuclides are not carried through the entire screening process.

Groundwater potentially contaminated by an accidental liquid release would discharge at a location approximately 10,410 ft (3,173 m) upstream of the confluence of Walker Run and the NBSR. Prior to reaching the Susquehanna River, the contaminants in Walker Run would be further diluted by small surface water tributaries, and groundwater inflow originating from uncontaminated portions of the local groundwater flow system downstream of the projected discharge area.

In accordance with Branch Technical Position 11-6, the evaluation should consider the impacts of the postulated tank failure on the nearest potable water supply in an unrestricted area. "Supply" is defined as a well or surface water intake that is used as a water source for direct human consumption or indirectly through animals, crops, or food processing (NRC, 2007b). As stated previously, there are no uses of surface water from Walker Run. The nearest municipal water supply that obtains water from the NBSR has been identified as the city of Danville, which is located approximately 20 miles (32 km) downstream of the Walker Run confluence. The 7-day low-flow value (10-yr recurrence) in the Susquehanna River at Danville is 1,017 cfs (28.8 m^3/s). When Walker Run mixes with the Susquehanna River, it will be significantly diluted. During the low flow conditions stated above (1,017 cfs (28.8 m^3/s)), the calculated dilution factor will be 2.26E-03. This would lower the cumulative ECL ratio (listed in Table 2.4-66) to 0.47 percent at the low flow rate. During normal flow rates in the Susquehanna River, the dilution would be even greater.

The following design measures are provided to prevent the potential release from a rupture of the Reactor Coolant Storage Tank, Liquid Waste Storage Tank, Volume Control Tank, or LHSI Heat Exchanger to the subsurface environment, in accordance with Branch Technical Position 11-6 in NUREG-0800 (NRC, 2007b):

1. The rooms/cubicles that house the Reactor Coolant Storage Tanks, Liquid Waste Storage Tanks, Volume Control Tank, and the LHSI Heat Exchangers are:

    a. Designed to contain the maximum liquid inventory in the event the associated tank or heat exchanger ruptures; and

    b. Lined with stainless steel up to a height equivalent to the tank/heat exchanger capacity;

2. The Reactor Coolant Storage Tank, Liquid Waste Storage Tank, and Volume Control Tank are provided with an overflow connection at least the size of the largest inlet connection; and

3. Sump collection systems are designed to collect any leakage from the steel compartments around the tanks/heat exchangers.

In addition, the following controls are provided to reduce the potential impact from the potential release from a rupture of the Reactor Coolant Storage Tank, Liquid Waste Storage Tank, Volume Control Tank, or LHSI Heat Exchanger to the subsurface environment:

1. Alarmed tank level monitoring systems are provided for the Reactor Coolant Storage Tanks, Liquid Waste Storage Tanks, and Volume Control Tank; and

2. Alarmed sump level monitoring systems.

2.4.13.2 Surface Water Pathway

2.4.13.2.1 Direct Releases to Surface Waters

As described in Section 2.4.13.1.1, all BBNPP facility containing radionuclide inventories are located in the nuclear island. For the Nuclear Auxiliary and Waste Buildings, the depth of the top of the basemat is approximately 41.5 ft (12.65 m) below grade. Assuming liquid releases from postulated Reactor Coolant Storage Tank and/or Liquid Waste Storage Tank ruptures would flood the lowest levels of the Nuclear Auxiliary and Waste Buildings, respectively, it is unlikely that a release could reach the ground surface prior to reaching Walker Run.

The concrete floor supporting the Volume Control Tank in the Fuel Building is at grade level (674 ft (205.4 m) msl). However, the room containing this tank is centrally located in the interior of the Fuel Building, and the tank is entirely surrounded by concrete walls. There are no doors providing entry to this room and access is only possible via a ladder through the top of the room. Therefore, a postulated release from the Volume Control Tank will not leave the Fuel Building, reach the ground surface, and impact surface water.

Two heat exchangers in each of the three Safeguards Buildings are located at grade level. One Safeguards Building (Building 2/3) houses its grade level heat exchangers within double wall concrete containment, and has no exterior doors leading into the building at grade level. The remaining Safeguards buildings (Buildings 1 and 4) do not have double wall containment, and grade level exterior entry doors are present. However, these doorways are designed with six inch concrete thresholds and the doors are watertight to a flood depth of 3.3 ft (1.0 m). Therefore, it is unlikely that a release from the grade level Heat Exchangers in the Safeguards Buildings will reach the ground surface and impact surface water.

Because there are no outdoor tanks that could release radioactive effluent, no accident scenario could result in the release of effluent directly to the surface water from outdoor tanks.

2.4.13.3 References

ASTM, 2003. Standard Test Method for 24-h Batch-Type Measurement of Contaminant Sorption by Soils and Sediments, ASTM D 4646-03, American Society for Testing and Materials, November 2003.

CFR, 2007. Title 10, Code of Federal Regulation, Part 20, Appendix B, Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations, Concentrations for Release to Sewerage, 2007.

ICRP, 1983. Radionuclide Transformations - Energy and Intensity Emissions, International Commission on Radiation Protection, ICRP Publication 38, 11-13, ICRP 1983, Pergamon Press, 1983.

Javandel, 1984. Groundwater Transport: Handbook of Mathematical Models, Water Resources Monograph 10, American Geophysical Union, I. Javandel, C. Doughty, and C. Tsang, 1984.

NRC, 1992. Residual Radioactive Contamination from Decommissioning, NUREG/CR-5512, Volume 1, Pacific Northwest Laboratory, W. Kennedy and D. Strenge, October, 1992.

NRC, 2000. Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes, NUREG/CR-6697, Argonne National Laboratory, C. Yu, D. LePoire, E. Gnanapragasam, J. Arnish, S. Kamboj, B. Biwer, J-J Cheng, A. Zilen, and S. Chen, 2000.

NRC, 2007a. Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters, NUREG-0800, Standard Review Plan, Section 2.4.13, Revision 3, Nuclear Regulatory Commission, March 2007.

NRC, 2007b. Postulated Radioactive Releases due to Liquid-Containing Tank Failures, Branch Technical Position 11-6, NUREG-0800, Standard Review Plan, Nuclear Regulatory Commission, March, 2007.}

2.4.14 Technical Specification and Emergency Operation Requirements

The U.S. EPR FSAR includes the following COL Item in Section 2.4.14:

> A COL applicant that references the U.S. EPR design certification will describe any emergency measures required to implement flood protection in safety-related facilities and to verify that there is an adequate water supply for shutdown purposes.

This COL Item is addressed as follows:

{References to elevation values in this section are based on the National Geodetic Vertical Datum of 1929 (NGVD), unless stated otherwise.

Sections 2.4.14.1 and 2.4.14.2 are added as a supplement to the U.S. EPR FSAR.

2.4.14.1 Need for Technical Specifications and Emergency Operations Requirements

The preceding subsections of Section 2.4 provide an in-depth evaluation of the site's hydrologic acceptability for locating BBNPP. The information provided below concludes that there is no need for emergency protective measures designed to minimize the impact of hydrology-related events on safety-related facilities. Therefore, the requirements of 10 CFR 50.36 (CFR, 2007a), 10 CFR Part 50, Appendix A, General Design Criteria 2 (CFR, 2007b), 10 CFR Part 100 (CFR, 2007c), and 10 CFR 52.79 (CFR, 2008) are met with respect to determining the acceptability of the site.

Sections 2.4.1 through 2.4.11 present a comprehensive discussion of the potential for flooding and low water at the site, including details of each potential cause and the resulting effects. These evaluations conclude that flooding in the power block area of safety-related structures, systems, and components due to local intense precipitation, or local Probable Maximum Precipitation (PMP), will be prevented by the site drainage features engineered and constructed for that purpose. The BBNPP design plant grade elevation is located above the design basis flood level and the Probable Maximum Flood (PMF) elevation from local streams. The plant grade elevation will be at elevation 674 ft (205.4 m) msl, which is approximately 161 ft (49 m) above the Susquehanna River 100-yr floodplain of approximately 513 ft (156 m) msl (FEMA, 2008). Additionally, there are no major water bodies (e.g., area greater than 10 acres (4.05 hectares)) directly adjacent to or on the BBNPP site. Near the BBNPP site the evaluations indicate a maximum PMF water surface elevation of 670.96 ft (204.51 m) msl for Walker Run. As a result, the plant site is dry with respect to major flooding on Walker Run. Because the BBNPP site is not located near a coastal region and due to the higher elevation of the plant site relative to the Susquehanna River 100-yr floodplain, tsunami and storm surge and seiche flooding considerations are not applicable for this site.

The U.S.EPR FSAR requires that the maximum post-construction groundwater elevation be at least 3.3 ft (1 m) below grade for the nuclear island. Since the final surface grade elevation is 674.0 ft (205.5 m) msl and the maximum expected groundwater level for the existing conditions is elevation 667 ft (203 m) msl for the saturated Glacial Overburden aquifier, a permanent dewatering system is not needed during operation of BBNPP.

BBNPP is designed such that no actions need be captured in Technical Specifications or Emergency Operating Procedures to protect the facility from flooding or interruption of water supply for shutdown and cooldown purposes.

Additionally, as described in U.S. EPR FSAR Section 9.2.5, the Essential Service Water System (ESWS) cooling tower basins are designed for operation without makeup for 3 days following a design basis accident (DBA), and the ESWEMS makeup pumps are only required for ESWS makeup following those 72 hours post-DBA. Three days of cooling water inventory in the ESWS cooling tower basin is sufficient for shutdown and cooldown, should a potential flooding event require plant shutdown. Operation of the ESWEMS pumps is therefore not required for achieving cold shutdown. The minimum 3 day water inventory in the ESWS cooling tower basin, along with additional details of ESWEMS/ESWS operation, are discussed in U.S. EPR FSAR Section 9.2.5 and Section 9.2.5.

The worst case low water event does not pose a potential of interrupting the supply of cooling water, as discussed in Section 2.4.11. There are no other uses of water drawn from the BBNPP ESWEMS Retention Pond, such as fire water or system charging requirements. There are no other interdependent safety-related water supply systems to the ESWS, such as reservoirs or cooling lakes. There is no potential of blockage to the safety-related ESWS intake due to ice or channel diversions as discussed in Sections 2.4.7 and 2.4.8. Other potential low water conditions are also evaluated and accounted for in the establishment of the design low water level, as discussed Section 2.4.11.

Accordingly, no emergency protective measures are required to minimize the effect of hydrology-related events on safety-related facilities.

2.4.14.2 References

CFR, 2007a. Technical Specifications, Title 10, Code of Federal Regulations, Part 50.36, 2007.

CFR, 2007b. General Design Criteria for Nuclear Power Plants, Criteria 2, Design Bases for Protection Against Natural Phenomena, Title 10, Code of Federal Regulations, Part 50, Appendix A, 2007.

CFR, 2007c. Reactor Site Criteria, Title 10, Code of Federal Regulations, Part 100, 2007.

CFR, 2008. Contents of Applications; Technical Information in Final Safety Analysis Report, Title 10, Code of Federal Regulations, Part 52.79 (a)(10(iii), 2008.

FEMA, 2008. Flood Insurance Map, Luzerne County. Website: http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1, Date accessed: March 27, 2008.}

Table 2.4-1— {Approximate Length and Average Gradient of Creeks Located near BBNPP}

#	River/Creek Name	Subbasin Name	Length ft (m)	Average Slope %
1	Lower Walker Run	SB-A1	10,410.10(3,173)	1.52%
2	Upper Walker Run	SB-A2	12,723.10(3,878)	2.30%
3	Unnamed Tributary No.1	SB-A3	11,161(3,402)	3.06%
Note: Length represents the entire length of each Creek. Slopes were estimated based on upstream and downstream elevations.				

Table 2.4-2— {Annual Peak Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1787 through 2006)}

(Page 1 of 3)

Water Year	Date	Gage Height (ft)	Streamflow (cfs)
1787	Oct. 05, 1786	N.A.	189,000
1807	Apr. 1807	N.A.	202,000
1809	Jul. 1809	N.A.	95,200
1833	May 14, 1833	N.A.	176,000
1865	Mar. 18, 1865	33.10	232,000
1891	Jan. 24, 1891	26.80	164,000
1892	Apr. 04, 1892	21.60	112,000
1893	May 05, 1893	22.02	115,000
1894	May 21, 1894	20.00	97,100
1895	Apr. 10, 1895	21.82	113,000
1896	Apr. 01, 1896	24.00	135,000
1897	Oct. 15, 1896	19.00	88,600
1898	Apr. 26, 1898	17.82	78,900
1899	Mar. 06, 1899	18.22	82,100
1900	Mar. 02, 1900	19.70	94,500
1901	Nov. 28, 1900	22.00	115,000
1902	Mar. 02, 1902	31.40	213,000
1903	Mar. 25, 1903	22.40	119,000
1904	Mar. 09, 1904	30.60	204,000
1905	Mar. 26, 1905	23.40	129,000
1906	Apr. 01, 1906	18.10	81,300
1907	Mar. 16, 1907	16.00	65,500
1908	Feb. 17, 1908	23.50	130,000
1909	May 02, 1909	23.00	125,000
1910	Mar. 03, 1910	26.10	157,000
1911	Mar. 29, 1911	19.70	94,500
1912	Apr. 03, 1912	23.20	127,000
1913	Mar. 28, 1913	28.50	184,000
1914	Mar. 29, 1914	28.30	182,000
1915	Feb. 26, 1915	23.30	127,000
1916	Apr. 02, 1916	26.50	160,000
1917	Mar. 28, 1917	17.70	75,700
1918	Mar. 15, 1918	23.00	124,000
1919	May 24, 1919	16.60	66,900
1920	Mar. 13, 1920	26.00	155,000
1921	Mar. 10, 1921	19.00	86,600
1922	Nov. 29, 1921	22.30	117,000
1923	Mar. 05, 1923	19.60	91,800
1924	Apr. 08, 1924	23.50	129,000
1925	Feb. 13, 1925	25.10	145,000
1926	Mar. 26, 1926	19.40	90,100
1927	Nov. 17, 1926	22.70	121,000
1928	Oct. 20, 1927	24.70	141,000
1929	Apr. 22, 1929	26.40	159,000
1930	Mar. 09, 1930	16.70	67,600
1931	Mar. 30, 1931	17.60	74,700

Table 2.4-2— {Annual Peak Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1787 through 2006)}
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Water Year	Date	Gage Height (ft)	Streamflow (cfs)
1932	Apr. 02, 1932	20.50	107,000
1933	Aug. 25, 1933	19.72	99,800
1934	Mar. 06, 1934	18.00	85,500
1935	Jul. 10, 1935	25.39	151,000
1936	Mar. 20, 1936	33.07	232,000
1937	Jan. 23, 1937	17.15	77,300
1938	Sep. 24, 1938	14.70	64,900
1939	Feb. 22, 1939	23.80	137,000
1940	Apr. 01, 1940	31.53	212,000
1941	Apr. 07, 1941	23.50	138,000
1942	Mar. 11, 1942	20.62	111,000
1943	Jan. 01, 1943	29.37	191,000
1944	May 09, 1944	18.50	90,000
1945	Mar. 05, 1945	21.80	119,000
1946	May 29, 1946	32.01	210,000
1947	Apr. 07, 1947	24.88	151,000
1948	Mar. 23, 1948	28.76	193,000
1949	Dec. 31, 1948	17.39	82,700
1950	Mar. 30, 1950	27.04	172,000
1951	Apr. 01, 1951	22.72	128,000
1952	Mar. 13, 1952	22.39	124,000
1953	Dec. 12, 1952	19.43	98,000
1954	May 5, 1954	16.85	78,900
1955	Mar. 03, 1955	17.80	85,900
1956	Mar. 09, 1956	28.17	186,000
1957	Apr. 07, 1957	20.48	107,000
1958	Apr. 08, 1958	26.80	170,000
1959	Jan. 23, 1959	21.14	113,000
1960	Apr. 02, 1960	29.60	184,000
1961	Feb. 27, 1961	26.20	163,000
1962	Apr. 02, 1962	22.84	128,000
1963	Mar. 28, 1963	22.26	131,000
1964	Mar. 10, 1964	N.A.	188,000
1965	Feb. 14, 1965	11.10	44,600
1966	Feb. 15, 1966	18.25	93,500
1967	Mar. 29, 1967	17.16	84,800
1968	Mar. 24, 1968	19.19	101,000
1969	Apr. 07, 1969	16.57	80,500
1970	Apr. 04, 1970	20.92	115,000
1971	Mar. 17, 1971	20.28	110,000
1972	Jun. 24, 1972	40.91	345,000
1973	Apr. 06, 1973	18.04	91,800
1974	Dec. 28, 1973	18.24	93,400
1975	Sep. 27, 1975	35.06	228,000
1976	Feb. 19, 1976	21.34	118,000
1977	Sep. 26, 1977	21.62	121,000

Table 2.4-2— {Annual Peak Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1787 through 2006)}
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Water Year	Date	Gage Height (ft)	Streamflow (cfs)
1978	Jan. 27, 1978	21.08	116,000
1979	Mar. 07, 1979	31.02	192,000
1980	Mar. 23, 1980	19.50	104,000
1981	Feb. 22, 1981	19.57	104,000
1982	Oct. 29, 1981	17.24	86,400
1983	Apr. 16, 1983	23.86	138,000
1984	Dec. 14, 1983	29.76	192,000
1985	Mar. 14, 1985	13.04	55,800
1986	Mar. 16, 1986	27.36	172,000
1987	Apr. 05, 1987	19.22	98,500
1988	May 21, 1988	16.88	82,200
1989	May 12, 1989	21.12	117,000
1990	Feb. 18, 1990	15.75	74,900
1991	Oct. 25, 1990	22.69	134,000
1992	Mar. 28, 1992	18.46	92,000
1993	Apr. 02, 1993	29.87	185,000
1994	Mar. 26, 1994	24.16	148,000
1995	Jan. 22, 1995	15.76	72,100
1996	Jan. 20, 1996	34.45	221,000
1997	Nov. 10, 1996	23.57	128,000
1998	Jan. 09, 1998	24.79	138,000
1999	Jan. 25, 1999	21.59	112,000
2000	Feb. 29, 2000	23.66	129,000
2001	Apr. 11, 2001	19.49	96,800
2002	Mar. 28, 2002	17.02	78,900
2003	Mar. 22, 2003	22.84	122,000
2004	Sep. 19, 2004	34.96	227,000
2005	Apr. 04, 2005	30.88	189,000
2006	Jun. 28, 2006	34.14	218,000
Note: N.A. = Not Available			

Table 2.4-3— {Monthly Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}

(Page 1 of 4)

Discharge, cubic feet per second													
Year	Monthly Mean in cfs (Calculation Period: 1/ 04/1899 to 9/30/2006)												Average Yearly Discharge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1899				28,770	8,567	3,378	1,965	1,653	1,140	1,072	7,045	12,680	
1900	18,270	28,220	23,770	26,340	6,583	3,506	2,320	1,635	1,239	1,120	10,850	14,070	11,494
1901	5,532	3,893	32,830	39,250	21,450	15,670	3,065	7,403	4,257	3,570	5,288	25,910	14,010
1902	11,530	7,264	65,710	21,860	4,847	4,968	29,010	10,070	4,917	14,970	8,394	22,930	17,206
1903	13,320	34,970	53,490	23,650	3,388	10,260	7,877	13,070	10,930	27,370	12,570	7,036	18,161
1904	14,090	15,720	52,520	31,290	15,750	11,170	3,636	5,192	4,119	11,250	5,972	7,658	14,864
1905	19,680	5,289	41,070	24,550	5,873	10,750	5,488	5,466	12,650	8,081	5,527	20,020	13,704
1906	15,400	10,690	18,650	37,390	12,100	13,920	6,493	3,662	1,869	5,128	10,070	11,070	12,204
1907	29,450	5,347	24,070	17,920	13,720	4,808	4,367	1,485	5,139	11,100	18,550	30,440	13,866
1908	14,070	21,570	45,190	25,010	25,840	4,471	2,718	1,480	869.3	1,059	1,476	1,357	12,093
1909	14,490	33,760	21,360	27,200	28,210	10,610	2,076	1,451	1,124	1,188	1,206	2,143	12,068
1910	12,730	6,407	51,580	17,050	15,620	10,970	1,946	996.1	1,030	1,117	3,074	2,611	10,428
1911	20,760	7,584	21,620	30,540	5,980	7,086	1,764	1,278	3,637	9,217	8,976	14,310	11,063
1912	6,796	8,097	32,870	46,810	16,450	3,641	1,249	1,817	12,860	9,300	13,080	15,590	14,047
1913	36,070	7,294	40,100	19,960	9,271	4,425	1,359	920.6	1,008	2,992	10,670	5,988	11,671
1914	7,662	14,860	29,750	53,770	26,430	4,183	4,774	5,100	3,800	1,448	1,689	2,130	12,966
1915	25,850	35,260	12,120	13,440	8,379	2,479	26,580	18,630	6,652	10,290	6,982	11,990	14,888
1916	25,390	11,490	18,370	59,300	16,650	22,970	5,886	1,758	2,360	4,871	5,166	6,873	15,090
1917	8,178	4,319	26,620	19,990	13,000	27,230	16,900	14,020	5,403	15,240	13,850	2,499	13,937
1918	1,450	18,650	41,430	27,980	16,850	9,701	3,672	1,480	5,144	9,190	14,180	11,490	13,435
1919	12,130	6,480	20,760	20,690	26,190	4,701	4,576	3,694	1,980	2,577	15,160	9,185	10,677
1920	2,839	2,710	48,990	23,090	9,845	3,896	7,191	7,686	7,497	10,080	13,200	24,170	13,433
1921	8,949	9,669	35,460	16,860	10,450	2,428	3,142	2,557	1,848	2,879	19,960	17,860	11,005
1922	6,303	15,530	32,910	32,310	9,612	24,760	11,890	5,544	4,555	2,056	2,069	2,458	12,500
1923	9,361	6,578	35,250	19,070	15,250	4,580	1,612	1,440	1,887	3,361	4,175	15,860	9,869
1924	19,480	5,369	14,990	40,400	23,830	6,096	3,983	2,554	3,865	16,760	3,658	5,501	12,207
1925	2,912	34,590	22,310	16,390	11,350	3,668	6,191	4,574	5,241	6,519	19,490	16,100	12,445
1926	10,370	14,760	28,820	35,280	8,108	4,088	2,052	5,947	5,990	14,490	30,970	9,160	14,170
1927	11,480	20,860	44,130	16,630	26,190	7,843	2,845	3,210	4,003	24,560	32,130	35,260	19,095
1928	15,090	17,640	21,790	32,330	23,720	23,050	17,160	7,714	2,520	2,090	3,554	7,607	14,522

Table 2.4-3— {Monthly Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}

(Page 2 of 4)

Discharge, cubic feet per second													
Year	Monthly Mean in cfs (Calculation Period: 1/ 04/1899 to 9/30/2006)												Average Yearly Discharge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1929	5,094	5,985	39,710	52,190	29,710	5,257	2,737	1,527	1,284	6,861	9,856	13,970	14,515
1930	21,510	12,780	29,640	18,360	9,824	9,205	3,542	1,105	1,968	1,105	1,089	1,933	9,338
1931	1,386	3,516	20,320	30,170	22,500	7,557	7,231	2,679	1,838	1,248	2,454	10,080	9,248
1932	21,670	20,910	13,790	41,680	16,620	3,803	4,292	2,240	1,116	11,290	23,390	6,096	13,908
1933	8,742	6,148	25,060	33,520	11,260	4,794	2,536	12,160	14,390	6,120	8,315	11,810	12,071
1934	17,540	3,882	20,790	32,410	6,496	4,413	2,050	1,657	7,036	4,734	9,027	13,840	10,323
1935	20,740	7,950	30,980	28,470	17,920	4,142	20,330	4,837	2,348	2,193	22,530	13,280	14,643
1936	8,910	5,233	80,560	26,230	8,509	3,261	1,479	2,132	1,602	3,417	12,630	11,800	13,814
1937	29,760	13,690	12,980	35,000	15,600	8,682	4,684	6,650	5,355	11,910	14,750	13,580	14,387
1938	11,100	21,240	23,240	17,790	7,799	4,326	3,667	4,648	12,470	4,771	7,107	23,010	11,764
1939	8,180	31,060	32,500	27,160	6,113	2,453	1,284	1,225	769.9	1,930	4,473	6,160	10,276
1940	3,523	3,800	16,890	85,900	15,430	8,798	5,736	2,103	4,709	3,159	9,089	15,950	14,591
1941	12,400	6,389	14,030	39,500	5,216	3,904	2,046	2,545	1,059	904.9	2,405	6,802	8,100
1942	6,200	6,554	36,930	20,310	15,050	9,016	4,167	5,583	5,040	12,310	18,120	21,510	13,399
1943	28,000	20,890	36,320	27,250	39,590	12,190	2,910	2,737	1,737	6,640	18,140	5,562	16,831
1944	3,124	6,258	26,340	28,050	20,310	9,326	3,343	1,544	1,882	3,481	5,022	10,100	9,898
1945	10,600	14,070	58,930	17,050	28,990	14,220	8,212	5,731	10,010	17,940	25,280	16,360	18,949
1946	17,750	6,591	33,520	6,918	31,800	21,870	7,571	6,876	3,019	8,004	5,342	4,075	12,778
1947	17,480	11,910	22,990	41,480	36,940	18,130	14,020	7,032	4,295	1,775	6,875	5,935	15,739
1948	3,503	13,100	50,290	32,680	22,200	9,963	5,886	4,287	1,514	1,605	7,474	10,340	13,570
1949	29,220	18,450	15,920	18,500	12,650	3,814	1,671	1,917	3,279	3,651	6,137	13,910	10,760
1950	20,880	11,830	33,230	41,180	14,060	10,620	4,331	4,639	11,120	6,144	18,670	29,980	17,224
1951	22,970	29,250	27,810	32,020	7,077	5,389	7,967	3,039	1,959	1,806	9,802	16,750	13,820
1952	29,560	16,460	32,470	30,100	19,900	6,702	5,783	2,753	2,868	1,681	5,252	20,200	14,477
1953	20,620	18,820	26,870	23,900	21,570	6,924	2,239	1,348	1,143	1,218	3,272	10,020	11,495
1954	7,011	22,010	20,700	23,300	22,120	8,750	2,105	1,133	2,173	1,408	10,730	17,090	11,544
1955	14,140	12,090	42,870	16,500	6,530	3,773	1,409	6,229	2,270	27,750	25,580	9,335	14,040
1956	7,138	14,700	44,380	55,210	17,570	7,812	5,722	2,580	6,346	5,035	7,171	21,930	16,300
1957	13,970	10,900	21,490	36,210	14,820	4,756	3,196	2,186	1,642	1,933	3,910	16,130	10,929
1958	10,880	6,400	27,030	72,870	25,600	11,420	6,419	3,028	4,221	6,490	12,520	8,166	16,254

Table 2.4-3— {Monthly Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}

(Page 3 of 4)

Discharge, cubic feet per second													
Year	Monthly Mean in cfs (Calculation Period: 1/ 04/1899 to 9/30/2006)												Average Yearly Discharge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1959	16,900	14,240	23,870	33,830	9,965	3,041	1,663	1,330	1,735	8,333	24,820	32,810	14,378
1960	18,110	22,090	13,210	57,530	22,600	22,280	5,162	3,425	9,404	3,774	4,878	2,862	15,444
1961	2,044	24,330	32,710	45,110	21,320	11,850	4,647	4,654	2,593	1,449	3,120	5,132	13,247
1962	12,800	5,855	26,660	42,730	9,660	2,519	1,086	1,118	861.7	7,335	11,230	7,981	10,820
1963	6,415	4,752	36,900	24,560	13,120	5,776	2,493	1,674	1,054	816.5	2,444	8,188	9,016
1964	16,260	8,928	55,860	24,200	13,350	2,784	1,452	853.2	636.7	704.7	723.6	2,451	10,684
1965	4,704	15,470	10,250	23,010	10,170	3,688	1,187	1,282	1,634	3,753	6,439	8,566	7,513
1966	7,521	18,240	36,870	16,560	19,580	7,569	1,862	1,260	1,346	1,656	3,552	10,110	10,511
1967	9,553	11,000	24,860	27,530	22,980	6,503	5,145	7,098	3,912	8,988	22,100	18,660	14,027
1968	6,505	13,740	27,100	13,710	18,800	20,470	7,344	2,190	5,413	2,884	22,460	16,070	13,057
1969	10,250	11,090	13,810	29,700	12,250	9,353	4,792	4,988	1,625	1,347	13,830	14,380	10,618
1970	5,874	22,800	17,510	51,580	13,790	4,132	4,021	1,994	2,241	5,925	14,730	11,060	12,971
1971	7,767	19,740	38,400	34,460	18,690	3,699	1,879	3,253	2,307	2,040	3,005	20,400	12,970
1972	16,220	6,116	43,240	38,690	29,620	54,330	14,570	3,648	1,849	2,357	29,280	36,630	23,046
1973	19,470	17,140	26,240	30,490	20,920	10,810	7,681	3,399	3,314	2,356	4,818	32,540	14,932
1974	22,850	18,390	23,190	36,500	14,200	5,423	6,097	2,467	5,865	4,053	11,950	20,440	14,285
1975	20,840	29,320	25,430	18,730	19,580	11,460	3,920	2,762	28,680	25,020	14,030	15,520	17,941
1976	16,160	43,030	30,810	18,630	17,690	12,950	9,978	9,028	4,863	29,510	13,020	9,375	17,920
1977	4,565	9,047	50,960	30,020	13,040	3,763	3,330	3,991	24,940	39,860	27,930	33,670	20,426
1978	33,900	12,740	39,440	39,740	17,690	7,113	2,779	5,043	2,789	4,496	4,799	9,565	15,008
1979	34,360	12,090	53,400	24,870	14,660	6,938	2,444	1,979	3,667	8,481	15,970	14,510	16,114
1980	7,779	3,326	31,090	37,530	11,500	3,701	4,497	1,975	1,152	1,762	4,645	7,363	9,693
1981	2,290	40,790	12,550	11,970	15,020	8,667	3,694	2,535	3,769	14,000	16,970	11,510	11,980
1982	10,240	16,870	32,180	30,600	7,935	20,780	7,588	2,458	1,339	1,267	3,487	8,053	11,900
1983	6,995	18,160	19,070	51,430	31,020	8,614	3,637	1,877	1,171	1,338	5,446	34,770	15,294
1984	5,548	36,800	15,660	50,110	31,200	14,800	10,800	7,481	3,254	1,995	4,493	19,310	16,788
1985	9,432	8,889	21,270	14,260	5,520	3,692	2,828	1,806	4,752	6,413	17,260	17,210	9,444
1986	12,160	18,620	42,820	21,230	10,770	11,930	6,083	8,627	2,581	6,454	21,960	20,430	15,305
1987	8,313	4,682	24,780	35,420	6,451	4,690	5,725	2,001	8,459	5,971	8,365	14,200	10,755
1988	6,334	16,060	19,730	13,220	19,150	4,155	2,357	1,985	3,293	2,888	12,090	5,955	8,935

Table 2.4-3— {Monthly Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}

(Page 4 of 4)

Discharge, cubic feet per second													
Year	Monthly Mean in cfs (Calculation Period: 1/ 04/1899 to 9/30/2006)												Average Yearly Discharge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1989	5,107	7,206	13,360	25,890	38,140	24,420	6,988	2,695	3,167	8,989	14,190	5,239	12,949
1990	14,550	37,320	17,650	22,600	21,320	6,815	5,823	3,874	2,957	24,180	22,160	28,540	17,316
1991	20,800	19,540	27,590	21,420	10,990	2,712	1,311	1,346	1,209	1,919	5,246	11,190	10,439
1992	12,460	8,367	24,330	26,780	14,270	10,660	6,203	10,040	7,683	9,541	22,580	15,820	14,061
1993	23,150	5,857	22,170	100,000	12,800	4,445	2,039	1,589	2,166	3,162	16,940	19,600	17,827
1994	6,917	17,430	43,670	61,030	11,450	11,680	9,344	19,560	7,105	5,358	10,760	18,080	18,532
1995	19,380	8,199	20,670	14,180	6,508	4,091	1,841	1,352	1,079	9,809	15,750	10,600	9,455
1996	40,740	19,470	21,020	32,350	36,730	8,321	8,785	4,846	4,778	13,040	29,540	44,610	22,019
1997	12,780	14,640	28,580	20,490	14,800	7,063	2,680	1,809	1,813	1,912	7,600	10,970	10,428
1998	36,890	21,510	41,770	32,420	20,380	13,140	13,990	2,388	1,781	2,354	2,078	2,997	15,975
1999	19,670	18,000	23,070	22,980	6,720	2,137	1,850	977.2	5,629	5,660	6,522	12,500	10,476
2000	14,040	21,930	35,820	42,570	32,330	18,920	6,466	5,308	3,217	5,470	5,309	14,310	17,141
2001	6,057	14,130	20,660	42,310	5,076	9,479	3,451	1,497	3,100	2,123	2,043	9,778	9,975
2002	5,599	20,470	18,500	20,520	31,090	23,330	4,078	1,387	2,146	10,330	15,860	17,870	14,265
2003	16,060	9,674	43,550	31,090	13,520	28,280	10,210	11,860	15,980	17,550	26,180	34,030	21,499
2004	16,350	6,844	33,800	26,890	22,110	9,290	13,870	18,180	37,600	10,400	13,250	30,870	19,955
2005	30,770	18,550	24,500	47,890	7,532	4,134	3,076	1,317	2,284	17,970	20,430	22,730	16,765
2006	35,210	21,190	13,930	13,280	9,054	31,720	23,620	8,361	12,880				
Mean of Monthly Discharge	14,300	14,900	30,100	31,200	16,400	9,490	5,640	4,150	4,700	7,110	11,300	14,400	**13,641**

Table 2.4-4— {Mean Daily Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}

	Discharge, cubic feet per second											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	15,700	13,300	23,200	40,600	20,400	11,500	8,600	4,510	4,240	6,340	8,680	15,000
2	15,200	12,800	23,600	40,300	19,900	11,300	8,440	4,540	4,330	6,170	8,270	15,300
3	15,200	13,300	22,900	40,800	18,800	11,200	7,740	4,500	4,680	5,780	8,730	15,200
4	15,000	14,000	22,600	40,100	18,100	11,300	7,130	4,360	4,840	5,430	8,910	14,900
5	14,800	13,200	23,700	39,800	17,600	10,700	6,460	4,470	4,430	5,040	8,850	15,000
6	14,700	12,100	24,700	41,200	17,100	10,300	6,080	4,260	4,070	4,900	9,000	14,800
7	15,000	11,300	26,300	41,500	16,900	10,900	6,100	4,360	3,770	5,450	8,720	14,600
8	15,400	10,900	25,700	39,600	17,400	10,400	5,910	4,080	3,390	5,250	8,970	14,700
9	15,500	10,800	26,000	37,700	17,300	9,740	6,970	4,000	3,190	5,480	10,900	14,800
10	15,000	10,300	25,800	35,700	17,200	9,150	7,850	4,210	3,440	6,590	11,700	14,300
11	13,600	11,700	24,600	35,100	18,000	8,590	6,740	4,100	3,390	6,690	11,500	15,100
12	12,800	13,300	26,100	33,000	18,600	8,370	5,690	3,960	3,480	6,180	11,000	15,700
13	12,500	12,900	27,400	31,800	19,300	8,380	5,310	3,970	3,830	5,860	10,300	15,200
14	12,400	12,900	27,800	31,200	19,200	8,480	5,260	3,850	3,880	5,620	10,700	15,800
15	12,500	13,800	29,300	31,200	17,900	9,040	5,000	4,050	3,710	5,820	11,100	17,100
16	12,100	15,500	30,800	31,400	16,500	9,220	4,780	4,080	3,890	6,390	10,700	16,900
17	11,800	15,400	31,500	31,100	15,600	9,140	4,530	3,740	4,120	6,720	12,000	15,400
18	11,200	15,100	32,300	29,300	15,100	9,340	4,290	3,930	5,230	7,030	12,600	14,100
19	11,900	14,700	32,000	27,000	14,700	8,910	4,240	4,810	5,900	7,460	12,800	13,700
20	13,400	14,700	30,300	25,300	14,800	8,120	4,180	4,040	5,310	8,660	12,800	13,000
21	13,800	16,700	30,200	25,200	15,400	8,160	4,330	3,730	4,830	9,230	12,700	12,800
22	14,900	17,500	31,400	25,700	15,800	8,910	4,740	3,890	4,770	8,890	12,200	12,900
23	15,800	18,000	33,100	25,300	15,600	10,700	5,080	4,080	4,830	8,380	12,000	12,700
24	15,900	18,800	33,100	24,000	14,800	11,000	5,270	4,270	4,780	8,490	11,600	12,800
25	16,300	20,300	33,500	24,000	14,800	10,100	5,420	4,630	5,310	8,750	11,600	13,600
26	17,100	21,500	34,300	24,200	14,600	8,310	5,140	4,230	6,550	8,740	12,300	13,400
27	16,800	20,700	36,900	22,500	13,900	7,510	4,610	3,680	7,710	8,770	13,600	13,100
28	15,900	20,400	40,300	21,000	13,600	8,490	4,790	3,900	7,180	8,640	14,600	12,600
29	14,700	17,500	42,400	20,400	14,300	8,730	4,880	3,770	5,910	9,240	15,500	12,500
30	13,700		41,300	20,000	14,100	8,550	4,620	4,330	5,870	9,390	15,400	13,300
31	13,600		40,500		12,400		4,540	4,330		8,910		15,000

Table 2.4-5— {Maximum Daily Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}

	Discharge, cubic feet per second											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	180,000	68,900	193,000	206,000	97,200	64,100	120,000	47,100	47,600	111,000	66,900	99,100
2	111,000	59,500	206,000	199,000	118,000	76,800	94,000	36,500	38,400	107,000	50,900	70,700
3	103,000	50,500	198,000	181,000	103,000	72,600	59,100	34,500	39,700	70,000	39,000	124,000
4	90,900	77,900	149,000	187,000	77,800	64,200	39,500	27,200	50,200	41,500	60,300	99,000
5	61,900	84,500	112,000	157,000	74,700	54,600	34,500	49,200	44,900	35,100	47,900	113,000
6	54,800	66,100	166,000	170,000	54,700	38,400	28,300	46,300	33,300	29,400	52,500	95,000
7	77,300	48,100	202,000	178,000	59,600	67,400	42,300	55,300	35,000	45,800	42,500	63,600
8	73,600	36,600	150,000	167,000	78,100	65,900	49,900	36,000	27,700	50,300	53,800	83,900
9	123,000	51,600	179,000	141,000	81,200	50,000	99,700	28,600	17,600	40,300	68,400	78,100
10	126,000	38,800	139,000	137,000	66,300	39,000	142,000	51,500	51,600	89,400	123,000	65,200
11	103,000	62,400	187,000	167,000	84,200	35,900	115,000	32,300	56,500	107,000	92,600	71,100
12	85,700	130,000	129,000	174,000	111,000	38,400	56,200	32,800	36,400	106,000	80,500	89,600
13	70,300	138,000	182,000	132,000	120,000	36,900	37,400	25,900	28,700	79,200	61,200	81,100
14	93,200	95,400	150,000	97,500	101,000	36,400	35,300	27,200	33,600	47,100	58,600	157,000
15	132,000	108,000	131,000	89,900	76,300	44,600	35,500	27,400	26,500	44,500	68,700	184,000
16	92,500	179,000	169,000	115,000	64,000	61,600	26,900	31,000	26,600	151,000	61,900	166,000
17	66,900	133,000	136,000	125,000	67,800	55,900	21,400	22,500	43,300	144,000	95,400	122,000
18	48,500	102,000	192,000	123,000	56,200	59,600	22,200	32,700	122,000	109,000	112,000	59,500
19	97,300	115,000	229,000	93,000	57,500	52,000	23,400	95,300	204,000	99,800	84,900	58,300
20	210,000	110,000	221,000	69,600	56,400	35,300	16,500	64,600	125,000	130,000	70,800	50,400
21	193,000	113,000	184,000	98,100	77,200	41,700	39,400	46,800	67,000	120,000	70,500	45,000
22	128,000	129,000	144,000	148,000	68,500	81,200	57,800	38,900	57,900	70,700	61,400	73,700
23	99,400	84,700	180,000	141,000	68,500	272,000	48,100	38,200	57,000	63,500	47,100	75,100
24	82,300	88,400	162,000	94,500	77,800	329,000	45,900	59,500	64,100	69,900	39,900	65,000
25	110,000	144,000	134,000	100,000	70,000	275,000	48,300	90,400	58,200	126,000	42,000	86,100
26	92,300	154,000	139,000	136,000	100,000	128,000	54,700	65,800	126,000	80,400	81,700	69,300
27	101,000	158,000	155,000	115,000	80,000	73,500	37,400	38,000	244,000	79,700	110,000	54,900
28	103,000	123,000	178,000	91,800	149,000	184,000	63,500	37,600	201,000	58,600	102,000	88,300
29	73,100	127,000	179,000	66,100	206,000	179,000	72,100	30,600	80,300	73,700	107,000	79,200
30	54,500		168,000	64,600	138,000	151,000	60,500	90,000	50,000	69,600	96,300	75,200
31	66,100		173,000		87,900		42,300	68,700		78,200		176,000

Table 2.4-6— {Minimum Daily Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}

	Discharge, cubic feet per second											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	1,090	1,300	2,100	8,050	6,230	2,000	1,330	787	725	681	699	992
2	1,090	1,300	2,200	8,390	5,910	2,000	1,320	836	746	674	664	984
3	1,160	1,280	2,300	7,590	5,340	2,000	1,280	808	706	658	642	992
4	1,110	1,280	2,200	7,140	5,070	1,810	1,280	774	708	729	632	1,140
5	1,060	1,220	2,200	6,750	4,800	1,810	1,280	780	712	722	627	1,190
6	1,060	1,160	2,100	6,470	4,540	1,810	1,210	768	704	722	642	1,220
7	1,160	1,160	2,100	6,780	4,280	1,810	1,150	732	675	720	637	1,240
8	1,160	1,160	2,600	7,660	4,280	1,810	1,110	808	670	720	627	1,230
9	1,060	1,110	2,820	7,600	4,280	2,000	1,090	720	675	699	637	1,090
10	1,060	1,060	2,820	7,380	3,780	2,000	1,070	722	670	693	653	860
11	1,010	1,060	2,600	7,100	3,540	1,810	995	716	637	687	653	1,090
12	1,160	1,110	2,390	6,930	3,540	1,970	983	799	627	675	653	1,060
13	1,390	1,340	2,390	6,280	3,300	1,840	990	842	597	675	653	1,060
14	1,340	1,800	3,270	6,280	3,070	1,840	969	822	588	670	637	1,060
15	1,300	1,530	3,400	6,540	3,070	1,840	924	815	588	664	627	1,060
16	1,290	1,530	3,300	6,540	3,070	1,720	909	801	583	670	632	1,060
17	1,300	1,950	3,300	5,660	2,840	1,790	872	780	578	681	653	1,060
18	1,320	2,100	3,600	5,660	2,840	1,960	1,040	774	569	681	653	1,060
19	1,410	2,200	4,200	7,100	2,620	1,880	1,020	810	552	693	653	1,090
20	1,660	2,100	5,340	6,540	2,620	1,810	986	787	548	716	710	1,220
21	1,530	2,470	4,800	6,000	2,620	1,700	920	794	544	722	681	1,340
22	1,300	2,290	4,800	5,730	2,660	1,670	920	822	544	700	681	1,400
23	1,210	2,200	4,280	5,690	2,620	1,570	928	836	552	700	681	1,090
24	1,220	2,000	4,280	5,470	2,620	1,480	986	836	569	720	704	970
25	1,230	2,000	4,540	5,210	2,200	1,440	942	818	548	722	761	1,490
26	1,310	2,000	4,800	5,210	2,200	1,400	920	785	536	722	913	1,490
27	1,410	2,000	5,070	5,210	2,200	1,350	944	795	532	710	992	1,490
28	1,530	2,000	6,440	5,470	2,200	1,350	878	805	578	704	1,100	1,220
29	1,470	2,200	7,070	5,470	2,000	1,470	843	785	699	704	1,080	1,360
30	1,400		7,450	6,000	2,000	1,400	815	735	684	710	1,040	1,090
31	1,360		7,660		2,000		787	725		710		1,090

Table 2.4-7— {Annual Peak Streamflow for Danville, PA USGS Station No. 01540500, (1865 through 2006)}
(Page 1 of 3)

Water Year	Date	Gage Height (ft)	Streamflow (cfs)
1865	Mar. 18, 1865	28.00	N.A.
1900	Mar. 02, 1900	15.90	105,000
1901	Nov. 28, 1900	18.50	135,000
1902	Mar. 03, 1902	26.90	243,000
1903	Mar. 25, 1903	18.20	132,000
1904	Mar. 27, 1904	19.62	148,000
1905	Mar. 26, 1905	18.62	136,000
1906	Apr. 01, 1906	15.40	99,500
1907	Mar. 17, 1907	13.00	73,400
1908	Feb. 17, 1908	17.40	122,000
1909	May 2, 1909	18.40	134,000
1910	Mar. 03, 1910	21.00	165,000
1911	Mar. 29, 1911	15.20	97,300
1912	Apr. 03, 1912	17.91	129,000
1913	Mar. 28, 1913	23.11	192,000
1914	Mar. 29, 1914	22.60	186,000
1915	Feb. 26, 1915	19.00	141,000
1916	Apr. 02, 1916	21.80	175,000
1917	Mar. 29, 1917	14.80	92,900
1918	Mar. 16, 1918	18.60	139,000
1919	May 24, 1919	13.70	80,800
1920	Mar. 14, 1920	20.90	170,000
1921	Mar. 10, 1921	15.50	101,000
1922	Nov. 30, 1921	18.10	133,000
1923	Mar. 05, 1923	15.80	105,000
1924	Apr. 08, 1924	18.80	142,000
1925	Feb. 13, 1925	20.30	162,000
1926	Mar. 27, 1926	15.50	101,000
1927	Nov. 17, 1926	18.80	142,000
1928	Oct. 21, 1927	19.90	156,000
1929	Apr. 23, 1929	20.35	163,000
1930	Mar. 09, 1930	13.50	78,700
1931	Mar. 30, 1931	14.35	88,500
1932	Apr. 02, 1932	17.05	119,000
1933	Aug. 25, 1933	17.04	119,000
1934	Mar. 06, 1934	14.50	98,600
1935	Jul. 11, 1935	20.00	153,000
1936	Mar. 20, 1936	27.42	250,000
1937	Jan. 23, 1937	15.20	93,400
1938	Oct. 24, 1937	13.80	79,400
1939	Feb. 22, 1939	19.20	139,000
1940	Apr. 02, 1940	25.25	222,000
1941	Apr. 07, 1941	19.45	142,000
1942	Mar. 11, 1942	17.08	116,000
1943	Jan. 01, 1943	24.00	204,000
1944	May 9, 1944	15.48	97,600

Table 2.4-7— {Annual Peak Streamflow for Danville, PA USGS Station No. 01540500, (1865 through 2006)}
(Page 2 of 3)

Water Year	Date	Gage Height (ft)	Streamflow (cfs)
1945	Mar. 05, 1945	17.55	121,000
1946	May 26, 1946	25.98	234,000
1947	Apr. 07, 1947	19.95	150,000
1948	Mar. 24, 1948	22.63	184,000
1949	Jan. 01, 1949	15.16	89,600
1950	Mar. 30, 1950	21.81	168,000
1951	Dec. 05, 1950	19.02	131,000
1952	Mar. 13, 1952	18.84	127,000
1953	Dec. 13, 1952	16.80	103,000
1954	May 5, 1954	14.71	82,100
1955	Mar. 03, 1955	15.09	85,900
1956	Mar. 09, 1956	22.47	175,000
1957	Apr. 08, 1957	17.78	114,000
1958	Apr. 08, 1958	21.87	169,000
1959	Jan. 24, 1959	17.45	112,000
1960	Apr. 02, 1960	23.92	198,000
1961	Feb. 28, 1961	21.72	167,000
1962	Apr. 02, 1962	19.38	136,000
1963	Mar. 29, 1963	18.89	130,000
1964	Mar. 11, 1964	25.13	261,000
1965	Feb. 14, 1965	N.A	44,900
1966	Feb. 15, 1966	16.26	98,900
1967	Mar. 30, 1967	15.23	87,500
1968	Mar. 24, 1968	16.75	104,000
1969	Apr. 07, 1969	14.67	81,700
1970	Apr. 04, 1970	18.24	122,000
1971	Mar. 17, 1971	17.34	111,000
1972	Jun. 25, 1972	32.16	363,000
1973	Dec. 08, 1972	15.96	99,600
1974	Dec. 29, 1973	16.39	103,000
1975	Sep. 28, 1975	27.52	257,000
1976	Feb. 19, 1976	18.13	120,000
1977	Sep. 27, 1977	18.04	122,000
1978	Mar. 23, 1978	17.98	116,000
1979	Mar. 07, 1979	23.93	188,000
1980	Mar. 23, 1980	16.65	104,000
1981	Feb. 22, 1981	16.95	105,000
1982	Oct. 30, 1981	14.61	83,300
1983	Apr. 17, 1983	20.53	149,000
1984	Apr. 07, 1984	24.14	194,000
1985	Mar. 14, 1985	11.77	55,300
1986	Mar. 16, 1986	22.68	173,000
1987	Apr. 06, 1987	16.74	104,000
1988	May 21, 1988	14.81	83,500
1989	May 15, 1989	17.70	116,000
1990	Feb. 18, 1990	13.51	70,900

Table 2.4-7— {Annual Peak Streamflow for Danville, PA USGS Station No. 01540500, (1865 through 2006)}
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Water Year	Date	Gage Height (ft)	Streamflow (cfs)
1991	Oct. 25, 1990	18.51	124,000
1992	Mar. 29, 1992	15.37	89,200
1993	Apr. 03, 1993	23.97	187,000
1994	Mar. 26, 1994	20.15	139,000
1995	Jan. 22, 1995	13.81	73,700
1996	Jan. 21, 1996	25.96	209,000
1997	Dec. 03, 1996	19.06	130,000
1998	Jan. 10, 1998	20.43	143,000
1999	Jan. 25, 1999	17.81	116,000
2000	Feb. 29, 2000	19.24	132,000
2001	Apr. 11, 2001	15.95	97,800
2002	May 15, 2002	14.84	84,700
2003	Mar. 22, 2003	18.81	130,000
2004	Sep. 19, 2004	26.22	220,000
2005	Apr. 04, 2005	24.28	202,000
2006	Jun. 28, 2006	28.19	260,000
Note: N.A. = Not Available			

Table 2.4-8— {Monthly Streamflow for the Danville, PA USGS Station No. 01540500, (1905 through 2006)}
(Page 1 of 4)

Discharge, cubic feet per second													
Year	Monthly mean in cfs (Calculation Period: 4/01/1905 - 9/30/2006)												Average Yearly Discharge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1905				26,690	6,975	11,620	6,260	6,885	15,520	10,060	6,878	22,370	
1906	18,760	13,000	22,820	44,750	14,010	18,240	8,100	5,331	3,203	7,000	12,300	13,950	15,122
1907	32,910	5,861	26,290	20,100	15,810	6,923	6,359	2,296	6,974	12,670	22,020	35,290	16,125
1908	16,680	25,740	51,260	27,780	31,220	5,752	3,637	1,960	1,016	1,346	1,935	1,602	14,161
1909	16,220	38,830	23,740	31,820	32,710	11,850	2,798	1,852	1,437	1,545	1,593	2,584	13,915
1910	12,070	7,473	55,380	20,850	17,720	14,050	2,864	1,486	1,566	1,636	4,058	3,169	11,860
1911	23,580	9,125	23,720	34,140	7,699	8,713	2,594	2,343	5,892	12,700	11,550	16,960	13,251
1912	7,800	10,780	38,270	53,280	21,170	5,148	2,088	3,116	15,420	11,570	16,190	19,600	17,036
1913	43,230	9,358	45,020	24,970	12,600	6,498	2,440	1,318	1,540	4,069	11,870	8,030	14,245
1914	8,545	18,160	34,920	64,170	31,080	5,310	6,131	6,258	4,822	2,159	2,400	2,742	15,558
1915	33,090	42,620	14,230	14,970	10,860	4,194	28,490	23,110	8,444	10,920	7,879	13,260	17,672
1916	28,700	13,950	22,340	71,860	18,850	27,360	10,610	3,262	3,701	6,272	6,212	9,144	18,522
1917	16,300	6,172	31,350	23,400	14,130	31,190	19,040	17,000	7,562	17,750	18,310	3,981	17,182
1918	2,347	25,200	49,110	34,650	18,290	12,060	5,111	2,849	6,956	11,030	16,260	12,810	16,389
1919	14,250	7,635	23,630	24,330	31,250	6,039	5,546	4,664	2,473	3,100	17,670	13,300	12,824
1920	4,013	2,841	60,370	26,320	11,050	5,347	8,229	8,514	7,688	11,500	14,870	29,340	15,840
1921	9,878	11,120	42,470	19,140	12,590	3,280	3,948	3,594	2,664	3,542	20,660	22,200	12,924
1922	7,430	18,650	37,800	38,940	11,050	28,690	14,460	5,834	4,916	2,402	2,329	2,821	14,610
1923	10,690	7,754	41,870	21,040	17,200	5,029	2,908	2,134	2,489	4,246	4,884	18,240	11,540
1924	23,650	6,335	16,110	46,590	27,550	7,487	6,139	3,030	4,367	21,010	4,001	6,196	14,372
1925	3,600	42,760	23,410	17,220	13,090	4,436	6,850	5,852	5,555	7,076	21,570	18,530	14,162
1926	11,030	17,380	32,950	37,850	8,879	4,755	2,623	6,863	7,270	16,560	38,540	9,884	16,215
1927	13,620	24,310	49,610	17,990	28,470	9,109	3,675	3,729	4,692	27,320	34,140	41,170	21,486
1928	15,980	19,430	23,570	35,390	26,120	25,300	22,670	8,542	3,481	2,541	3,878	7,904	16,234
1929	5,729	6,196	43,640	57,570	34,080	6,229	3,345	2,015	1,802	7,475	11,290	15,510	16,240
1930	23,530	14,160	32,470	21,570	10,890	10,450	4,406	1,318	2,093	1,186	1,169	2,215	10,455
1931	1,853	4,309	22,200	34,740	25,440	8,604	7,905	3,169	2,181	1,501	2,730	10,830	10,455
1932	23,410	22,480	14,430	45,700	19,010	4,794	4,662	2,627	1,279	12,850	26,930	7,636	15,484
1933	10,230	7,600	29,370	38,910	13,080	5,651	3,423	14,990	18,410	6,982	8,904	12,650	14,183
1934	19,520	4,192	21,120	37,360	7,989	5,057	2,447	1,979	8,769	6,301	11,070	18,820	12,052

Table 2.4-8— {Monthly Streamflow for the Danville, PA USGS Station No. 01540500, (1905 through 2006)}
(Page 2 of 4)

Discharge, cubic feet per second													
Year	Monthly mean in cfs (Calculation Period: 4/01/1905 - 9/30/2006)												Average Yearly Discharge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1935	22,380	9,110	35,520	33,970	21,640	5,199	22,850	5,455	2,698	2,206	25,460	17,460	16,996
1936	11,610	6,014	91,900	30,280	9,428	4,058	1,738	2,352	1,768	3,523	14,260	14,800	15,978
1937	36,760	17,490	16,090	41,430	19,630	9,863	5,218	7,180	5,984	14,650	17,010	15,760	17,255
1938	13,430	25,760	26,470	20,810	9,120	5,055	5,117	5,448	13,280	5,505	8,292	27,460	13,812
1939	9,322	34,870	36,540	32,930	7,258	2,803	1,605	1,662	911.5	2,139	5,257	7,104	11,867
1940	3,911	4,176	20,620	97,110	18,020	10,990	6,578	2,343	6,115	3,741	10,950	18,200	16,896
1941	14,990	7,337	16,390	43,570	5,643	4,415	2,465	3,132	1,457	1,127	2,712	8,076	9,276
1942	7,613	8,429	41,600	24,080	20,540	10,580	4,605	6,132	4,972	13,660	20,190	23,630	15,503
1943	33,560	22,900	40,340	29,810	44,980	14,600	3,654	2,941	2,011	8,207	23,310	6,597	19,409
1944	3,754	7,272	30,950	32,900	24,280	11,170	4,149	1,845	2,161	3,931	5,461	11,790	11,639
1945	11,520	14,770	66,550	19,050	32,990	15,570	10,140	7,149	12,030	19,910	27,540	18,900	21,343
1946	20,490	7,163	38,140	7,664	37,300	25,600	7,933	7,651	3,090	8,306	5,702	4,394	14,453
1947	18,590	13,560	24,790	43,390	41,620	20,500	18,230	8,488	4,690	1,941	8,676	6,634	17,592
1948	4,121	14,370	54,340	37,420	24,970	10,650	6,838	4,418	1,623	1,734	8,543	11,810	15,070
1949	35,400	21,690	18,290	22,480	15,480	4,502	1,971	2,173	3,479	3,987	6,451	16,140	12,670
1950	24,950	15,360	36,690	45,660	16,260	13,770	4,992	4,979	11,580	6,291	21,130	35,330	19,749
1951	27,270	35,210	31,730	36,270	7,972	6,465	8,685	3,544	2,209	2,206	12,090	19,780	16,119
1952	34,060	19,190	35,650	34,000	23,940	7,858	7,143	3,423	4,159	1,829	7,034	23,580	16,822
1953	23,490	21,100	29,130	26,670	24,500	8,629	2,608	1,589	1,653	1,477	3,817	12,460	13,094
1954	7,151	23,560	24,230	25,310	25,180	9,309	2,410	1,380	2,335	1,642	11,060	17,820	12,616
1955	15,950	13,270	44,810	17,850	7,356	4,393	1,708	8,922	3,071	30,330	29,280	9,984	15,577
1956	7,694	16,860	45,600	56,540	20,630	9,339	7,264	3,276	7,350	6,066	8,861	24,810	17,858
1957	15,940	12,210	23,660	41,090	15,530	5,294	3,321	2,268	1,836	2,209	4,507	18,600	12,205
1958	13,370	7,872	29,950	75,350	28,060	12,570	7,421	3,451	4,858	7,035	13,690	8,810	17,703
1959	18,280	16,340	25,170	36,320	11,630	3,675	2,289	1,514	2,188	9,127	25,600	35,820	15,663
1960	20,550	23,580	12,950	61,820	24,610	23,230	5,934	4,531	12,430	4,796	5,715	3,983	17,011
1961	3,274	25,900	37,090	47,330	23,860	12,710	5,200	5,043	3,096	1,546	3,461	5,740	14,521
1962	13,180	6,175	28,160	46,910	10,470	2,923	1,359	1,675	1,339	8,947	14,020	9,736	12,075
1963	8,029	6,514	43,000	26,730	14,650	6,684	2,889	1,934	1,241	984.3	2,717	9,145	10,376
1964	20,300	10,970	61,210	29,170	14,840	3,420	1,745	1,091	740.3	867.7	852.4	2,786	12,333

Table 2.4-8— {Monthly Streamflow for the Danville, PA USGS Station No. 01540500, (1905 through 2006)}

(Page 3 of 4)

Year	Discharge, cubic feet per second												
	Monthly mean in cfs (Calculation Period: 4/01/1905 - 9/30/2006)												Average Yearly Discharge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1965	5,624	17,150	11,740	24,410	11,850	4,189	1,308	1,625	2,080	4,580	6,735	9,639	8,411
1966	8,595	20,440	39,060	17,930	22,370	8,552	2,165	1,613	1,574	2,083	3,854	11,340	11,631
1967	10,160	12,080	27,270	29,710	25,990	7,602	5,666	8,076	4,438	9,505	23,460	20,470	15,369
1968	7,423	15,990	28,220	15,440	20,160	23,070	8,742	2,452	6,052	3,334	23,610	16,750	14,270
1969	10,890	11,890	14,670	31,140	14,180	10,920	5,906	6,460	1,892	1,787	14,840	15,540	11,676
1970	7,226	26,450	19,530	55,460	15,920	5,449	4,482	2,666	2,633	6,641	16,550	12,700	14,642
1971	9,125	23,530	42,660	35,140	20,990	4,894	2,298	4,425	2,944	2,684	4,070	23,410	14,681
1972	18,110	7,645	46,580	41,550	33,120	62,370	17,240	4,701	2,416	2,947	31,840	42,700	25,935
1973	22,360	20,490	28,310	34,380	23,570	12,670	9,428	4,203	4,500	3,078	5,471	37,380	17,153
1974	26,780	20,990	26,140	40,960	16,070	6,803	7,448	3,229	8,007	4,983	12,400	23,030	16,403
1975	23,040	31,680	28,960	20,670	22,150	13,790	5,816	3,435	30,900	29,060	16,280	15,570	20,113
1976	18,760	46,420	32,500	20,480	19,450	14,540	11,430	10,040	5,698	35,080	15,240	11,090	20,061
1977	5,187	11,250	57,620	34,250	14,000	4,443	4,050	4,237	25,450	43,890	30,970	37,730	22,756
1978	37,030	13,910	44,050	43,570	21,820	8,738	3,502	5,632	3,754	5,335	5,659	11,440	17,037
1979	40,070	15,070	55,340	27,040	17,820	8,873	3,034	2,615	5,315	10,040	17,240	15,760	18,185
1980	8,755	4,010	32,190	40,040	13,140	3,984	4,474	2,226	1,417	1,796	4,388	7,380	10,317
1981	2,729	43,290	13,240	12,120	16,410	9,403	4,523	2,874	3,893	13,080	17,500	12,120	12,599
1982	11,490	18,030	33,400	33,170	8,892	23,790	8,542	3,128	1,816	1,783	4,192	8,903	13,095
1983	8,560	19,620	20,320	56,670	34,060	10,080	4,799	2,358	1,588	1,799	6,226	39,040	17,093
1984	6,461	38,810	18,270	55,060	34,360	18,060	12,910	8,550	3,356	2,417	5,029	22,070	18,779
1985	11,380	10,600	23,500	16,570	7,275	5,319	3,657	2,811	5,619	7,923	19,850	20,260	11,230
1986	12,640	21,340	46,380	24,880	12,940	14,110	6,766	10,080	3,082	7,225	24,780	24,530	17,396
1987	10,160	5,771	28,000	40,150	7,786	5,250	7,155	2,550	13,140	7,070	10,590	16,850	12,873
1988	8,529	18,380	21,940	15,350	23,100	5,380	3,434	2,732	4,601	3,266	14,130	6,839	10,640
1989	6,531	8,508	14,050	28,440	44,090	27,710	8,753	3,365	3,641	11,060	16,660	6,548	14,946
1990	16,500	40,980	20,070	25,260	25,800	8,817	7,579	5,668	4,079	26,710	25,310	32,050	19,902
1991	24,930	22,320	30,730	24,190	13,420	3,435	1,729	1,715	1,480	2,220	6,080	13,280	12,127
1992	13,760	9,441	27,960	30,280	16,710	12,410	7,591	10,980	8,582	10,860	25,470	18,250	16,025
1993	26,550	6,229	21,870	106,900	16,290	4,904	2,365	2,081	2,733	3,898	18,800	24,950	19,798
1994	8,276	20,330	48,400	68,430	14,580	12,630	11,290	21,810	8,567	6,622	12,100	21,680	21,226

Table 2.4-8— {Monthly Streamflow for the Danville, PA USGS Station No. 01540500, (1905 through 2006)}

(Page 4 of 4)

Discharge, cubic feet per second													
Year	Monthly mean in cfs (Calculation Period: 4/01/1905 - 9/30/2006)												Average Yearly Discharge
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1995	22,830	9,418	23,150	16,080	7,515	4,984	2,527	1,937	1,605	10,850	18,460	12,560	10,993
1996	44,410	21,470	25,310	36,640	40,940	9,710	10,710	5,867	5,504	14,980	31,230	49,410	24,682
1997	14,240	15,160	29,850	21,720	16,010	7,591	2,972	2,166	2,306	2,072	7,568	11,440	11,091
1998	39,690	24,400	44,160	36,060	22,520	13,560	14,090	2,745	2,003	2,797	2,327	3,303	17,305
1999	21,190	19,580	24,940	26,100	7,587	2,427	1,961	1,087	6,046	6,697	6,917	14,520	11,588
2000	14,310	21,490	40,550	45,100	32,860	21,720	7,803	7,372	4,247	7,028	5,771	15,200	18,621
2001	6,745	15,660	22,020	46,520	6,408	10,530	4,397	2,154	3,849	2,856	2,552	10,170	11,155
2002	6,552	23,180	20,410	20,610	34,040	23,660	4,578	1,795	2,543	13,030	17,810	20,840	15,754
2003	18,500	12,350	48,140	33,290	14,250	32,960	11,420	13,990	17,460	18,550	28,830	37,990	23,978
2004	19,150	7,373	34,870	27,970	23,720	10,630	13,780	19,720	40,630	12,380	14,500	35,800	21,710
2005	36,310	21,020	26,950	54,720	8,578	4,813	3,675	1,591	2,374	18,200	21,280	25,800	18,776
2006	40,330	24,280	14,620	15,360	10,930	36,060	28,330	8,739	14,520				
Mean of Monthly Discharge	16,500	16,900	32,500	35,000	19,300	11,100	6,590	4,830	5,580	8,000	13,000	16,500	**15,483**

Table 2.4-9— {Mean Daily Streamflow for Danville, PA USGS Station No. 01540500, (1905 through 2006)}

	Discharge, cubic feet per second											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	17,600	14,900	24,000	44,800	23,200	13,400	9,900	5,270	4,540	7,300	10,100	17,700
2	17,900	14,500	23,900	44,700	22,600	13,100	9,740	5,300	4,610	7,320	9,860	17,700
3	18,100	14,600	23,800	44,800	21,700	12,800	9,220	5,180	5,070	6,860	9,800	18,200
4	17,800	15,700	24,100	44,600	20,900	12,900	8,560	5,100	5,580	6,400	10,300	17,900
5	17,000	15,000	25,000	44,100	20,500	13,100	7,830	5,240	5,570	6,140	10,100	17,900
6	16,900	13,800	26,700	45,300	19,700	12,200	7,380	5,120	4,910	5,800	10,200	17,400
7	17,100	12,900	28,300	46,200	19,800	12,600	6,910	4,990	4,790	6,040	10,400	17,300
8	17,800	12,400	28,800	44,500	20,300	12,300	6,670	4,810	4,310	6,370	10,200	17,100
9	18,400	12,000	28,100	41,700	20,300	11,500	6,910	4,580	3,990	6,260	11,800	17,100
10	17,800	11,700	28,300	39,400	20,100	10,700	8,840	4,850	3,950	6,800	13,400	17,100
11	16,400	12,900	27,800	38,100	20,600	9,860	8,400	4,870	4,230	6,840	13,500	17,700
12	15,200	14,800	27,900	36,600	21,700	9,620	7,060	4,800	4,100	6,420	13,000	18,200
13	15,000	14,800	29,100	35,200	22,300	9,710	6,270	4,610	4,590	6,060	12,200	18,000
14	14,700	14,300	30,000	34,600	22,800	9,890	6,270	4,680	4,780	6,190	12,200	18,200
15	14,600	15,400	32,000	35,100	21,600	10,000	6,180	4,530	4,650	6,210	12,900	18,800
16	14,400	17,500	34,000	35,600	20,200	10,700	5,860	4,950	4,540	6,990	13,000	18,100
17	14,000	17,600	34,700	35,400	19,000	10,600	5,600	4,770	5,090	7,590	13,900	17,000
18	13,500	17,500	36,300	33,900	17,900	10,800	5,290	4,550	5,700	7,760	14,400	15,900
19	13,900	17,200	36,100	31,100	17,600	11,100	5,180	5,470	7,020	8,350	14,400	15,500
20	15,100	17,000	34,000	29,100	17,100	9,990	5,090	5,200	6,600	9,450	14,900	15,100
21	15,700	18,500	33,000	28,300	17,300	9,620	4,990	4,610	6,080	10,300	14,800	14,700
22	16,700	19,900	33,700	28,400	18,200	10,700	5,100	4,430	5,810	10,200	14,500	14,800
23	17,400	20,400	35,600	28,300	18,800	12,200	5,540	4,700	5,970	9,660	14,100	14,600
24	17,200	21,000	35,600	27,300	17,800	12,500	5,810	5,020	5,880	9,490	13,600	14,500
25	18,000	22,700	34,900	26,800	17,500	12,100	6,070	5,300	6,160	9,730	13,500	15,200
26	19,000	24,800	35,900	27,400	17,400	10,200	6,060	4,940	7,440	9,820	14,000	15,300
27	19,400	25,200	37,400	26,100	16,700	8,980	5,540	4,400	8,430	10,200	14,400	15,100
28	18,600	24,200	41,300	24,700	16,200	10,100	5,410	4,240	8,710	10,000	15,600	14,600
29	17,100	19,900	45,200	23,700	16,500	10,500	5,840	4,560	7,280	10,100	17,500	14,000
30	15,900		45,700	23,200	16,500	10,300	5,520	4,260	6,930	10,700	17,800	14,700
31	14,900		44,900		14,700		5,230	4,360		10,700		16,200

Table 2.4-10— {Maximum Daily Streamflow for Danville, PA USGS Station No. 01540500, (1905 through 2006)}

	Discharge, cubic feet per second											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	201,000	82,200	124,000	205,000	91,900	76,600	147,000	44,400	40,000	129,000	94,200	93,600
2	161,000	77,600	144,000	219,000	126,000	75,500	117,000	44,800	27,800	126,000	72,500	92,400
3	102,000	54,300	160,000	187,000	116,000	75,800	82,200	31,400	38,400	96,500	52,700	116,000
4	106,000	83,000	154,000	199,000	86,300	84,400	50,600	24,400	47,300	60,800	59,200	120,000
5	74,300	70,600	127,000	188,000	76,900	66,100	44,100	55,000	50,200	41,100	56,000	125,000
6	61,600	59,000	128,000	168,000	64,500	49,200	45,800	58,500	42,200	33,100	50,800	115,000
7	85,000	54,400	182,000	191,000	68,100	72,500	36,900	66,500	39,700	41,200	52,800	82,500
8	81,300	43,900	166,000	160,000	82,800	69,000	35,000	49,900	37,400	57,200	52,900	91,100
9	115,000	43,800	163,000	161,000	95,400	57,700	51,300	35,100	24,400	48,400	62,500	85,400
10	138,000	40,600	158,000	146,000	73,400	46,800	138,000	39,100	26,200	93,600	113,000	77,900
11	117,000	78,700	203,000	140,000	90,900	40,800	134,000	47,600	63,300	106,000	113,000	94,100
12	98,400	147,000	185,000	177,000	98,000	40,800	80,600	43,500	43,200	76,200	85,400	99,900
13	80,300	159,000	186,000	154,000	114,000	45,000	45,800	31,100	35,400	50,900	72,500	98,100
14	73,400	131,000	179,000	110,000	112,000	49,200	41,300	27,800	38,400	37,500	55,400	131,000
15	142,000	93,900	125,000	106,000	99,000	42,500	39,600	30,300	33,800	43,600	73,400	189,000
16	126,000	159,000	170,000	112,000	75,500	54,500	33,000	40,800	31,800	123,000	77,400	154,000
17	85,600	149,000	148,000	144,000	76,700	60,200	25,200	30,800	69,400	164,000	128,000	102,000
18	63,500	114,000	190,000	119,000	76,300	69,300	21,800	27,500	74,600	117,000	134,000	68,600
19	98,000	117,000	241,000	113,000	56,800	82,900	25,300	78,500	205,000	106,000	112,000	57,600
20	155,000	116,000	245,000	85,200	63,700	47,600	25,700	82,100	179,000	131,000	93,000	64,600
21	205,000	107,000	210,000	84,100	73,200	40,800	19,100	56,900	93,500	152,000	73,500	51,000
22	155,000	133,000	157,000	131,000	72,400	91,200	21,800	47,900	61,000	110,000	69,600	84,400
23	103,000	101,000	160,000	158,000	87,900	262,000	24,100	45,800	54,200	72,100	55,800	78,700
24	101,000	89,400	181,000	121,000	98,000	328,000	38,800	53,000	67,800	69,500	51,000	69,600
25	100,000	112,000	135,000	92,300	82,800	335,000	39,200	114,000	62,400	116,000	46,100	88,400
26	110,000	154,000	138,000	119,000	105,000	188,000	50,100	88,500	112,000	99,300	80,700	85,100
27	91,600	166,000	118,000	135,000	90,800	96,300	26,600	53,600	217,000	82,500	114,000	64,200
28	112,000	152,000	187,000	109,000	131,000	206,000	30,900	34,600	236,000	70,400	94,800	90,200
29	90,900	127,000	216,000	82,600	226,000	234,000	76,500	47,200	124,000	59,000	105,000	97,400
30	67,300		212,000	75,600	200,000	180,000	66,500	26,000	65,300	76,800	124,000	78,800
31	61,400		162,000		105,000		50,500	40,000		109,000		175,000

Table 2.4-11— {Minimum Daily Streamflow for Danville, PA USGS Station No. 01540500, (1905 through 2006)}

	Discharge, cubic feet per second											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	1,300	1,850	2,400	7,730	6,370	3,250	1,760	974	880	980	842	1,310
2	1,300	1,800	2,600	8,630	6,940	3,420	1,720	924	860	916	842	1,220
3	1,500	1,800	3,000	8,810	6,750	3,170	1,660	940	860	931	813	1,240
4	1,500	1,800	3,400	8,460	6,180	3,000	1,600	920	840	978	784	1,400
5	1,280	1,750	4,000	8,010	5,800	2,920	1,560	894	840	978	755	1,450
6	1,430	1,700	3,600	7,660	5,250	3,000	1,480	888	857	886	755	1,420
7	1,700	1,700	3,440	7,570	5,250	2,900	1,420	921	857	857	742	1,500
8	1,920	1,700	3,530	8,100	5,440	2,790	1,380	974	813	842	742	1,420
9	1,850	1,750	3,600	8,540	6,030	2,720	1,280	940	770	857	755	1,250
10	1,800	1,700	3,600	8,440	5,920	2,600	1,230	876	755	842	742	1,100
11	1,810	1,600	4,360	8,130	6,110	2,500	1,270	880	770	799	742	1,350
12	1,850	1,550	4,260	7,730	5,760	2,400	1,210	860	755	813	755	1,300
13	1,550	1,650	4,050	7,530	5,540	2,300	1,250	860	715	813	742	1,300
14	1,600	1,800	3,800	6,970	5,260	2,200	1,190	1,140	674	799	742	1,650
15	1,700	1,900	3,680	6,930	4,820	2,200	1,270	1,090	661	799	742	1,700
16	1,700	2,100	3,680	7,140	4,700	2,100	1,100	1,020	647	799	742	1,600
17	1,750	2,700	3,710	6,750	4,540	2,100	1,040	1,020	634	828	728	1,530
18	1,800	3,200	3,770	6,560	4,470	2,300	1,180	1,000	634	857	728	1,700
19	1,900	3,000	4,190	7,140	4,380	2,400	1,150	1,000	647	891	755	1,500
20	2,100	3,000	5,480	7,340	4,200	2,300	1,170	1,020	634	889	799	1,400
21	1,900	2,900	7,220	6,750	4,000	2,000	1,150	1,020	595	871	813	1,600
22	1,800	2,800	7,350	6,180	3,980	1,900	1,130	993	595	871	828	1,600
23	1,750	2,600	7,150	5,990	3,820	1,800	1,090	1,010	595	871	784	1,430
24	1,700	2,600	6,800	5,990	3,940	1,800	1,090	1,020	558	869	799	1,250
25	1,700	2,600	6,960	5,800	3,790	1,700	1,140	1,040	558	842	842	1,700
26	1,800	2,400	6,720	5,620	3,640	1,700	1,120	993	595	850	1,100	1,700
27	1,950	2,300	6,530	5,620	3,700	1,600	1,060	993	558	839	1,200	1,700
28	2,100	2,300	6,940	5,620	3,610	1,500	1,010	978	595	857	1,180	1,500
29	2,100	2,600	6,790	5,620	3,610	1,600	978	947	770	842	1,150	1,700
30	2,050		6,980	5,800	3,390	1,760	947	947	952	871	1,290	1,500
31	1,900		7,610		3,170		900	900		846		1,300

Table 2.4-12— {Susquehanna River Basin Upstream Dam Information}

(Page 1 of 2)

NAME	TIOGA[1,2] (PA)	HAMMOND[1,2](PA)	STILLWATER[1,2](PA)	AYLESWORTH CREEK[4] (PA)	COWANESQUE[2] (PA)	EAST SIDNEY[1,3] (NY)	WHITNEY POINT[1,3](NY)	ALMOND[1,3] (NY)
OWNER	**CENAB**	**CENAB**	**CENAB**	**CENAB**	**CENAB**	**CORPS OF ENGINEERS - BALTIMORE DISTRICT**	**CENAB**	**CORPS OF ENGINEERS - BALTIMORE DISTRICT**
PURPOSE	**FLOOD CONTROL / RECREATION**	**FLOOD CONTROL / RECREATION**	**FLOOD CONTROL / WATER SUPPLY**	**FLOOD CONTROL / RECREATION**	**FLOOD CONTROL / RECREATION / WATER SUPPLY**	**FLOOD CONTROL / RECREATION**	**FLOOD CONTROL / RECREATION**	**FLOOD CONTROL / RECREATION**
STATUS (DATE)	**COMPLETE (1980)**	**COMPLETE (1980)**	**COMPLETE (1960)**	**COMPLETE (1970)**	**COMPLETE (1980)**	**COMPLETE (1950)**	**COMPLETE (1942)**	**COMPLETE (1949)**
Stream	Tioga River	Crooked Creek	Lackawanna River	Aylesworth Creek	Cowanesque River	Ouleout Creek	Otselic River	Canacadea Creek
River Mile[1]	350	350	234	-	341	405	331	373
Drainage Area (sq. mi.)	280	122	37.1	6	298	103	257	55.8
Structure Type	Earth Fill	Earth Fill	Earth Fill	Earth Fill	Rolled Earth / Rock Fill	Concrete Dam / Rock Fill Dike	Earth Fill	Earth Fill
Dam Crest Length1 (ft)	2,710	6, 450	1,700	1,270	3,100	750 (concrete) 2,010(earth)	4,900	1,260
Height of Dam[1] (ft)	140	122	77	90	151	130	95	90
Design Freeboard[1] (ft)	5.2	5.3	4.9	-	5.7	6	8.7	5.5
Spillway Crest Length[1] (ft)	312	312	264	80	400	240	220	285
Design Discharge[1] (cfs)	-	215,500	37,780	10, 000	224,000	81,000	75,000	54,000
Elevations (ft msl)								
Gate Sill	-	-	-	-	-	1,115.0	950.0	1,229.0
Conservation Pool	-	-	-	-	-	-	-	-
Recreation Pool	1,081.0	1,086.0	-	-	1,080.0	-	-	-
Flood Control Pool	1,131.0	1,131.0	1,621.0	-	1,117.0	1,203.0	1,010.0	1,300.0
Maximum Pool	-	-	-	-	-	-	-	-
Top of Dam[1]	1,171.0	1,168.5	-	-	1,154.0	1,228.5	1,039.5	1,320.0
Storage Volumes (Acre-ft)								
Conservation Pool	-	-	-	-	-	-	-	-
Recreation Pool	9,500	8,850	-	-	32,600	-	-	-
Flood Control Pool	62,000	63,000	12,000	-	89,110	33,606	86,468	14,800

Table 2.4-12— {Susquehanna River Basin Upstream Dam Information}
(Page 2 of 2)

Maximum Pool	143, 200	136, 000	17, 000	3. 040	171,000	58,350	176,000	22,600
Reservoir Areas (Acres)								
Recreation Pool	-	-	-	-	-	-	-	-
Flood Control Pool	-	-	-	-	-	-	-	-

Table 2.4-12— {Susquehanna River Basin Upstream Dam Information}
(Page 1 of 2)

NAME	MILL BROOK SITE[4] (NY)	PATTERSON BRIXIUS GREY WATERSHED[4](NY)	FINCH HOLLOW SITE[4](NY)	NANTICOKE CREEK SITE 13 [4] (NY)	NANTICOKE CREEK SITE 7A [4] (NY)	ARKPORT[4](NY)	NEWTOWN HOFFMAN SITE 3A [4] (NY)	NEWTOWN HOFFMAN SITE 12E[4](NY)
OWNER	**TOWN OF NEW BERLIN**	**BROOME COUNTY**	**BROOME COUNTY**	**BROOME COUNTY**	**BROOME COUNTY**	**CENAB**	**CHEMUNG COUNTY**	**CHEMUNG COUNTY**
PURPOSE	**FLOOD CONTROL**	**FLOOD CONTROL**	**FLOOD CONTROL**	**FLOOD CONTROL**	**FLOOD CONTROL**	**FLOOD CONTROL**	**FLOOD CONTROL / RECREATION**	**FLOOD CONTROL**
STATUS (DATE)	**COMPLETE (1986)**	**COMPLETE (1966)**	**COMPLETE (1973)**	**COMPLETE (1967)**	**COMPLETE (1981)**	**COMPLETE (1940)**	**COMPLETE (1976)**	**COMPLETE (1982)**
Stream	Tr-Unadilla River	Patterson Creek	Little Choconut Creek	Bradley Creek	Tr-Nanticoke	Canisteo River	Newton Creek	N Branch Newtown Crk.
River Mile[1]	-	-	-	-	-	-	-	-
Drainage Area (sq. mi.)	1.35	4.4199	11.72	6-09999	5	30	2.6699	18.09
Structure Type	Earth Fill	Earth Fill	Earth Fill	Earth Fill	Earth Fill	Earth Fill	Earth Fill	Earth Fill
Dam Crest Length1 (ft)	730	1,300	1,050	700	1,300	1,200	800	2,250
Height of Dam[1] (ft)	87	65	57	57	67	113	53	71
Design Freeboard[1] (ft)	-	-	-	-	-	-	-	-
Spillway Crest Length[1] (ft)	190	355	107	331	500	160	200	166
Design Discharge[1] (cfs)	5,617	17,500	31,403	12,600	19,084	29,100	7,155	47,919
Elevations (ft msl)								
Gate Sill	-	-	-	-	-	-	-	-
Conservation Pool	-	-	-	-	-	-	-	-
Recreation Pool	-	-	-	-	-	-	-	-
Flood Control Pool	-	-	-	-	-	-	-	-
Maximum Pool	-	-	-	-	-	-	-	-
Top of Dam[1]	-	-	-	-	-	-	-	-
Storage Volumes (Acre-ft)								
Conservation Pool	-	-	-	-	-	-	-	-
Recreation Pool	-	-	-	-	-	-	-	-
Flood Control Pool	-	-		-	-	-	1,480	
Maximum Pool	1,065	1.280	1,480	1,395	1,475	10,800	58,350	8,081
Reservoir Areas (Acres)								

Table 2.4-12— {Susquehanna River Basin Upstream Dam Information}
(Page 2 of 2)

Recreation Pool	-	-	-	-	-	-	-	-
Flood Control Pool	-	-	-	-	-	-	-	-

Table 2.4-12— {Susquehanna River Basin Upstream Dam Information}
(Page 1 of 2)

NAME	NEWTOWN HOFFMAN SITE 5A[4] (NY)	EATON BROOK RESERVOIR[4] (NY)	KINGSEY BROOK RESERVOIR [4,2](NY)	LAKE MORAIN[4](NY)	BROWNEL RESERVOIR[4] (PA)	ELMHURST[4](PA)	WILLIAMS BRIDGE RESERVOIR[4] (PA)	LAKE SCRANTON[4](PA)
OWNER	CHEMUNG COUNTY	NYS CANAL CORP	NYS CANAL CORP	NYS CANAL CORP	PENNSYLVANIA - AMERICAN WATER COMPANY	PENNSYLVANIA - AMERICAN WATER COMPANY	PENNSYLVANIA - AMERICAN WATER COMPANY	PENNSYLVANIA - AMERICAN WATER COMPANY
PURPOSE	FLOOD CONTROL	NAVIGATION / RECREATION	RECREATION	NAVIGATION / RECREATION/ OTHER	WATER SUPPLY	WATER SUPPLY	WATER SUPLY	WATER SUPPLY
STATUS (DATE)	COMPLETE (1999)	COMPLETE (1893)	COMPLETE (1867)	COMPLETE (1836)	COMPLETE (1908)	COMPLETE (1889)	COMPLETE (1893)	COMPLETE (1898)
Stream	Jackson Creek	Eaton Brook	Kingsley Brook	Payne Brook	Racket Brook	Roaring Brook	Stafford Meadow Brook	Stafford Meadow Brook
River Mile[1]	-	-	-	-	-	-	-	-
Drainage Area (sq. mi.)	1977	7.96	5.21	8.21	4	37.2999	5.4	7.0499
Structure Type	Earth Fill	Earth Fill	Earth Fill	Earth Fill	Concrete	Earth Fill	Earth Fill	Earth Fill
Dam Crest Length1 (ft)	315	820	900	1,400	613	380	810	460
Height of Dam[1] (ft)	58	58	63	57	64	64	54	60
Design Freeboard[1] (ft)	-	-	-	-	-	-	-	-
Spillway Crest Length[1] (ft)	0	41	16	35	0	0	0	0
Design Discharge[1] (cfs)	21,243	3,060	671	1,070	0	0	0	0
Elevations (ft msl)								
Gate Sill	-	-	-	-	-	-	-	-
Conservation Pool	-	-	-	-	-	-	-	-
Recreation Pool	-	-	-	-	-	-	-	-
Flood Control Pool	-	-	-	1-	-	-	-	-
Maximum Pool	-	-	-	-	-	-	-	-
Top of Dam[1]	-	-	-	-	-	-	-	-
Storage Volumes (Acre-ft)								
Conservation Pool	-	-	-	-	-	-	-	-
Recreation Pool	-	-	-	-	-	-	-	-
Flood Control Pool		-	-	-	-	-	-	-
Maximum Pool	1,469	7,886	2,260	2.850	2,995	3,744	1,276	8,397

Table 2.4-12— {Susquehanna River Basin Upstream Dam Information}
(Page 2 of 2)

	Reservoir Areas (Acres)							
Recreation Pool	-	-	-	-	-	-	-	-
Flood Control Pool	-	-	-	-	-	-	-	-

Table 2.4-12— {Susquehanna River Basin Upstream Dam Information}

(Page 1 of 2)

NAME	NESBIT[4] (PA)	WATRES[4] (PA)	LACKAWANNA[4](PA)	BEECHWOOD LAKE[4](PA)	MILL CREEK[4] (PA)	FRANCES SLOCUM[1](PA)	PIKES CREEK[4] (PA)	
OWNER	PENNSYLVANIA - AMERICAN WATER SUPPLY	PENNSYLVANIA - AMERICAN WATER SUPPLY	DCNR	PA FISH AND BOAT COMMISION	PENNSYLVANIA - AMERICAN WATER COMPANY	DCNR	PENNSYLVANIA - AMERICAN WATER SUPPLY	
PURPOSE	HYDROELECTRIC WATER SUPPLY	WATER SUPPLY	RECREATION	FLOOD CONTROL / RECREATION	WATER SUPPLY	FLOOD CONTROL / RECREATION	WATER SUPPLY	
STATUS (DATE)	COMPLETE (1903)	COMPLETE (1925)	COMPLETE (1971)	COMPLETE (1963)	COMPLETE (1898)	COMPLETE (1965)	COMPLETE (1911)	
Stream	Spring Brook	Spring Brook	S Branch Tunchannock Ck.	E Beech Woods Creek	Mill Creek	Abrahams Creek	Pikes Creek	
River Mile[1]	-	-	-	-	-	-	-	
Drainage Area (sq. mi.)	37.1	15.4	44.8999	3.2999	3	6.0999	10.5	
Structure Type	Earth Fill	Earth Fill	Rock Fill	Earth Fill	Earth Fill	Earth Fill	Earth Fill	
Dam Crest Length1 (ft)	267	1,406	350	1,030	1,345	935	2.360	
Height of Dam[1] (ft)	101	135	69	63	74	51	65	
Design Freeboard[1] (ft)	-	-	-	-	-	-	-	
Spillway Crest Length[1] (ft)	0	0	0	0	0	0	0	
Design Discharge[1] (cfs)	0	0	0	0	0	0	0	
Elevations (ft msl)								
Gate Sill	-	-	-	-	-	-	-	
Conservation Pool	-	-	-	-	-	-	-	
Recreation Pool	-	-	-	-	-	-	-	
Flood Control Pool	-	-	-	-	-	-	-	
Maximum Pool	-	-	-	-	-	-	-	
Top of Dam[1]	-	-	-	-	-	-	-	
Storage Volumes (Acre-ft)								
Conservation Pool	-	-	-	-	-	-	-	
Recreation Pool	-	-	-	-	-	-	-	
Flood Control Pool	-	-	-	-	-	-	-	
Maximum Pool	5,034	8,421	14,200	2,400	2.350	5.340	10,556	
Reservoir Areas (Acres)								

Table 2.4-12— {Susquehanna River Basin Upstream Dam Information}
(Page 2 of 2)

Recreation Pool	-	-	-	-	-	-	-	
Flood Control Pool	-	-	-	-	-	-	-	

Sources: USGS, 2002; USGS, 2008c through g; PPL, 1999a; USACE, 2007
[1]Dam information obtained from **PPL, 1999a**
[2]Dam information obtained from **USGS, 2008c through g**
[3]Dam information obtained from **USGS, 2002**
[3] Dam information obtained from **USACE, 2007**

Table 2.4-13— {Surface Water Users in Luzerne County}

(Page 1 of 2)

ORGANIZATION	SITE_ID	WATER BODY	PRIMARY USE	SITE STATUS
AIRPORT SAND & GRAVEL CO INC	256331	ABRAHAM CREEK DIV	MINERAL USE	ACTIVE
AMER ASPHALT PAVING CO	448323	BROWNS CREEK DIV	MINERAL USE	ACTIVE
APPLEWOOD GC	625899	LEWIS CREEK	COMMERCIAL USE	ACTIVE
BARLETTA BROS	245902	NESCOPECK CREEK	COMMERCIAL USE	ACTIVE
BARLETTA MATERIALS & CONST INC	271224	SUSQUEHANNA RIVER	INDUSTRIAL USE	ACTIVE
BURTAM CORP	491078	POND HOLE 18	COMMERCIAL USE	ACTIVE
CARBON SALES INC	259022	MILL CREEK WITH	MINERAL USE	ACTIVE
CHRISTINE & WILLIAM MISSON	245088	POND A	COMMERCIAL USE	ACTIVE
CHRISTINE & WILLIAM MISSON	245088	POND B	COMMERCIAL USE	ACTIVE
CHRISTINE & WILLIAM MISSON	245088	POND C	COMMERCIAL USE	ACTIVE
CONTINENTIAL ENERGY ASSOC	492489	POND DIV	MINERAL USE	ACTIVE
DIAMOND COAL CO INC	250506	RESERVOIR DIV	MINERAL USE	ACTIVE
DRUE CHAPIN & SONS	662342	INTAKE 1	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662342	INTAKE 2	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662342	INTAKE 3	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	672354	INTAKE 1	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662343	RIVER INTAKE 1	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662343	RIVER INTAKE 2	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662343	RIVER INTAKE 3	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662343	RIVER INTAKE 4	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662343	RIVER INTAKE 5	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662343	RIVER INTAKE 6	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	662343	RIVER INTAKE 7	AGRICULTURAL USE	ACTIVE
DRUE CHAPIN & SONS	672341	INTAKE 1	AGRICULTURAL USE	ACTIVE
FRED W ECKEL SONS	677216	SUSQUEHANNA RIVER INTAKE	AGRICULTURAL USE	ACTIVE
GEN CRUSHED STONE CO	258181	POND WITHDRAWAL	MINERAL USE	ACTIVE
GERALD & LEWIS NAUGLE	261815	PIKES CRK DIV	MINERAL USE	ACTIVE
HUNLOCK SAND & GRAVEL CO	450734	ROARING BROOK	MINERAL USE	ACTIVE
HUNLOCK SAND & GRAVEL CO	450734	POND	MINERAL USE	ACTIVE
HUNTSVILLE GC	446924	MARKET STREET IRRIGATION POND	COMMERCIAL USE	ACTIVE
INDIAN SPRINGS SAWMILL	549919	YEAGER RUN	INDUSTRIAL USE	ACTIVE
JA & WA HESS INC	452784	SUSQUEHANNA RVR	MINERAL USE	ACTIVE

Table 2.4-13— {Surface Water Users in Luzerne County}
(Page 2 of 2)

ORGANIZATION	SITE_ID	WATER BODY	PRIMARY USE	SITE STATUS
JA & WA HESS INC	452784	SUSQUEHANNA WITHDRAWAL	MINERAL USE	ACTIVE
JEAN RUN INC	449143	FARM POND	COMMERCIAL USE	ACTIVE
KAMINSKI BROS INC	442707	POND WITHDRAWAL	MINERAL USE	ACTIVE
KAMINSKI BROS INC	449046	SILT POND	INDUSTRIAL USE	ACTIVE
KELLY INVESTORS INC	445826	RESERVOIR DIV	MINERAL USE	INACTIVE
KEYSTONE COCA COLA BOTTLING CORP	258071	SURFACE WITHDRAW	INDUSTRIAL USE	ACTIVE
NEWBERRY GOLF ESTATE CC	269371	POND	COMMERCIAL USE	ACTIVE
PG ENERGY INC	494082	COAL CREEK	COMMERCIAL USE	ACTIVE
PG ENERGY INC	494082	HARVEYS CREEK	COMMERCIAL USE	ACTIVE
PG ENERGY INC	494082	CAMPBELLS LEDGE	COMMERCIAL USE	ACTIVE
PG ENERGY INC	494082	LAUREL RUN	COMMERCIAL USE	ACTIVE
PG ENERGY INC	494082	PINE RUN INTAKE	COMMERCIAL USE	ACTIVE
PG ENERGY INC	494082	WANAMIE	COMMERCIAL USE	ACTIVE
SHIRLEY M RINEHIMER	254432	POND WITHDRAWAL	MINERAL USE	INACTIVE
SUGARLOAF GC INC	243760	POND	COMMERCIAL USE	ACTIVE
SUGARLOAF GC INC	243760	BUCK MOUNTAIN STREAM	COMMERCIAL USE	ACTIVE
Unavailable	259075	SURFACE WITHDRAWAL	AGRICULTURAL USE	ACTIVE
VALLEY CC	243972	POND 3	COMMERCIAL USE	ACTIVE
WILKES BARRE CITY GEN MUNI AUTH LUZERNE CNTY	243780	FIVE MILE RUN	COMMERCIAL USE	ACTIVE
WYOMING VALLEY CC	260442	POND	COMMERCIAL USE	ACTIVE

Table 2.4-14— {SSES Units 1 and 2 Monthly Consumptive Water Use (Million Gallons per Month)}

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	824	785	569	554	1,011	1,089	1,131	1,157	1,046	1,028	950	894
2002	868	748	436	592	1,030	1,103	1,175	1,173	1,079	770	894	851
2003	986	927	865	625	1,042	1,051	1,145	1,139	931	986	927	865
2004	740	702	503	581	1,081	1,060	1,112	1,129	1,045	985	833	850
2005	791	682	531	870	1,024	1,032	1,145	1,153	1,078	985	757	827
2006	884	744	525	739	974	1,054	1,149	1,138	1,008	685	930	911

Table 2.4-15— {Major Public Water Suppliers within Luzerne and Columbia Counties}

PWSIS	System Name	County	Source Waterbody Name	Source Pumping Capacity (GPD)	Source Safe Yield (GPD)
4190008	United Water PA Bloomsburg	Columbia	Fishing Creek	5,760,000	5,000,000
2409002	PA American Water Company- Ceasetown	Luzerne	Ceasetown Reservoir	8,300,000	13,200,000
2409002	PA American Water Company- Ceasetown	Luzerne	Harveys Creek	1,300,000	1,300,000
2409003	PA American Water Company- Crystal Lake	Luzerne	Crystal Lake	0	5,000,000
2409003	PA American Water Company- Crystal Lake	Luzerne	Crystal Lake	-	-
2409013	PA American Water Company- Huntsville	Luzerne	Huntsville Reservoir	4,500,000	6,000,000
2409010	PA American Water Company- Nesbitt	Luzerne	Maple Lake	0	0
2409010	PA American Water Company- Nesbitt	Luzerne	Watres Reservoir	-	2,600,000
2409010	PA American Water Company- Nesbitt	Luzerne	Nesbitt	0	0
2409011	PA American Water Company- Watres	Luzerne	Mill Creek Reservoir	-	-
2409011	PA American Water Company- Watres	Luzerne	Gardner Cr. Reservoir	-	-
2409011	PA American Water Company- Watres	Luzerne	Watres Reservoir	0	0
2400148	Stockton Water System	Luzerne	Ponds	-	-
2408001	HCA Roan Filter Plant ID-006	Luzerne	Stony Cabin Creek	0	0
2408001	HCA Roan Filter Plant ID-005	Luzerne	Wolfe's Run	0	0
2408001	HCA Roan Filter PlantID-004	Luzerne	Dreck Creek	0	0
2408001	HCA Roan Filter Plant ID-003	Luzerne	Biesel's Run	0	0
2408001	HCA Roan Filter Plant ID-002	Luzerne	Oberson's Run	0	0
2408001	HCA Roan Filter Plant ID-018	Luzerne	Shaffers Run	0	0
2408001	HCA Roan Filter Plant ID-012	Luzerne	Mt. Pleasant Spring	0	0
2408001	HCA Roan Filter Plant ID-021	Luzerne	Lehigh River	0	0

Note: GPD = Gallons per day

Table 2.4-16— {SSES Units 1 and 2 Cooling Tower Blowdown Discharge Rate Permit NoI PA0047325}

MONTH	2000		2001		2002		2003		2004		2005		2006		2007	
	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max
January	6.86	11.81	11.17	15.55	8.91	10.42	6.58	10.42	11.08	17.72	12.09	17.29	9.41	15.08	10.63	16.92
February	9.68	17.28	10.24	11.88	7.52	10.08	9.22	10.30	12.36	14.36	11.15	17.28	9.72	12.10	11.47	14.69
March	8.26	17.28	6.45	10.94	5.67	9.07	6.70	8.64	8.84	14.44	8.76	17.28	8.16	11.48	9.49	16.48
April	7.80	11.28	6.96	11.52	8.46	10.85	7.28	10.37	11.94	17.28	14.54	17.28	10.93	12.94	13.04	17.28
May	14.37	17.28	15.86	17.28	12.80	17.06	12.84	16.85	11.30	15.88	12.89	14.28	12.01	15.56	14.36	17.22
June	15.19	17.28	17.08	17.28	16.68	17.28	13.64	17.28	14.53	16.98	13.15	17.28	14.33	17.28	17.17	17.28
July	15.66	17.28	15.40	17.28	17.13	17.28	16.79	17.28	16.35	17.28	12.27	16.05	16.15	17.28	17.20	17.28
August	13.51	17.28	16.33	16.70	17.05	17.28	17.13	17.28	15.61	17.28	12.63	17.28	17.01	17.28	17.28	17.28
September	14.40	17.28	16.72	17.28	16.16	17.28	13.26	17.28	16.54	17.28	13.28	17.28	16.35	17.28	15.24	17.28
October	11.12	13.39	13.18	15.26	10.60	15.12	9.56	15.26	11.62	16.72	13.71	17.28	12.83	17.10	13.51	17.28
November	9.36	16.92	13.71	16.18	9.19	12.24	11.57	17.28	9.84	13.61	8.59	13.21	12.74	17.16	10.73	17.28
December	11.46	17.28	11.17	15.55	6.49	11.52	9.73	17.78	13.42	17.28	9.91	16.71	11.75	16.36	9.23	14.33

Table 2.4-17— {Water Pollution Control Facilities in Luzerne County}
(Page 1 of 2)

ORGANIZATION	SITE_ID	SUB_FACI_2	SITE_STATUS
ABF FREIGHT SYS INC	535140	DISCHARGE POINT	ACTIVE
AGWAY PETRO CORP	245439	DISCHARGE POINT	ACTIVE
ALLIANCE LDFL	452024	DISCHARGE POINT	ACTIVE
AMER ROCK SALT CO LLC	534131	DISCHARGE POINT	ACTIVE
AQUA PA INC	257459	CONVEYANCE SYSTEM	ACTIVE
BEMIS CO INC	238511	DISCHARGE POINT	ACTIVE
BP PROD NORTH AMER INC	245780	DISCHARGE POINT	ACTIVE
BRIDON AMER CORP	465509	DISCHARGE POINT	ACTIVE
BRUSH WELLMAN CORP	450819	DISCHARGE POINT	ACTIVE
BUTLER PROD	540068	DISCHARGE POINT	ACTIVE
CABOT CORP	241624	PRODUCTION SERVICE UNIT	ACTIVE
CASTEK INC	515571	DISCHARGE POINT	ACTIVE
CBD ENTERPRISES INC	250561	DISCHARGE POINT	ACTIVE
CELOTEX CORP	513776	DISCHARGE POINT	ACTIVE
CERTAINTEED CORP	242936	DISCHARGE POINT	ACTIVE
CON WAY FREIGHT INC	534973	DISCHARGE POINT	ACTIVE
DALLAS AREA MUNI AUTH	681690	PUMP STATION	ACTIVE
DIAL CORP	262476	DISCHARGE POINT	ACTIVE
EDWARD LUKASHEWSKI	532225	DISCHARGE POINT	ACTIVE
ELDORADO PROP CORP	236472	DISCHARGE POINT	ACTIVE
ENTENMANNS	534395	DISCHARGE POINT	INACTIVE
EXXON 739 CORP	260255	TREATMENT PLANT	ACTIVE
FABRAL INC	607189	DISCHARGE POINT	ACTIVE
FEDEX CORP	533615	PRODUCTION SERVICE UNIT	ACTIVE
FEDEX NATL LTL INC	662274	DISCHARGE POINT	ACTIVE
FLEXTRONICS	547487	DISCHARGE POINT	ACTIVE
GEN MILLS INC	536701	DISCHARGE POINT	ACTIVE
GRAHAM PKG CO LP	635944	DISCHARGE POINT	ACTIVE
GRAHAM PKG CO LP	637387	DISCHARGE POINT	ACTIVE
GREIF BROS CORP	534867	DISCHARGE POINT	ACTIVE
GRUMA CORP	655837	DISCHARGE POINT	ACTIVE
GSD PKG LLC	670073	PRODUCTION SERVICE UNIT	ACTIVE
GULF OIL LTD PARTNERSHIP	465179	DISCHARGE POINT	ACTIVE
HAZLETON CASTING CO	647590	DISCHARGE POINT	ACTIVE
HAZLETON CITY WATER AUTH LUZERNE CNTY	447541	DISCHARGE POINT	ACTIVE
HERSHEY FOODS CORP	481099	DISCHARGE POINT	ACTIVE
HPG INTL INC	248877	TREATMENT PLANT	ACTIVE
INDALEX INC - MOUNTAINTOP DIV	525674	DISCHARGE POINT	ACTIVE
INTERMETRO IND CORP	248955	DISCHARGE POINT	ACTIVE
INTERMETRO IND CORP	527804	DISCHARGE POINT	ACTIVE
INTERSIL CORP	471870	DISCHARGE POINT	ACTIVE
IRECO INC	241565	DISCHARGE POINT	ACTIVE
JACOBSON CO INC	699736	PRODUCTION SERVICE UNIT	ACTIVE
LOUIS COHEN & SON INC	534190	DISCHARGE POINT	ACTIVE
OFFSET PAPERBACK MANUFACTURERS INC	243274	PRODUCTION SERVICE UNIT	ACTIVE
PA AMER WATER CO	243286	TREATMENT PLANT	ACTIVE
PA AMER WATER CO	446349	DISCHARGE POINT	ACTIVE

Table 2.4-17— {Water Pollution Control Facilities in Luzerne County}
(Page 2 of 2)

ORGANIZATION	SITE_ID	SUB_FACI_2	SITE_STATUS
PA AMER WATER CO	449229	DISCHARGE POINT	ACTIVE
PA AMER WATER CO	449233	DISCHARGE POINT	ACTIVE
PA AMER WATER CO	452022	DISCHARGE POINT	ACTIVE
PA AMER WATER CO	480951	DISCHARGE POINT	ACTIVE
PA DEP NERO	544343	DISCHARGE POINT	ACTIVE
PA DEPT OF CORR	516545	DISCHARGE POINT	ACTIVE
PETRO SVC CORP	547319	DISCHARGE POINT	ACTIVE
PILOT CORP	250389	DISCHARGE POINT	ACTIVE
POLYGLASS USA INC	525105	DISCHARGE POINT	ACTIVE
PPL ELEC UTILITIES CORP	250359	DISCHARGE POINT	ACTIVE
SANDUSKY LEWIS METAL PROD INC	236732	DISCHARGE POINT	ACTIVE
SCHOTT GLASS TECH INC	256591	DISCHARGE POINT	ACTIVE
SLUSSER BROS TRUCKING & EXCAV CO INC	513213	DISCHARGE POINT	ACTIVE
SLUSSER BROS TRUCKING & EXCAV CO INC	534045	DISCHARGE POINT	ACTIVE
SMITHS AEROSPACE COMPONENTS	665612	DISCHARGE POINT	ACTIVE
SOUTHERN ALLEGHENIES LDFL INC	803	TREATMENT PLANT	ACTIVE
STAR ENTERPRISE	248793	DISCHARGE POINT	ACTIVE
STERICYCLE INC	535121	DISCHARGE POINT	ACTIVE
SUNOCO INC	465963	DISCHARGE POINT	ACTIVE
SVC MFG INC	481491	DISCHARGE POINT	ACTIVE
TECHNEGLAS INC	244619	DISCHARGE POINT	ACTIVE
THREE SPRINGS WATER CO	261223	DISCHARGE POINT	ACTIVE
UGI DEVELOPMENT COMPANY	264295	DISCHARGE POINT	ACTIVE
UNISON ENGINE COMPONENTS INC	511980	DISCHARGE POINT	ACTIVE
UPS INC	534803	DISCHARGE POINT	ACTIVE
WEIR HAZLETON INC	511126	DISCHARGE POINT	ACTIVE
WILKES BARRE SCRANTON INTL AIRPORT	489635	DISCHARGE POINT	ACTIVE
WILLIAMS GAS PIPELINE TRANSCO	689478	DISCHARGE POINT	ACTIVE

Table 2.4-18— {1-Hour 1 mi^2 Probable Maximum Precipitation (PMP) Depths}

Duration (hrs)	All Season PMP (in)	All Season PMP (cm)
5	5.88	14.94
15	9.26	23.52
30	13.2	33.73
60	17.50	44.45

Table 2.4-19— {72-Hour 10 mi^2 Probable Maximum Precipitation (PMP) Depths}

Duration (hrs)	All Season PMP (in)	All Season PMP (cm)
6	26.3	66.8
12	30.0	76.2
24	32.6	82.8
48	36.4	92.5
72	37.6	95.5

Table 2.4-20— {Sub-Basin Drainage Areas for BBNPP (Site Drainage)}

Hydrologic Element/ Sub-Basin	Drainage Area ft^2 (m^2)	Drainage Area ac (ha)
Waste Disposal Area	5,026,902.6 (467,014.5)	115.398 (46.702)
Switchyard	1,308,070.2 (121,523.7)	30.028 (12.152)
Power Block	2,480,613.5 (230,456.5)	56.945 (23.046)
ESWEMS Pond	272,153.12 (25,283.9)	6.248 (2.529)
Wetlands Area	487,063.0 (45,249.6)	11.181 (4.525)
Switchyard Extension	3,416,501.6 (317, 403.4)	78.429 (31.740)
Parking Lot	1,633,405.2 (497,861.9)	37.496 (15.175)

Table 2.4-21— {HEC-HMS Sub-Basin Site PMP Peak Discharges for BBNPP (Site Drainage)}

Hydrologic Element/ Sub-basin	Drainage Area $ft^2(m^2)$	Peak Discharge cfs (cms)	Runoff Volume in (cm)
Waste Disposal Area[1]	5,026,902.6 (467,014.5)	7,450.96 (210.99)	17.12 (43.48)
Switchyard[1]	1,308,070.2 (121,523.7)	2,120.26 (60.04)	17.30 (43.94)
Power Block[1]	2,480,613.5 (230,283.9)	2,479.59 (70.21)	16.02 (40.69)
ESWEMS Pond[2]	272,153.2 (25,283.9)	120.71 (3.42)	37.77 (95.94)
Wetlands Area[1]	487,063.0 (45,249.6)	789.48 (22.36)	17.30 (43.94)
Switchyard Extension[1]	3,416,501.6 (317,403.4)	2,702.34 (76.52)	16.02 (40.69)
Parking Lot[1]	1,633,405.2 (497.861.9)	2,161.61 (61.21)	16.94 (43.03)

[1]Sub-basin evaluated using 1-hour PMP data (see Table 2.4-18).
[2] Sub-basin evaluated using 72-hour PMP data (see Table 2.4-19).

Table 2.4-22— {Safety-Related Facility Entrance Elevation Summary}

Safety-Related Facility	Entrance Elevation ft (m)	PMP Peak Water Elevation ft (m)	Freeboard ft (m)
Nuclear Island[*,1]	674.00 (205.44)	670.66 (204.42)	3.34 (1.02)
ESW Cooling Tower Structures[1]	674.00 (205.13)	670.66 (204.42)	3.34 (1.02)
Emergency Power Generator Building[1]	674.00 (205.13)	670.66 (204.42)	3.34 (1.02)
ESWEMS Building[2]	674.00 (205.44)	672.13 (204.87)	1.87 (0.57)

[*] Includes Reactor, Fuel and Safeguards Buildings.
[1] Evaluated using 1-hour PMP data (see Table 2.4-18).
[2] Evaluated using 72-hour PMP data (see Table 2.4-19).

Table 2.4-23— {Walker Run Probable Maximum Precipitation Depths}

Area (mi^2)	6-hr	12-hr	24-hr	48-hr	72-hr
10	26.3	30.0	32.6	36.4	37.6
200	17.8	21.2	24.2	27.8	28.7
1,000	12.8	16.0	19.3	22.0	23.1
5,000	7.7	11.1	13.6	16.8	17.8
10,000	6.0	9.2	11.4	13.9	15.3
Source: NOAA, 1978.					

Table 2.4-24— {Walker Run PMP Peak Flow Rates}

Hydrologic Element	Drainage Area mi^2 (km^2)	Peak Discharge cfs (m^3/sec)	Time of Peak* (hr)
Junction-1	4.10 (10.61)	21,747 (616)	40:40
Junction-2	3.12 (8.08)	16,685 (472)	40:25
Reach-1-Walker Run	4.10 (10.61)	21,747 (616)	40:40
Reach-2-Walker Run	3.12 (8.08)	16,542 (468)	40:50
Reach-3-Walker Run	3.12 (8.08)	16,554 (469)	40:45
Reach-4-Walker Run	3.12 (8.08)	16,573 (469)	40:40
Sub-Basin A1	0.98 (2.54)	6,312 (179)	40:15
Sub-Basin A2	2.43 (6.29)	13,033 (369)	40:40
Sub-Basin A3	0.69 (1.79)	5,224 (148)	40:00

* Note: Time to peak is measured from the start of the synthetic Probable Maximum Precipitation Event. The peak intensity rainfall occurs at time 39:15 from the start of the 72-hr storm (USACE, 1984).

Table 2.4-25— {Walker Run PMF Water Surface Elevations}

(Page 1 of 2)

	River/Stream	Cross Section/River Station (ft)	Discharge (cfs)	Water Surface Elevation		Location (See Figure 2.4-30 through Figure 2.4-32)
				(ft) msl	(m) msl	
1	Walker Run	20,547	13,033	810.32	246.99	Upstream of Plant
2	Walker Run	19,542	13,033	781.62	238.24	Upstream of Plant
3	Walker Run	19,069	Bridge	Bridge	Bridge	Bridge
4	Walker Run	18,546	13,033	765.89	233.44	Upstream of Plant
5	Walker Run	18,062	Bridge	Bridge	Bridge	Bridge
6	Walker Run	17,444	Bridge	Bridge	Bridge	Bridge
7	Walker Run	15,810	13,033	694.18	211.59	Upstream of Plant
8	Walker Run	15,029	Bridge	Bridge	Bridge	Beach Grove Road
9	Walker Run	13,697	Bridge	Bridge	Bridge	Market Street
10	Walker Run	13,573	13,033	677.11	206.38	Cooling Tower US
11	Walker Run	13,557	13,033	677.05	206.36	Cooling Tower
12	Walker Run	13,473	13,033	676.68	206.25	Cooling Tower
13	Walker Run	13,405	13,033	675.87	206.01	Cooling Tower
14	Walker Run	13,342	13,033	675.31	205.83	Cooling Tower
15	Walker Run	13,300	13,033	675.28	205.83	Cooling Tower
16	Walker Run	13,274	13,033	675.1	205.77	Cooling Tower
17	Walker Run	13,226	13,033	674.3	205.53	Cooling Tower
18	Walker Run	13,167	13,033	671.7	204.73	Cooling Tower DS
19	Walker Run	12,715	13,033	670.96	204.51	Plant US
20	Walker Run	12,680	13,033	670.89	204.49	Plant
21	Walker Run	12,636	13,033	670.81	204.46	Plant
22	Walker Run	12,592	13,033	670.73	204.44	Plant
23	Walker Run	12,560	13,033	670.68	204.42	Plant
24	Walker Run	12,498	13,033	670.62	204.40	Plant
25	Walker Run	12,463	13,033	670.56	204.39	Plant
26	Walker Run	12,406	13,033	670.49	204.37	Plant
27	Walker Run	12,346	13,033	670.44	204.35	Plant
28	Walker Run	12,277	13,033	669.94	204.20	Plant
29	Walker Run	12,252	Bridge	Bridge	Bridge	Site Access Road
30	Walker Run	12,225	13,033	669.98	204.21	Plant
31	Walker Run	12,093	13,033	669.99	204.21	Plant
32	Walker Run	12,011	13,033	669.99	204.21	Plant
33	Walker Run	11,951	13,033	669.98	204.21	Plant
34	Walker Run	11,881	13,033	669.97	204. 21	Plant
35	Walker Run	11,812	13,033	669.97	204.21	Plant
36	Walker Run	11,763	13,033	669.96	204.20	Plant DS
37	Walker Run	11,594	16,685	669.9	204.19	Downstream of Plant
38	Walker Run	9,692	Bridge	Bridge	Bridge	Market Street
39	Walker Run	9,182	18,700	669.24	203.98	Downstream of Plant
40	Walker Run	9,040	Bridge	Bridge	Bridge	Bridge
41	Walker Run	7,806	19,200	667.24	203.37	Downstream of Plant
42	Walker Run	7,544	Bridge	Bridge	Bridge	Bridge
43	Walker Run	5,022	20,200	638.21	194.53	Downstream of Plant
44	Walker Run	2,029	21,747	552.06	168.27	Downstream of Plant
45	Walker Run	1,469	Bridge	Bridge	Bridge	Route 11

Table 2.4-25— {Walker Run PMF Water Surface Elevations}

(Page 2 of 2)

	River/Stream	Cross Section/River Station (ft)	Discharge (cfs)	Water Surface Elevation		Location (See Figure 2.4-30 through Figure 2.4-32)
				(ft) msl	(m) msl	
46	Walker Run	1,232	Bridge	Bridge	Bridge	Bridge
47	Walker Run	1,123	21,747	521	158.80	Downstream of Plant

Table 2.4-26— {Historical Tsunamis and Maximum Generated Wave Heights}

Date	Country	City	Latitude	Longitude	Earthquake[1] Magnitude	TsunamiCause	Maximum Tsunami Water Height (meter) above sea level
11/01/1755	Portugal	Lisbon	36.000	-11.000	N.A.	Earthquake	30.00
06/27/1864	Canada	Avalon Peninsula, Newfoundland	46.500	-53.700	N.A.	Earthquake	N.A.
12/16/1811	USA	New Madrid Earthquakes, MO	35.600	-90.400	8.5	Earthquake	N.A.
12/16/1811	USA	New Madrid Earthquakes, MO	35.600	-90.400	8.0	Earthquake	N.A.
01/23/1812	USA	New Madrid, MO	36.300	-89.600	8.4	Earthquake	N.A.
02/07/1812	USA	New Madrid, MO	36.500	-89.600	8.8	Earthquake	N.A.
09/01/1886	USA	Charleston, SC	32.900	-80.000	7.7	Earthquake	N.A.
09/01/1895	USA	High Bridge, NJ	40.667	-74.883	4.3	Earthquake	N.A.
10/11/1918	USA Territory	Mona Passage, Puerto Rico	18.500	-67.500	7.3	Earthquake	6.10
11/18/1929	Canada	Grand Banks, Newfoundland	44.690	-56.000	7.4	Earthquake and Submarine Landslide	7.00
08/04/1946	Dominican Republic	Northeastern Coast	19.300	-68.900	8.1	Earthquake	5.00
08/08/1946	Dominican Republic	Northeastern Coast	19.710	-69.510	7.9	Earthquake	0.60
05/19/1964	USA	Long Island, NY	40.800	73.100	N.A.	SubmarineLandslide	0.28

(1)The value in this column contains the primary earthquake magnitude: 0.0 to 9.9
N.A. = Not Available

Table 2.4-27— {Estimated Average Monthly Ice Thickness, Susquehanna River 2001-2007}

Month	AFDD (°F)	Ice Thickness (in)	Ice Thickness (cm)
January	190.4	2.07	5.26
February	125.1	1.68	4.27
December	88.1	1.41	3.58
Average	134.5	1.72	4.37
Note: Estimated values based on SSES Unit 1 & 2 Meteorological Tower data (PPL, 2008).			

Table 2.4-28— {Estimated Average Monthly Ice Thickness, ESW Emergency Makeup Retention Pond 2001-2007}

Month	AFDD (°F)	Ice Thickness (in)	Ice Thickness (cm)
January	190.4	9.66	24.54
February	125.1	7.83	19.89
December	88.1	6.57	16.69
Average	134.5	8.02	20.37
Note: Estimated values based on SSES Unit 1 & 2 Meteorological Tower data (PPL, 2008).			

Table 2.4-29— {10 mi^2 (25.9 km^2)Probable Maximum Precipitation Depths at the ESWEMS}

Duration (hrs)	All Season PMP (in)	All Season PMP (cm)
6	26.3	66.8
12	30.0	76.2
24	32.6	82.8
48	36.4	92.5
72	37.6	95.5

Table 2.4-30— {Data Input and Results for Wind Setup Calculations}

Scenario	**Wind Velocity U (mph)**	**Effective Fetch E_g (ft)**	**Wind Tide Fetch F (mi)**	**Average Depth D (ft)**	**Wind Setup S (ft)**
Highest Annual Wind	57	688.78	0.2609	20.63	0.03
2-year Wind Event	50	688.78	0.2609	20.63	0.02
10-year Wind Event	60	688.78	0.2609	20.63	0.03
25-year Wind Event	70	688.78	0.2609	20.63	0.04
50-year Wind Event	71	688.78	0.2609	20.63	0.05
100-year Wind Event	83	688.78	0.2609	20.63	0.06
1,000-year Wind Event	118	688.78	0.2609	20.63	0.13
Scenario	Wind Velocity U (km/hr)	Effective Fetch F_e (m)	Wind Tide Fetch F (km)	Average Depth D (m)	Wind Setup S (m)
Highest Annual Wind	92	209.9	0.4198	6.3	0.009
2-year Wind Event	80	209.9	0.4198	6.3	0.006
10-year Wind Event	97	209.9	0.4198	6.3	0.009
25-year Wind Event	113	209.9	0.4198	6.3	0.012
50-year Wind Event	114	209.9	0.4198	6.3	0.015
100-year Wind Event	134	209.9	0.4198	6.3	0.018
1,000-year Wind Event	190	209.9	0.4198	6.3	0.040

Table 2.4-31— {Wave Runup Results}

Scenario	Wind Setup (ft) S	Wave Runup (ft) $R_{u2\%}$	Freeboard Requirement (ft) $S+R_{u2\%}$
Highest Annual Wind	0.03	0.56	0.59
2-year Wind Event	0.02	0.50	0.52
10-year Wind Event	0.03	0.59	0.62
25-year Wind Event	0.04	0.68	0.73
50-year Wind Event	0.05	0.69	0.74
100-year Wind Event	0.06	0.81	0.88
1,000-year Wind Event	0.13	1.17	1.30
Scenario	**Wind Setup (m) S**	**Wave Runup (m) $R_{u2\%}$**	**Freeboard Requirement (m) $S+R_{u2\%}$**
Highest Annual Wind	0.009	0.17	0.18
2-year Wind Event	0.006	0.15	0.16
10-year Wind Event	0.009	0.18	0.19
25-year Wind Event	0.012	0.21	0.22
50-year Wind Event	0.015	0.21	0.23
100-year Wind Event	0.018	0.25	0.27
1,000-year Wind Event	0.040	0.36	0.40

Table 2.4-32— {Highest Wind Speeds Using Fisher-Tippet Type I (Frechet) Distribution}

Scenario	[1]Highest Wind Speed(mph)	Highest WindSpeed (km/h)
[2]Highest Annual Wind	57	92
2-year Wind Event	50	80
10-year Wind Event	60	97
25-year Wind Event	70	113
50-year Wind Event	71	114
100-year Wind Event	83	134
1,000-year Wind Event	118	190

[1] Highest Wind Speed Interpolated for BBNPP site.
[2] Highest Annual wind was obtained from the SSES Unit 1 & 2 meteorological tower, based on available data from 2001 to 2007.

Table 2.4-33— {Summary of Information of the Stations and Range of Data Used}

Station Name	USGS Station ID	Location		mslStation Datum ft (m)	Period of Record
		Latitude	Longitude		
Danville, PA	01540500	40°57'9"	76°37'10"	431.29 (131.46)	1900-2006
Wilkes-Barre, PA	01536500	41°15'03"	75°52'52"	510.86 (155.71)	1899-2006

Table 2.4-34— {Annual Minimum Water Levels at Danville, PA Station}
(Page 1 of 3)

Date	[1]Stage Elevation (ft) msl	Gauge Height (ft)	Streamflow (cfs)
25-Sep-1900	432.89	1.60	822
27-Oct-1901	434.39	3.10	4,510
19-Sep-1902	434.04	2.75	3,115
8-Oct-1903	434.75	3.46	5,728
8-Jul-1905	435.19	3.90	7,720
30-Jun-1906	435.52	4.23	9,360
15-Oct-1907	436.96	5.67	14,700
15-Sep-1908	433.03	1.74	981
25-Jun-1909	435.27	3.98	8,426
20-May-1912	438.84	7.55	25,612
4-Aug-1913	433.39	2.10	1,593
3-May-1915	436.35	5.06	14,022
4-Oct-1915	435.09	3.80	7,655
25-Sep-1917	434.29	3.00	3,767
5-Oct-1917	433.99	2.70	2,766
5-Oct-1918	436.52	5.23	12,900
29-Aug-1919	434.05	2.76	3,240
23-Jun-1920	435.47	4.18	9,290
21-Jun-1921	433.76	2.47	2,360
27-Aug-1922	437.66	6.37	20,400
18-Jul-1923	433.38	2.09	1,540
11-Aug-1924	433.77	2.48	2,360
22-Jul-1925	434.85	3.56	5,990
15-Aug-1929	433.83	2.54	2,550
16-Nov-1929	433.99	2.70	3,110
17-Sep-1930	433.56	2.27	1,680
13-Nov-1931	433.55	2.26	1,730
25-May-1933	435.75	4.46	9,790
17-Oct-1933	434.2	2.91	3,750
12-Jun-1935	434.75	3.46	5,780
14-Oct-1936	433.45	2.16	1,640
24-Aug-1937	434.61	3.32	4,840
13-Jun-1938	434.37	3.08	4,140
31-Aug-1939	433.08	1.79	980
13-Aug-1940	433.82	2.53	2,450
2-Oct-1941	433.09	1.80	962
1-Dec-1941	433.81	2.52	2,450
4-Oct-1943	433.38	2.09	1,440
1-Sep-1944	433.49	2.20	1,510
17-Aug-1945	434.57	3.28	4,580
14-Sep-1946	433.83	2.54	2,000
6-Oct-1947	433.75	2.46	2,010
27-Sep-1948	433.47	2.18	1,370
1-Aug-1949	433.8	2.51	2,300
29-Sep-1950	434.46	3.17	4,140
29-Aug-1951	433.86	2.57	2,370
21-Oct-1952	433.55	2.26	1,700

Table 2.4-34— {Annual Minimum Water Levels at Danville, PA Station}
(Page 2 of 3)

Date	(1)Stage Elevation (ft) msl	Gauge Height (ft)	Streamflow (cfs)
2-Sep-1953	433.12	1.83	1,040
17-Aug-1954	433.32	2.03	1,400
2-Aug-1955	433.08	1.79	978
8-Aug-1956	434.35	3.06	3,960
27-Aug-1957	433.56	2.27	1,750
15-Oct-1958	434.19	2.90	3,440
29-Jul-1959	433.46	2.17	1,540
3-Aug-1960	434.12	2.83	2,990
30-Oct-1961	433.35	2.06	1,310
20-Jul-1962	433.5	2.21	1,640
16-Oct-1963	433.1	1.81	936
9-Sep-1964	433.02	1.73	823
30-Nov-1964	433.33	2.04	1,280
16-Aug-1966	433.46	2.17	1,430
5-Oct-1967	434.43	3.14	3,980
10-Sep-1968	434.01	2.72	2,840
30-Sep-1969	433.46	2.17	1,550
25-Aug-1970	433.82	2.53	2,330
8-Sep-1971	433.89	2.60	2,520
21-Sep-1972	434.01	2.72	2,860
2-Oct-1973	434.37	3.08	4,020
22-Jul-1974	434.28	2.99	3,610
6-Aug-1975	434.21	2.92	3,360
9-Dec-1975	437.1	5.81	7,060
8-Jun-1977	434.47	3.18	4,290
2-Oct-1978	434.09	2.80	2,940
19-Jul-1979	433.98	2.69	2,560
9-Sep-1980	433.49	2.20	1,500
28-Aug-1981	433.61	2.32	1,850
17-Aug-1982	433.97	2.68	2,700
3-Oct-1983	433.5	2.21	1,660
10-Nov-1983	433.55	2.26	1,610
31-Oct-1984	434.06	2.77	2,930
11-Mar-1986	437.3	6.01	16,400
6-Aug-1986	437.31	6.02	15,800
12-Jul-1988	433.52	2.23	1,650
12-Oct-1988	433.64	2.35	1,970
16-Aug-1989	434.16	2.87	3,110
8-Aug-1991	433.33	2.04	1,380
30-Oct-1991	433.85	2.56	2,160
21-Jul-1993	433.6	2.31	1,840
17-Oct-1994	434.61	3.32	4,560
27-Sep-1995	433.52	2.23	1,830
2-Jul-1996	435.59	4.30	8,510
20-Oct-1997	433.48	2.19	1,640
29-Jun-1998	437.11	5.82	14,700
24-Jun-1999	433.67	2.38	1,820

Table 2.4-34— {Annual Minimum Water Levels at Danville, PA Station}
(Page 3 of 3)

Date	[1]Stage Elevation (ft) msl	Gauge Height (ft)	Streamflow (cfs)
24-Nov-1999	435.96	4.67	4,080
23-May-2001	434.54	3.25	4,330
24-Sep-2001	433.47	2.18	1,670
15-Jul-2003	435.2	3.91	7,080
27-Aug-2004	437.24	5.95	16,600
10-Aug-2005	433.57	2.28	1,600
16-Sep-2005	433.56	2.27	1,720
10-Aug-2007	434.11	2.82	3,130
5-Nov-2007	435.41	4.12	8,340
[1] Stage elevation determined based on gage datum of 431.29 ft			

Table 2.4-35— {Annual Minimum Water Levels at Wilkes-Barre PA Station}

(Page 1 of 3)

Date	(1)Stage Elevation (ft) msl	Gauge Height (ft)	Streamflow (cfs)
26-Sep-1900	513.06	2.20	961
20-Aug-1901	513.96	3.10	2,170
20-Sep-1902	513.96	3.10	2,170
15-Sep-1904	514.56	3.70	3,540
7-Nov-1904	515.35	4.49	5,660
29-Mar-1905	530.83	19.97	97,680
2-Jul-1906	516.37	5.51	9,400
16-Oct-1907	516.35	5.49	11,200
29-Oct-1908	513.52	2.66	1,657
4-May-1909	526.44	15.58	59,171
5-Aug-1913	512.99	2.13	1,017
2-Jun-1914	515.21	4.35	5,581
25-Aug-1914	516.82	5.96	10,492
8-Oct-1915	517.87	7.01	15,146
11-Jul-1916	515.15	4.29	5,859
1-Oct-1919	513.26	2.40	1,810
12-Feb-1920	513.81	2.95	2,620
11-Jun-1920	513.94	3.08	3,200
14-Sep-1921	512.99	2.13	1,490
21-Aug-1922	513.82	2.96	2,930
14-Aug-1923	512.88	2.02	1,360
13-Aug-1924	513.64	2.78	2,410
18-May-1925	516.34	5.48	9,670
19-Jul-1926	513.42	2.56	1,950
13-Aug-1929	512.4	1.54	1,270
19-Aug-1930	511.93	1.07	1,010
11-Sep-1930	512.27	1.41	1,210
5-Oct-1932	512.34	1.48	1,240
5-Aug-1933	512.54	1.68	1,660
12-Jul-1934	512.64	1.78	1,870
22-Oct-1935	512.41	1.55	1,720
16-Jul-1936	512.38	1.52	1,350
31-Jul-1937	513.02	2.16	2,160
14-Sep-1938	512.55	1.69	1,710
18-Sep-1939	511.55	0.69	609
8-Aug-1940	512.71	1.85	1,960
3-Oct-1941	511.75	0.89	715
4-Dec-1941	512.84	1.98	1,920
29-Sep-1943	511.95	1.09	1,110
7-Sep-1944	511.9	1.04	1,200
29-Aug-1945	513.23	2.37	3,210
12-Sep-1946	512.57	1.71	2,210
8-Oct-1947	512.33	1.47	1,980
28-Sep-1948	511.92	1.06	1,280
8-Sep-1949	512.62	1.76	2,230
31-Oct-1950	513.3	2.44	3,570
16-Oct-1951	512.5	1.64	1,960

Table 2.4-35— {Annual Minimum Water Levels at Wilkes-Barre PA Station}

(Page 2 of 3)

Date	(1)Stage Elevation (ft) msl	Gauge Height (ft)	Streamflow (cfs)
12-Nov-1952	511.76	0.90	1,530
2-Oct-1953	511.24	0.38	839
2-Nov-1954	511.78	0.92	1,340
12-Jul-1955	512.2	1.34	1,840
22-Aug-1956	512.26	1.40	2,090
4-Sep-1957	511.64	0.78	1,410
16-Aug-1958	512.95	2.09	3,220
22-Sep-1959	510.82	-0.04	833
23-Aug-1960	512.4	1.54	2,470
31-Oct-1961	511.05	0.19	1,370
7-Sep-1962	510.01	-0.85	671
21-Oct-1963	509.45	-1.41	736
22-Sep-1964	509.13	-1.73	545
13-Aug-1965	509.57	-1.29	788
7-Sep-1966	509.89	-0.97	985
19-Sep-1967	511.43	0.57	2,980
30-Sep-1968	509.8	-1.06	2,000
24-Sep-1969	510.67	-0.19	1,320
14-Sep-1970	510.77	-0.09	1,480
22-Jul-1971	510.76	-0.10	1,430
17-Oct-1972	511.39	0.53	2,200
25-Oct-1973	511.05	0.19	1,590
2-Aug-1974	511.99	1.13	3,720
28-Aug-1975	511.85	0.99	3,200
22-Jul-1976	513.35	2.49	6,820
13-Jul-1977	512.24	1.38	3,800
14-Sep-1978	511.06	0.20	1,500
24-Jul-1979	511.47	0.61	2,780
17-Sep-1980	510.19	-0.67	1,010
6-Aug-1981	511.3	0.44	2,220
6-Oct-1982	510.48	-0.38	1,270
13-Sep-1983	510.23	-0.63	994
31-Oct-1984	511.6	0.74	2,710
22-Aug-1985	510.54	-0.32	1,080
29-Aug-1986	512.23	1.37	3,990
2-Jun-1987	512.37	1.51	4,660
28-Oct-1987	513.03	2.17	5,790
23-Aug-1989	511.1	0.24	2,070
5-Oct-1989	511.57	0.71	2,780
8-Aug-1991	510.37	-0.49	905
9-Oct-1992	512.25	1.39	3,960
5-Aug-1993	510.69	-0.17	1,380
25-Aug-1994	518.06	7.20	21,900
19-Jul-1995	510.78	-0.08	789
10-Jun-1996	514.03	3.17	9,230
18-Jul-1997	511.19	0.33	2,370
17-Oct-1997	510.64	-0.22	1,590

Table 2.4-35— {Annual Minimum Water Levels at Wilkes-Barre PA Station}

(Page 3 of 3)

Date	[1]Stage Elevation (ft) msl	Gauge Height (ft)	Streamflow (cfs)
12-Aug-1999	510.28	-0.58	757
7-Oct-1999	513.05	2.19	6,530
9-Aug-2001	510.99	0.13	1,740
11-Sep-2001	510.59	-0.27	1,110
20-Nov-2003	510.86	9.91	4,470
31-Mar-2005	510.86	20.05	1,050
20-Jul-2006	514.09	3.23	9,270
5-Sep-2007	510.65	-0.21	1,380
4-Oct-2007	511.09	0.23	2,120
[1] Stage elevation determined based on gage datum of 510.86 ft			

Table 2.4-36— {Annual Low Flow Statistics for Danville and Wilkes-Barre Stations}

Gauge Station	Drainage Area (mi^2)	Period of Record	$Q_{1,10}$ (cfs)	$Q_{7,10}$ (cfs)	$Q_{30,10}$ (cfs)	Mean (cfs)	Median (cfs)	Harmonic Mean (cfs)
USGS Wilkes-Barre (upstream)	9,960	1899 - 2006	799	850	1,032	13,606	7,390	4,283
USGS Danville (downstream)	11,220	1900 - 2006	945	1,017	1,284	15,501	8,770	5,262
BBNPP Site (using upstream gage)	10,200	-	818	870	1,056	-	-	-
BBNPP Site (using downstream gage)	10,200	-	859	924	1,167	-	-	-

Notes:

- BBNPP Site statistics were interpolated based on USGS gauging stations near SSES intake structure.
- Q1,10 flow is the mean stream flow over 1 day which, on a statistical basis, can be expected to occur once every 10 years.
- Q7,10 flow is the mean stream flow over 7 consecutive days which, on a statistical basis, can be expected to occur once every 10 years.
- Q30,10 flow is the mean stream flow over 30 consecutive days which, on a statistical basis, can be expected to occur once every 10 years.

Table 2.4-37— {Estimated Recurrence Interval for the Lowest Recorded Flow, Wilkes-Barre and Danville Stations}

Gage Station	Water Year of Low Flow Event	Flow(cfs)	Estimated Recurrence Interval		
			Weilbull T_r (yr)	Gumbel T_r (yr)	Log Pearson Type III *T_r (yr)
Wilkes-Barre	1964	532	109	33	4
Danville	1964	558	102	87	4
* T_r estimated using power trendline with R2 < 0.90 at each gauging station.					

Table 2.4-38— {Physical Characteristics of Groundwater Wells in the North Branch Susquehanna River Basin, Pennsylvania}

Geologic Unit	Well Type [1]	Well Depth (ft)				Casing Length (ft)				Depth to Water (ft)			
		No. of Wells	Percentile [2]			No. of Wells	Percentile [2]			No. of Wells	Percentile [2]		
			25th	50th	75th		25th	50th	75th		25th	50th	75th
Alluvium,Glacial Overburden	D	56	42	56	88	54	44	57	90	45	10	18	24
	N	71	35	68	97	43	28	51	83	37	8	17	30
Catskill Formation	D	950	145	198	275	918	30	42	80	737	7	55	101
	N	247	194	293	438	182	37	62	100	155	25	60	120
Trimmers Rock Formation	D	84	117	199	255	78	20	22	40	58	20	31	58
	N	11	197	300	395	8	-	60	-	7	-	35	-
Mahantango and Marcellus Formations (Hamilton Group)	D	124	75	120	155	106	21	30	45	95	15	23	36
	N	29	150	300	500	24	25	39	46	20	7	16	30
Onondaga and Old Port Formations	D	6	-	147	-	5	-	22	-	5	-	30	-
	N	11	90	218	420	11	35	47	77	11	15	25	34
Keyser and Tonoloway Formations	D	17	75	150	185	17	35	45	95	13	10	35	71
	N	9	-	205	-	8	-	55	-	9	-	19	-

Notes:
(1) D = Domestic, N = Nondomestic
(2) Percent of wells that have values less than or equal to the value shown

Table 2.4-39— {Yields and Specific Capacities of Wells in the North Branch Susquehanna River Basin, Pennsylvania}

Geologic Unit	Well Type(1)	Reported Well Yield (gpm)				Specific Capacity (gpm/ft)			
		No. of Wells	Percentile (2)			No. of Wells	Percentile (2)		
			25th	50th	75th		25th	50th	75th
Alluvium, Glacial Overburden	D	56	12	18	22	10	0.34	0.8	2
	N	60	50	164	500	20	7	20	43
Catskill Formation	D	931	7	12	20	352	0.16	0.5	1.0
	N	215	17	35	85	82	0.3	0.7	1.9
Trimmers Rock Formation	D	79	3	6	10	18	0.03	0.06	0.17
	N	11	10	15	30	5	-	0.10	-
Mahantango and Marcellus Formations (Hamilton Group)	D	103	6	10	17	53	0.06	0.18	0.69
	N	29	20	65	175	15	0.23	1.1	2.5
Onondaga and Old Port Formations	D	6	-	10	-	4	-	0.16	-
	N	9	-	122	-	6	-	3.5	-
Keyser and Tonoloway Formations	D	16	10	14	28	7	-	0.53	-
	N	7	-	80	-	6	-	2.1	-

Notes:
(1) D = Domestic, N = Nondomestic
(2) Percent of wells that have values less than or equal to the value show

Table 2.4-40— {Specific Capacities of Wells in the Berwick-Bloomsburg-Danville Area, Pennsylvania}

Geologic unit	No. of Wells	Median Well Depth (ft) (1)	Specific Capacity (gpm/ft)			
			Percentile (2)			Range
			25th	50th	75th	
Glacial outwash	10	66	3.7	11	19	1.4-84
Catskill Formation	15	165	0.16	0.39	1.2	0.08-3.8
Trimmers Rock Formation	8	200	0.06	0.13	0.37	0.03-0.55
Harrell and Mahantango Formations	16	263	0.06	0.27	0.79	0.03-2.5
Marcellus Formation	15	255	0.07	0.19	0.5	0.03-18
Onondaga and Old Port Formations	13	259	1.2	3.2	9.3	0.47-350
Keyser and Tonoloway Formations	18	205	1.6	4.6	20	0.35-280
Shale	35	268	0.07	0.23	0.5	0.03-18
Sandstone and shale	23	200	0.12	0.22	0.55	0.03-3.8
Sandstone, limestone, and shale	11	250	0.07	0.13	0.8	0.03-1.4
Carbonate rock and shale	28	202	1.5	3.1	5.5	0.23-250
Carbonate rock	18	205	1.6	4.6	20	0.35-280

Notes:
(1) Feet below land surface
(2) Percent of wells that have values less than or equal to the value shown

Table 2.4-41— {Effect of Lithology on Well Yields, Berwick-Bloomsburg - Danville Area, Pennsylvania}

Aquifer	Well Type (1)	No. of Wells	Median Well Depth (ft)(2)	Reported Well Yield (gpm)			
				Percentile (3)			Range
				25th	50th	75th	
Sand and gravel	D	4	44	-	20	-	15-50
	N	8	58	-	40	-	18-100
Shale	D	168	122	5	10	15	0.5-50
	N	31	300	8	15	50	1-225
Sandstone and shale	D	163	150	6	8	10	0.5-60
	N	19	300	20	32	64	3-100
Sandstone, limestone and shale	D	31	191	5	10	20	2-50
	N	7	305	-	93	-	10-300
Carbonate rock and shale	D	63	110	6	12	20	2-100
	N	22	224	23	38	49	20-184
Carbonate rock	D	28	165	10	20	30	3-150
	N	14	280	65	160	383	24-900

Notes:
(1) D = Domestic, N = Nondomestic
(2) Feet below land surface
(3) Percent of wells that have values less than or equal to the value shown

Table 2.4-42— {Computed Water Budget Components for Selected Drainage Basins in the North Branch Susquehanna River Basin, Pennsylvania}

Watershed	Period of Data	Water Budget Components (in/yr)				Source of Data
		Precipitation (P)	Surface Runoff (S_r)	Groundwater Discharge (R_g)	Evapotranspiration (ET)	
Towanda Creek Basin	1961-1980	35.10(26.21-44.47)	7.82(1.98-16.44)	10.34(5.05-16.26)	16.94(10.71-24.28)	Taylor, 1984
Wapwallopen Creek Basin	1961-1980	43.87(32.04-64.48)	5.94(3.69-11.77)	14.20 (6.60-21.81)	23.73(16.57-41.85)	Taylor, 1984
Tunkhannock Creek Basin	1961-1980	42.69(34.41-52.74)	7.35(2.14-11.28)	11.98(5.65-18.43)	23.36(16.68-28.03)	Taylor, 1984
East Branch Chillisquaque Creek	1963-1966	33.3	11.4(1)		21.9	Williams, 1987
East Branch Chillisquaque Creek	1972-1975	50.3	27.1(1)		22.8	Williams, 1987
Fishing Creek	1963-1966	33.3	17.4(2)		15.9	Williams, 1987
Fishing Creek	1972-1975	50.3	31.9(2)		18.4	Williams, 1987

Notes:

(1) Number represents total runoff (surface water and groundwater combined). Groundwater is approximately 44% of the total runoff.

(2) Number represents total runoff (surface water and groundwater combined). Groundwater is approximately 63% of the total runoff

Table 2.4-43— {BBNPP Monitoring Wells and Construction Details}

(Page 1 of 2)

Monitoring Well ID	Corresponding Geotechnical Boring	Northing(1) (ft)	Easting(1) (ft)	Ground Surface Elevation(2) (ft msl)	Top of Casing Elevation(2) (ft msl)	Boring Depth(ft bgs)	Well Depth(ft bgs)	Screen Diameter & Slot Size (in)	Screen Interval Depth		Screen Interval Elevation(2)		Filterpack Interval Depth	
									Top (ft bgs	Bottom (ft bgs	Top (ft bgs	Bottom (ft bgs	Top (ft bgs	Bottom (ft bgs
Glacial Overburden Wells														
MW301A	NA	339097.635	2405396.729	662.48	664.54	36.5	36.5	4.0 / 0.01	21.5	36.5	640.98	625.98	13.0	21.5
MW302A1	NA	339410.169	2406939.741	665.18	667.41	35.2	35.15	4.0 / 0.01	20.0	35.0	645.18	630.18	17.0	35.15
MW302A2	NA	339410.073	2406925.672	665.25	667.42	35.3	35.34	4.0 / 0.01	20.0	35.0	645.25	630.25	11.0	35.34
MW302A3	NA	339410.156	2406899.922	665.34	667.70	35.7	35.71	4.0 / 0.01	20.7	35.7	644.64	629.64	11.0	35.71
MW302A4	NA	339495.305	2406939.417	665.56	667.70	39.0	37.6	4.0 / 0.01	22.5	37.5	643.06	628.06	12.0	39.0
MW303A	NA	341504.719	2405505.308	734.13	736.18	28.0	28.0	4.0 / 0.01	18.0	28.0	716.13	706.13	12.0	28.0
MW304A	NA	340228.157	2408455.377	680.61	682.65	37.0	37.0	4.0 / 0.01	17.0	37.0	663.61	643.61	17.0	37.0
MW305A1	NA	341896.434	2407090.850	715.30	717.35	43.0	43.0	4.0 / 0.01	23.0	43.0	692.30	672.30	18.0	43.0
MW305A2	NA	341888.613	2407096.810	714.64	717.01	83.0	76.0	2.0 / 0.01	56.0	76.0	658.64	638.64	51.0	76.0
MW306A	NA	338899.631	2404351.670	662.46	664.67	38.0	38.0	4.0 / 0.01	23.0	38.0	639.46	624.46	11.0	38.0
MW307A	NA	337632.513	2407085.991	688.60	690.96	37.0	37.0	4.0 / 0.01	22.0	37.0	666.60	651.60	12.0	37.0
MW308A	NA	338355.504	2405979.804	661.38	663.42	33.5	33.5	4.0 / 0.01	13.5	33.5	647.88	627.88	12.0	33.5
MW309A	NA	338707.942	2408989.197	673.33	675.62	20.9	20.9	4.0 / 0.01	10.8	20.8	652.53	662.53	6.0	20.9
MW310A	NA	339453.777	2405156.296	674.48	676.73	21.0	19.2	4.0 / 0.01	9.2	19.2	665.28	655.28	8.0	19.2
Shallow Bedrock Wells														
MW301B1	NA	339098.941	2405384.283	662.40	664.39	162.0	160.0	4.0 / 0.01	130.0	160.0	532.40	502.40	105.0	162.0
MW301B2	B303	339142.987	2405338.529	664.18	666.48	151.0	150.0	1.5 / 0.01	130.0	150.0	534.18	514.18	126.0	151.0
MW301B3	B308	339069.298	2405288.632	662.41	664.61	100.0	100.0	1.5 / 0.01	80.0	100.0	582.14	562.41	75.0	100.0
MW301B4	B310	338987.788	2405444.974	658.46	660.51	102.0	100.0	1.5 / 0.01	80.0	100.0	578.46	558.46	74.0	100.0
MW303B	NA	341504.607	2405493.422	733.53	735.65	97.0	97.0	2.0 / 0.01	77.0	97.0	656.53	636.53	65.0	97.0
MW304B	NA	340245.014	2408443.451	681.27	683.09	181.0	181.0	2.0 / 0.01	161.0	181.0	520.27	500.27	151.0	181.0
MW305B	NA	341880.508	2407108.086	714.10	716.19	140.0	140.0	2.0 / 0.01	120.0	140.0	574.10	594.10	110.0	140.0
MW308B	NA	338356.711	2405969.620	661.00	663.36	79.4	79.4	2.0 / 0.01	59.0	79.0	602.00	582.00	54.4	79.4
MW309B	NA	338708.711	2408999.087	673.16	675.31	160.0	160.0	2.0 / 0.01	140.0	160.0	533.16	513.16	129.0	160.0
MW310B	B326	339454.708	2405176.410	675.31	678.04	90.4	90.0	2.0 / 0.01	70.0	90.0	605.31	585.31	55.0	90.4
MW311B	B325	339328.285	2405252.941	668.90	671.29	100.5	100.0	1.5 / 0.01	80.0	100.0	588.90	568.90	75.0	100.0
MW312B	B315	338820.623	2405297.698	656.90	659.00	100.0	100.0	1.5 / 0.01	85.0	100.0	571.90	556.90	75.0	100.0
MW313B	B323	338927.919	2405815.577	657.68	659.97	100.0	100.0	1.5 / 0.01	80.0	100.0	577.68	557.68	70.0	100.0
MW313C(3)	B322	338922.541	2405754.786	657.24	659.42	200.0	130.0	1.0 / 0.01	110.0	130.0	547.24	527.24	100.0	130.0

Table 2.4-43— {BBNPP Monitoring Wells and Construction Details}

(Page 2 of 2)

Monitoring Well ID	Corresponding Geotechnical Boring	Northing(1) (ft)	Easting(1) (ft)	Ground Surface Elevation(2) (ft msl)	Top of Casing Elevation(2) (ft msl)	Boring Depth(ft bgs)	Well Depth(ft bgs)	Screen Diameter & Slot Size (in)	Screen Interval Depth		Screen Interval Elevation(2)		Filterpack Interval Depth	
									Top (ft bgs	Bottom (ft bgs	Top (ft bgs	Bottom (ft bgs	Top (ft bgs	Bottom (ft bgs
MW315B	B338	340738.303	2406234.464	720.08	719.82	70.0	70.0	1.5 / 0.01	50.0	70.0	670.08	650.08	45.0	70.0
MW316B	B340	340298.177	2406433.929	702.37	702.08	80.0	80.0	1.0 / 0.01	60.0	80.0	642.37	622.37	55.0	80.0
MW317B	B333	339772.487	2406401.475	681.17	683.30	100.0	70.0	1.0 / 0.01	50.0	70.0	631.17	611.17	45.0	70.0
MW318B	B335	340493.179	2405516.324	801.32	803.79	70.0	70.0	1.0 / 0.01	50.0	70.0	751.32	731.32	40.0	70.0
MW319B	B337	340239.458	2405528.135	790.57	793.04	100.0	100.0	1.0 / 0.01	80.0	100.0	710.57	690.57	60.0	100.0
Deep Bedrock Wells														
MW301C	B301	339151.791	2405430.679	666.38	NA	400.0	400.0	1.0 /0.01	400.0	370.0	NA	NA	400.0	375.0
MW302B(4)	NA	339409.882	2406954.167	665.29	667.42	215.0	215.0	2.0 / 0.01	195.0	215.0	470.29	450.29	165.0	215.0
MW303C	NA	341503.537	2405483.363	732.94	734.98	250.0	250.0	2.0 / 0.01	230.0	250.0	502.94	482.94	181.0	250.0
MW304C	NA	340236.492	2408449.592	680.57	682.44	600.0	400.0	2.0 / 0.01	360.0	400.0	320.57	280.57	340.0	400.0
MW306C	NA	338889.031	2404353.483	662.47	664.70	335.0	330.0	2.0 / 0.01	280.0	330.0	382.47	332.47	270.0	330.0
MW307B(4)	NA	337632.749	2407096.694	688.33	690.85	270.0	270.0	2.0 / 0.01	250.0	270.0	438.33	418.33	200.0	270.0
MW310C	B327	339452.089	2405233.062	675.38	678.35	201.0	199.5	2.0 / 0.01	169.5	199.5	505.88	475.88	159.5	199.5
MW311C	B306	339313.213	2405413.688	669.07	671.18	203.0	203.0	1.5 / 0.01	183.0	203.0	466.07	486.07	178.0	203.0

(1) Horizontal Datum NAD83 State Plane feet
(2) Vertical Datum NAVD88 feet
(3) Well MW313C grouped with Shallow Bedrock Wells because well screen is only 130 ft bgs.
(4) Wells MW302B and MW307B were grouped with Deep Bedrock Wells because water-producing zones were not detected in shallow bedrock and, as a result, the wells were installed deeper than originally planned.

Table 2.4-44— {Monthly Groundwater Elevation Measurements, BBNPP}

(Page 1 of 5)

Monitoring Well ID	Elevation (ft msl)[1]		Depth To Groundwater (ft btor)[2]											
	Ground Surface	Top of Casing Reference Point	October 31, 2007	November 29, 2007	December 13, 2007	January 26, 2008	February 25, 2008	March 24, 2008	April 14, 2008	May 20, 2008	June 9, 2008	July 23, 2008	August 12, 2008	September 4, 2008
Overburden Wells														
MW301A	662.48	664.54	8.83	6.88	7.01	6.86	5.78	5.21	6.46	7.16	7.68	8.75	8.87	9.51
MW302A1	665.18	667.41	9.03	6.67	6.60	5.84	4.46	3.56	5.32	6.54	7.29	8.85	9.05	9.55
MW302A2	665.25	667.42	9.04	6.67	6.60	5.84	4.47	3.58	5.32	6.57	7.30	8.86	9.06	9.56
MW302A3	665.34	667.70	9.33	6.97	6.90	6.17	4.79	3.91	5.67	6.90	7.63	6.19	9.39	9.89
MW302A4	665.56	667.70	9.33	6.95	6.90	6.13	4.73	3.84	5.99	6.84	7.57	9.13	9.33	9.83
MW303A	734.13	736.18	22.85	21.56	22.00	21.86	20.22	19.07	21.36	21.25	21.77	22.64	22.39	23.05
MW304A	680.61	682.65	13.91	12.33	12.06	11.6	10.92	10.49	11.24	11.73	12.57	13.58	13.65	14.38
MW305A1	715.30	717.35	12.65	11.41	11.24	10.49	8.92	9.34	10.39	10.60	11.39	12.49	12.54	13.05
MW305A2	714.64	717.01	12.38	11.25	11.11	10.57	9.36	9.78	10.60	10.81	11.53	12.43	12.43	12.96
MW306A	662.46	664.67	9.58	8.01	8.45	8.74	7.82	7.60	8.75	9.00	9.57	10.26	10.22	10.84
MW307A	688.60	690.96	6.21	4.86	4.95	6.31	5.41	5.14	5.13	4.46	6.74	6.92	7.62	9.16
MW308A	661.38	663.42	8.07	6.63	6.90	7.21	6.49	6.40	7.02	7.11	7.79	8.39	8.46	9.30
MW309A	673.33	675.62	8.39	5.78	6.00	6.37	5.05	5.05	6.37	6.61	8.43	11.36	10.54	10.98
MW310A	674.48	676.73	19.33	17.22	17.55	17.48	16.09	15.64	17.36	18.36	18.83	19.84	19.97	20.33
Shallow Bedrock Wells														
MW301B1	662.40	664.39	6.92	4.62	4.95	5.02	3.96	3.77	5.10	5.46	6.03	6.89	6.93	7.46
MW301B2	664.18	666.48	10.35	8.77	8.90	5.79	7.72	7.20	8.56	9.10	9.62	10.65	10.78	11.43
MW301B3	662.41	664.61	10.41	7.21	7.38	7.39	6.39	5.97	7.16	7.57	8.09	5.98	9.10	9.75
MW301B4	658.46	660.51	10.81	2.67	2.92	2.71	1.35	1.53	2.69	3.14	3.75	4.66	4.73	5.41
MW303B	733.53	735.65	18.50	15.48	17.10	18.01	15.54	15.38	17.76	16.98	18.84	19.97	19.56	20.49
MW304B	681.27	683.09	14.48	13.02	12.85	12.49	12.14	11.53	12.16	12.60	13.43	14.60	13.82	14.34
MW305B	714.10	716.19	11.57	10.51	10.37	9.84	8.65	9.10	9.89	10.07	10.79	11.64	11.67	12.19

Table 2.4-44— {Monthly Groundwater Elevation Measurements, BBNPP}
(Page 2 of 5)

Monitoring Well ID	Elevation (ft msl)[1]		Depth To Groundwater (ft btor)[2]											
	Ground Surface	Top of Casing Reference Point	October 31, 2007	November 29, 2007	December 13, 2007	January 26, 2008	February 25, 2008	March 24, 2008	April 14, 2008	May 20, 2008	June 9, 2008	July 23, 2008	August 12, 2008	September 4, 2008
MW308B	661.00	663.36	68.50	66.45	65.57	62.88	69.23	74.67	73.40	75.98	74.85	72.52	75.72	74.58
MW309B	673.16	675.31	9.75	7.84	8.15	8.70	8.16	7.98	8.74	9.21	10.33	11.44	10.79	12.14
MW310B	675.31	678.04	16.35	13.81	14.01	13.23	11.71	11.80	13.33	13.68	14.29	15.22	15.15	15.47
MW311B	668.90	671.29	14.34	11.71	11.98	11.82	10.54	10.12	11.73	12.61	13.13	14.40	14.58	15.19
MW312B	656.90	659.00	8.88	2.40	2.53	2.01	1.30	0.80	2.30	2.61	3.17	4.00	4.02	4.66
MW313B	657.68	659.97	4.15	2.20	2.34	1.73	0.65	0.00	1.98	2.36	3.10	4.04	4.16	4.90
MW313C	657.24	659.42	NA	1.55	0.65	1.18	1.66	1.41	1.58	131.91	130.10	126.11	NR	122.08
MW315B	720.09	719.82	NA	2.15	2.17	1.15	0.55	0.03	1.77	2.07	2.73	3.76	3.84	4.17
MW316B	702.37	702.08	NA	9.84	9.98	8.54	7.36	8.30	8.96	7.81	8.87	10.72	10.77	11.43
MW317B	681.17	683.30	NA	23.24	23.20	22.52	21.23	20.39	22.10	23.33	23.90	25.42	25.60	26.15
MW318B	801.32	803.79	NA	53.57	53.51	44.64	42.40	42.75	45.36	45.18	46.61	49.50	48.22	52.60
MW319B	790.57	793.04	NA	87.14	83.66	73.85	70.38	71.33	74.19	74.77	76.42	79.52	79.85	81.02
Deep Bedrock Wells														
MW301C(3)	668.38	668.79	(3)	(3)	(3)	(3)	(3)	(3)	(3)	6.78	4.03	4.82	5.04	5.41
MW302B(4,5)	665.29	667.42	0.74	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
MW303C	732.94	734.98	31.08	28.64	29.90	30.80	29.27	30.28	32.98	33.64	35.22	36.90	35.86	36.26
MW304C	680.57	682.44	NA	15.47	13.75	12.01	11.72	11.30	11.85	12.01	12.57	13.81	14.51	15.19
MW306C	662.47	664.70	9.00	7.40	7.80	7.91	6.98	6.88	8.01	7.55	7.47	8.22	8.22	8.64
MW307B(4)	688.33	690.85	79.30	72.12	69.70	63.99	55.72	53.33	63.91	68.58	70.62	78.60	78.52	79.90
MW310C(5)	675.38	678.35	NA	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
MW311C	669.07	671.18	NR	147.64	146.34	142.37	139.67	137.03	135.20	131.91	130.10	126.11	NR	122.08
Overburden Wells														
MW301A	662.48	664.54	655.71	657.66	657.53	657.68	658.76	659.33	658.08	657.38	656.86	655.79	655.67	655.03

Table 2.4-44— {Monthly Groundwater Elevation Measurements, BBNPP}

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Monitoring Well ID	Elevation (ft msl)[1]		Depth To Groundwater (ft btor)[2]											
	Ground Surface	Top of Casing Reference Point	October 31, 2007	November 29, 2007	December 13, 2007	January 26, 2008	February 25, 2008	March 24, 2008	April 14, 2008	May 20, 2008	June 9, 2008	July 23, 2008	August 12, 2008	September 4, 2008
MW302A1	665.18	667.41	658.38	660.74	660.81	661.57	662.95	663.85	662.09	660.87	660.12	658.56	658.36	657.86
MW302A2	665.25	667.42	658.38	660.75	660.82	661.58	662.95	663.84	662.10	660.85	660.12	658.56	658.36	657.86
MW302A3	665.34	667.70	658.37	660.73	660.80	661.53	662.91	663.79	662.03	660.80	660.07	661.51	658.31	657.81
MW302A4	665.56	667.70	658.37	660.75	660.80	661.57	662.97	663.86	661.71	660.86	660.13	658.57	658.37	657.87
MW303A	734.13	736.18	713.33	714.62	714.18	714.32	715.96	717.11	714.82	714.93	714.41	713.54	713.79	713.13
MW304A	680.61	682.65	668.74	670.32	670.59	671.05	671.73	672.16	671.41	670.92	670.08	669.07	669.00	668.27
MW305A1	715.30	717.35	704.70	705.94	706.11	706.86	708.43	708.01	706.96	706.75	705.96	704.86	704.81	704.30
MW305A2	714.64	717.01	704.63	705.76	705.90	706.44	707.65	707.23	706.41	706.20	705.48	704.58	704.58	704.05
MW306A	662.46	664.67	655.09	656.66	656.22	655.93	656.85	657.07	655.92	655.67	655.10	654.41	654.45	653.83
MW307A	688.60	690.96	684.75	686.10	686.01	684.65	685.55	685.82	685.83	686.50	684.22	684.04	683.34	681.80
MW308A	661.38	663.42	655.35	656.79	656.52	656.21	656.93	657.02	656.40	656.31	655.63	655.03	654.96	654.12
MW309A	673.33	675.62	667.23	669.84	669.62	669.25	670.57	670.57	669.25	669.01	667.19	664.26	665.08	664.64
MW310A	674.48	676.73	657.40	659.51	659.18	659.25	660.64	661.09	659.37	658.37	657.90	656.89	656.76	656.40
Shallow Bedrock Wells														
MW301B1	662.40	664.39	657.47	659.77	659.44	659.37	660.43	660.62	659.29	658.93	658.36	657.50	657.46	656.93
MW301B2	664.18	666.48	656.13	657.71	657.58	660.69	658.76	659.28	657.92	657.38	656.86	655.83	655.70	655.05
MW301B3	662.41	664.61	654.20	657.40	657.23	657.22	658.22	658.64	657.45	657.04	656.52	658.63	655.51	654.86
MW301B4	658.46	660.51	649.70	657.84	657.59	657.80	659.16	658.98	657.82	657.37	656.76	655.85	655.78	655. 10
MW303B	733.53	735.65	717.15	720.17	718.55	717.64	720.11	720.27	717.89	718.67	716.81	715.68	716.09	715.16
MW304B	681.27	683.09	668.61	670.07	670.24	670.60	670.95	671.56	670.93	670.49	669.66	668.49	669.27	668.75
MW305B	714.10	716.19	704.62	705.68	705.82	706.35	707.54	707.09	706.30	706.12	705.40	704.55	704.52	704.00
MW308B	661.00	663.36	594.86	596.91	597.79	600.48	594.13	588.69	589.96	587.38	588.51	590.84	587.64	588.78
MW309B	673.16	675.31	665.56	667.47	667.16	666.61	667.15	667.33	666.57	666.10	664.98	663.87	664.52	663.17

Table 2.4-44— {Monthly Groundwater Elevation Measurements, BBNPP}

(Page 4 of 5)

Monitoring Well ID	Elevation (ft msl)[1]		Depth To Groundwater (ft btor)[2]											
	Ground Surface	Top of Casing Reference Point	October 31, 2007	November 29, 2007	December 13, 2007	January 26, 2008	February 25, 2008	March 24, 2008	April 14, 2008	May 20, 2008	June 9, 2008	July 23, 2008	August 12, 2008	September 4, 2008
MW310B	675.31	678.04	661.69	664.23	664.03	664.81	666.33	666.24	664.71	664.36	663.75	662.82	662.89	662.57
MW311B	668.90	671.29	656.95	659.58	659.31	659.47	660.75	661.17	659.56	658.68	658.16	656.89	656.71	656.10
MW312B	656.90	659.00	650.12	656.60	656.47	656.99	657.70	658.20	656.70	656.39	655.83	655.00	654.98	654.34
MW313B	657.68	659.97	655.82	657.77	657.63	658.24	659.32	659.97	657.99	657.61	656.87	655.93	655.81	655.07
MW313C	657.24	659.42	NA	657.87	658.77	658.24	657.76	658.01	657.84	527.51	529.32	533.31	NR	537.34
MW315B	720.09	719.82	NA	717.67	717.65	718.67	719.27	719.79	718.05	717.75	717.09	716.06	715.98	715.65
MW316B	702.37	702.08	NA	692.24	692.10	693.54	694.72	693.78	693.12	694.27	693.21	691.36	691.31	690.65
MW317B	681.17	683.30	NA	660.06	660.10	660.78	662.07	662.91	661.20	659.97	659.40	657.88	657.70	657.15
MW318B	801.32	803.79	NA	750.22	750.28	759.15	761.39	761.04	758.43	758.61	757.18	754.29	755.57	751.19
MW319B	790.57	793.04	NA	705.90	709.38	719.19	722.66	721.71	718.85	718.27	716.62	713.52	713.19	712.02
Deep Bedrock Wells														
MW301C[3]	668.38	668.79	(3)	(3)	(3)	(3)	(3)	(3)	(3)	662.01	664.76	663.97	663.75	663.38
MW302B[4,5]	665.29	667.42	666.68	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
MW303C	732.94	734.98	703.90	706.34	705.08	704.18	705.71	704.70	702.00	701.34	699.76	698.08	699.12	698.72
MW304C	680.57	682.44	NA	666.97	668.69	670.43	670.72	671.14	670.59	670.43	669.87	668.63	667.93	667.25
MW306C	662.47	664.70	655.70	657.30	656. 90	656.79	657.72	657.82	656.69	657.15	657.23	656.48	656.48	656.06
MW307B[4]	688.33	690.85	611.55	618.73	621.15	626.86	635.13	637.52	626.94	622.27	620.23	612.25	612.33	610.95
MW310C[5]	675.38	678.35	NA	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
MW311C	669.07	671.18	NR	523.54	524.84	528.81	531.51	534.15	535.98	539.27	541.08	545.07	NR	549.10

Table 2.4-44— {Monthly Groundwater Elevation Measurements, BBNPP}

(Page 5 of 5)

Monitoring Well ID	Elevation (ft msl)[1]		Depth To Groundwater (ft btor)[2]											
	Ground Surface	Top of Casing Reference Point	October 31, 2007	November 29, 2007	December 13, 2007	January 26, 2008	February 25, 2008	March 24, 2008	April 14, 2008	May 20, 2008	June 9, 2008	July 23, 2008	August 12, 2008	September 4, 2008

(1) ft msl= feet above mean sea level; vertical datum NAVD88 feet
(2) ft btor = feet below top of PVC riser pip (Top of Casing)
(3) Monitoring well MW301C was installed on May 20, 2008; water level monitoring was performed after this date.
(4) Monitoring wells MW302B and MW307B were drilled deeper than originally planned in order to intersect a water-bearing zone. These wells are therefore classified as Deep Bedrock wells because their screens are deeper than 200 ft bgs.
(5) Artesian pressure was encountered in this well and well is flowing. Groundwater elevation was set equal to the top of casing.
NA = Not Applicable
NR = Not Recorded

Table 2.4-45— {Monthly Surface Water Elevation Measurements, BBNPP}

(Page 1 of 2)

Gauging Station ID	Surveyed Elevation Point (ft)	October 31, 2007	November 29, 2007	December 13, 2007	January 28, 2008	February 29, 2008	March 25, 2008	April 15, 2008	May 21, 2008	June 10, 2008	July 23, 2008	August 12, 2008	September 4, 2008
Depth to Water (ft)													
Stream Gauges													
G1	670.97	7.67	8.77	11.58	8.88	8.67	8.69	8.73	8.73	9.00	8.99	8.93	9.12
G2	656.81	NM	9.56	9.60	10.24	9.83	9.81	10.63	9.92	10.57	10.28	10.43	10.77
G3	729.20	NM	6.70	6.75	6.73	6.71	9.66	6.75	6.60	6.75	6.75	6.78	NM
G5	608.10	6.53	NR	6.40	6.33	6.15	6.20	6.25	6.33	6.44	3.35	6.30	NM
G10	529.77	NM	NM	11.38	9.00	8.75	NM	11.57	11.42	11.50	11.49	11.52	11.61
G12	661.25	NM	NM	NM	NM	NM	NM	0.51	0.58	0.36	1.34	0.44	0.34
G13	649.12	NM	NM	NM	NM	NM	10.3	10.50	10.41	10.89	10.24	10.76	11.04
Pond Gauges													
G6	714.27	1.00	0.80	2.10	2.32	2.50	2.82	2.44	2.06	1.74	1.17	1.08	0.68
G7	687.52	0.82	0.78	0.71	0.36	0.30	0.44	0.90	1.14	1.08	0.95	1.26	0.40
G8	656.62	0.54	0.84	0.99	0.72	0.09	0.98	1.22	1.40	1.40	0.09	0.80	0.58
G9	667.75	1.03	1.58	1.59	1.57	2.10	2.18	1.00	2.02	1.74	1.40	1.42	1.11
Water Elevation (ft msl)													
Stream Gauges													
G1	670.97	663.30	662.20	659.39	662.09	662.30	662.28	662.24	662.24	661.97	661.98	662.04	661.85
G2	656.81	NM	647.25	647.21	646.57	646.98	647.00	646.18	646.89	646.24	646.53	646.38	646.04
G3	729.20	NM	722.50	722.45	722.47	722.49	719.54	722.45	722.60	722.45	722.45	722.42	NF
G5	608.10	601.57	NM	601.70	601.77	601.95	601.90	601.85	601.77	601.66	604.75	601.80	NF
G10	529.77	NM	NM	518.39	520.77	521.02	NM	518.20	518.35	518.27	518.28	518.25	518.16
G12	649.12	NM	NM	NM	NM	NM	638.82	638.62	638.71	638.23	638.88	638.36	638.08
G13	661.25	NM	NM	NM	NM	NM	NM	658.46	658.53	658.31	659.29	658.39	658.29
Pond Gauges													
G6	714.27	711.97	711.77	713.07	713.29	713.47	713.79	713.41	713.03	712.71	712.14	712.05	711.65

Table 2.4-45— {Monthly Surface Water Elevation Measurements, BBNPP}

(Page 2 of 2)

Gauging Station ID	Surveyed Elevation Point (ft)	October 31, 2007	November 29, 2007	December 13, 2007	January 28, 2008	February 29, 2008	March 25, 2008	April 15, 2008	May 21, 2008	June 10, 2008	July 23, 2008	August 12, 2008	September 4, 2008
G7	687.52	685.04	685.00	684.93	684.58	684.52	684.66	685.12	685.36	685.30	685.17	685.48	684.62
G8	656.62	653.86	654.16	654.31	654.04	653.41	654.30	654.54	654.72	654.72	653.41	654.12	653.90
G9	667.75	665.48	666.03	666.04	666.02	666.55	666.63	665.45	666.47	666.19	665.85	665.87	665.56

msl = mean sea level
NM = No Measurement
NF = No Flow

Table 2.4-46— {Water Use in the Upper Susquehanna River Basin, Pennsylvania, in 1970}

Type of Use	Withdrawals					
	Groundwater		Surface Water		Total	
	million gpd	lpd	million gpd	lpd	million gpd	lpd
Public Supply	13.1	4.95E+07	99.5	3.76E+08	112.6	4.26E+08
Domestic Supply	8.3	3.14E+07	0.0	0.00E+00	8.3	3.14E+07
Industrial	8.1	3.06E+07	34.0	1.29E+08	42.1	1.59E+08
Mineral	10.3	3.89E+07	5.5	2.08E+07	15.8	5.97E+07
Agricultural	3.6	1.36E+07	2.0	7.56E+06	5.6	2.12E+07
Golf Course	0.2	7.56E+05	1.0	3.78E+06	1.2	4.54E+06
Institutional	0.6	2.27E+06	0.4	1.51E+06	1.0	3.78E+06
Power	0.0	0.00E+00	120.9	4.57E+08	120.9	4.57E+08
Totals	44.2	1.67E+08	263.3	9.95E+08	307.5	1.16E+09

gpd = gallons per day
lpd = liters per day
Reference: Taylor, 1984

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
(Page 1 of 20)

PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
92407	ALBERTSON R	1/1/1966	COLUMBIA	41.09083	-76.25778	115	OPEN HOLE	15		30.00	DOMESTIC
92367	ALBERTSON T	11/17/1982	COLUMBIA	41.08556	-76.25139	122	OPEN HOLE	5	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
14148	ANDREZZI, LEW	3/17/1969	COLUMBIA	41.04472	-76.23139	125	OPEN HOLE	10		0.00	DOMESTIC
14283	BECK, JACK	8/3/1973	COLUMBIA	41.10222	-76.23611	175	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
92309	BERWICK WATER C		COLUMBIA	41.05444	-76.23167	160	OPEN HOLE	500		0.00	PUBLIC SUPPLY
92310	BERWICK WATER C		COLUMBIA	41.05417	-76.23222	90	OPEN HOLE	500		0.00	PUBLIC SUPPLY
92311	BERWICK WATER C		COLUMBIA	41.05389	-76.23278	87	OPEN HOLE	500		0.00	PUBLIC SUPPLY
14287	CARRATHERS MARTIN	9/21/1972	COLUMBIA	41.10306	-76.23000	100	OPEN HOLE	8	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
14288	CARRATHERS WILLIAM	9/18/1972	COLUMBIA	41.10389	-76.23056	105	OPEN HOLE	8	VOLUMETRIC, WATCH & BUCKET	65.00	DOMESTIC
92422	COLLINS E	1/1/1970	COLUMBIA	41.09250	-76.25500	185	OPEN HOLE	10		0.00	DOMESTIC
14272	COLLINS, EUGENE A	2/19/1970	COLUMBIA	41.09722	-76.25333	185	OPEN HOLE	0		114.00	DOMESTIC
92306	CONSOL CIGAR CO		COLUMBIA	41.07833	-76.24111	284		0		0.00	INDUSTRIAL
92307	CONSOL CIGAR CO		COLUMBIA	41.06139	-76.24222	151		0		0.00	INDUSTRIAL
14175	CONSOLIDATED CIGAR CORP	3/12/1957	COLUMBIA	41.06139	-76.24083	284	OPEN HOLE	200	REPORTED, METHOD NOT KNOWN	0.00	AIR CONDITIONING
14176	CONSOLIDATED CIGAR CORP	4/11/1957	COLUMBIA	41.06139	-76.24194	151	OPEN HOLE	0		0.00	UNUSED
260836	Dana	11/18/1998	COLUMBIA	41.05583	-76.20750	54	SCREEN	0		0.00	OTHER
260837	Dana	11/18/1998	COLUMBIA	41.05583	-76.20750	48	SCREEN	0		0.00	OTHER
260838	Dana	11/18/1998	COLUMBIA	41.05583	-76.20750	54	SCREEN	0		0.00	OTHER
260839	Dana	11/18/1998	COLUMBIA	41.05583	-76.20750	42	SCREEN	0		0.00	OTHER
261342	Dana	11/18/1998	COLUMBIA	41.05583	-76.20750	42	SCREEN	0		0.00	OTHER
92423	DENT JACK	1/1/1973	COLUMBIA	41.09250	-76.25500	150	OPEN HOLE	12		0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
(Page 2 of 20)

PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
14281	DENT, JACK W	8/2/1973	COLUMBIA	41.10056	-76.24111	150	OPEN HOLE	12	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
14265	DENT, RICHARD	3/26/1974	COLUMBIA	41.09583	-76.25917	150	OPEN HOLE	6	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
14000	DIBATTISTA JOHN	4/28/1975	COLUMBIA	41.06028	-76.25000	100	OPEN HOLE	10	TOTALING METER	35.92	DOMESTIC
14280	FULTZ, CURTIS	7/18/1972	COLUMBIA	41.10000	-76.23917	175	OPEN HOLE	16	VOLUMETRIC, WATCH & BUCKET	80.00	DOMESTIC
92425	GRASLEY HAROLD	1/1/1972	COLUMBIA	41.09250	-76.25500	150	OPEN HOLE	8		0.00	DOMESTIC
14017	HECKMAN, DREW	8/16/1968	COLUMBIA	41.07667	-76.24333	75	OPEN HOLE	12	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
14292	HESS, KENNETH L	9/12/1973	COLUMBIA	41.10639	-76.25556	100	OPEN HOLE	8	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
14254	HOFFMAN, DRUE C	10/9/1966	COLUMBIA	41.09250	-76.25500	130	OPEN HOLE	7	BAILER	65.00	DOMESTIC
92366	HOLLINGAER H	10/14/1982	COLUMBIA	41.09167	-76.25500	160	OPEN HOLE	30	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
92451	HUNSINGER DON		COLUMBIA	41.07889	-76.23667	100	OPEN HOLE	15	UNKNOWN	0.00	DOMESTIC
92360	KARC M	5/12/1983	COLUMBIA	41.10972	-76.22972	200	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
92389	KEPNER F	6/8/1981	COLUMBIA	41.07167	-76.24500	185	OPEN HOLE	40	ESTIMATED	0.00	DOMESTIC
14267	KERIS, ALEX	7/24/1975	COLUMBIA	41.09611	-76.25833	150	OPEN HOLE	7	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
420681	KEVINTANRIBILIR	6/12/2007	COLUMBIA	41.06910	-76.25692	300	OPEN HOLE	15	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
14165	KEYSTONE WATER CO.	1/1/1957	COLUMBIA	41.05444	-76.23250	87	OPEN HOLE	1300		32.40	PUBLIC SUPPLY
14166	KEYSTONE WATER CO.	6/24/1957	COLUMBIA	41.05444	-76.23278	90	UNKNOWN	1200		30.50	PUBLIC SUPPLY
14167	KEYSTONE WATER CO.	3/29/1957	COLUMBIA	41.05500	-76.23278	160	OPEN HOLE	1300		31.90	PUBLIC SUPPLY
14019	KISHBAUGH	10/14/1975	COLUMBIA	41.07750	-76.24750	100	OPEN HOLE	0		44.10	DOMESTIC
14018	KISHBAUGH, RANDALL C	11/1/1978	COLUMBIA	41.07694	-76.24722	150	OPEN HOLE	0		31.10	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
92427	KISLY WALTER	1/1/1974	COLUMBIA	41.09250	-76.25500	150	OPEN HOLE	6		0.00	DOMESTIC
92444	KISLY WALTER	1/1/1974	COLUMBIA	41.08833	-76.25694	175	OPEN HOLE	10	UNKNOWN	0.00	DOMESTIC
92359	KLINESMITH D	11/23/1983	COLUMBIA	41.09583	-76.25750	177	OPEN HOLE	8	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
92385	KLINGER L	8/19/1983	COLUMBIA	41.06250	-76.25389	160	OPEN HOLE	9	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
92379	KOWALCHICK S	9/25/1980	COLUMBIA	41.07000	-76.25472	150	OPEN HOLE	0	ESTIMATED	0.00	DOMESTIC
14261	KREISCHER, GARY	2/12/1977	COLUMBIA	41.09389	-76.25056	100	OPEN HOLE	8	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
14258	KREISCHER, WILLIAM	2/12/1977	COLUMBIA	41.09361	-76.25139	100	OPEN HOLE	6	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
14011	MAGRONE, JOHN	1/1/1981	COLUMBIA	41.06806	-76.25667	30	WALLED	0		23.10	UNUSED
14012	MAGRONE, JOHN	9/25/1979	COLUMBIA	41.06806	-76.25667	67	OPEN HOLE	0		28.30	DOMESTIC
92353	MILLER P	11/6/1984	COLUMBIA	41.10250	-76.22972	275	OPEN HOLE	6	BAILER	0.00	DOMESTIC
13982	PENNDOT	1/1/1977	COLUMBIA	41.05167	-76.23111	0		0		0.00	UNUSED
13983	PENNDOT	1/1/1977	COLUMBIA	41.05167	-76.23111	0		0		0.00	UNUSED
13984	PENNDOT	1/1/1977	COLUMBIA	41.05194	-76.23139	0	UNKNOWN	0		0.00	UNUSED
13985	PENNDOT	1/1/1977	COLUMBIA	41.05222	-76.23167	0	UNKNOWN	0		0.00	UNUSED
13986	PENNDOT	1/1/1977	COLUMBIA	41.05222	-76.23167	0	UNKNOWN	0		0.00	UNUSED
13988	PENNDOT	1/1/1977	COLUMBIA	41.05250	-76.23194	0	UNKNOWN	0		0.00	UNUSED
13989	PENNDOT	1/1/1977	COLUMBIA	41.05278	-76.23222	0	UNKNOWN	0		0.00	UNUSED
13990	PENNDOT	1/1/1977	COLUMBIA	41.05333	-76.23278	0	UNKNOWN	0		0.00	UNUSED
13991	PENNDOT	1/1/1977	COLUMBIA	41.05361	-76.23278	0	UNKNOWN	0		0.00	UNUSED
13992	PENNDOT	1/1/1977	COLUMBIA	41.05389	-76.23306	0	UNKNOWN	0		0.00	UNUSED
13993	PENNDOT	1/1/1977	COLUMBIA	41.05417	-76.23333	0	UNKNOWN	0		0.00	UNUSED
13994	PENNDOT	1/1/1977	COLUMBIA	41.05417	-76.23333	0	UNKNOWN	0		0.00	UNUSED
14264	PERSANS, EDMUND C	7/19/1974	COLUMBIA	41.09583	-76.25833	175	OPEN HOLE	10	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
92355	RABER T	6/28/1985	COLUMBIA	41.10083	-76.23111	225	OPEN HOLE	6	ESTIMATED	0.00	DOMESTIC
14235	RICHARDS, REBA		COLUMBIA	41.08667	-76.22889	0		0		0.00	DOMESTIC
92365	ROBBINS W	9/29/1982	COLUMBIA	41.09194	-76.25944	200	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
14248	ROTHERY	5/29/1974	COLUMBIA	41.09111	-76.25806	100	OPEN HOLE	8	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
14270	SHULTZ, EDWARD A	5/6/1976	COLUMBIA	41.09639	-76.25722	175	OPEN HOLE	6	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
92424	SITLER ALLEN	1/1/1974	COLUMBIA	41.09250	-76.25500	175	OPEN HOLE	12		0.00	DOMESTIC
92421	SMITH JACK	1/1/1969	COLUMBIA	41.09250	-76.25500	135	OPEN HOLE	8		0.00	DOMESTIC
92361	VANDERMARK R	5/12/1983	COLUMBIA	41.08111	-76.23722	175	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
92453	VENCLOSKI DAVID		COLUMBIA	41.11806	-76.23694	200	OPEN HOLE	9		0.00	DOMESTIC
92452	VENCLOSKI JOSPH		COLUMBIA	41.11944	-76.23750	100	OPEN HOLE	10		0.00	DOMESTIC
92409	WALTMAN H J	1/1/1966	COLUMBIA	41.08528	-76.25750	130	OPEN HOLE	7	UNKNOWN	65.00	DOMESTIC
92406	WHITMYER VERNON	1/1/1967	COLUMBIA	41.09444	-76.25500	150	OPEN HOLE	6		0.00	DOMESTIC
92398	WOLFINGER	1/1/1967	COLUMBIA	41.09972	-76.24444	120	OPEN HOLE	6	UNKNOWN	30.00	DOMESTIC
92382	YALCH A	7/25/1980	COLUMBIA	41.10111	-76.25417	150	OPEN HOLE	7	ESTIMATED	0.00	DOMESTIC
14121	YODER, RICHARD L	11/22/1974	COLUMBIA	41.03389	-76.22972	100	OPEN HOLE	6	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
92426		1/1/1969	COLUMBIA	41.09250	-76.25500	150	OPEN HOLE	8		0.00	DOMESTIC
182729	BEACH HAVEN FIR	1/1/1973	LANCASTER	41.06806	-76.16167	100	OPEN HOLE	12	UNKNOWN	40.00	
182732	BRADER HERB	1/1/1972	LANCASTER	41.08944	-76.18056	100	OPEN HOLE	12	UNKNOWN	0.00	DOMESTIC
182730	MOLYNEAUX SHLDN	1/1/1974	LANCASTER	41.06917	-76.16639	50	OPEN HOLE	15	UNKNOWN	0.00	DOMESTIC
182731	VARNER ARTHUR	1/1/1974	LANCASTER	41.08583	-76.19250	125	OPEN HOLE	7	UNKNOWN	0.00	DOMESTIC
128988	ADAMS A	5/1/1988	LUZERNE	41.04417	-76.18389	360	OPEN HOLE	15	BAILER	85.00	DOMESTIC
25327	ADAMS, MARK	3/27/1974	LUZERNE	41.03361	-76.18028	230	OPEN HOLE	18	VOLUMETRIC, WATCH & BUCKET	30.00	DOMESTIC
128823	ARNER GENNY	9/1/1987	LUZERNE	41.07361	-76.10111	300	OPEN HOLE	4	ESTIMATED	0.00	DOMESTIC
25333	ATEN, TOM	7/17/1974	LUZERNE	41.03611	-76.17472	125	OPEN HOLE	8	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128995	AUDIMATION	4/1/1988	LUZERNE	41.05278	-76.16556	240	OPEN HOLE	20		60.00	INDUSTRIAL

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
25486	B. GENSEL	6/1/1977	LUZERNE	41.13083	-76.22778	175	OPEN HOLE	6	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
128820	BADMAN RON	7/17/1974	LUZERNE	41.06611	-76.10222	510		1	ESTIMATED	0.00	DOMESTIC
129225	BAER RUSSEL		LUZERNE	41.10472	-76.15611	125	OPEN HOLE	10	UNKNOWN	0.00	DOMESTIC
25474	BAER, RUSSEL	7/8/1975	LUZERNE	41.11306	-76.16361	125	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129140	BAKER W	11/25/1981	LUZERNE	41.08056	-76.18861	325	OPEN HOLE	5	ESTIMATED	0.00	DOMESTIC
25516	BALSHAMER,JAKE	10/7/1930	LUZERNE	41.15889	-76.15611	47	OPEN END	0		7.00	DOMESTIC
129149	BANKES R	1/5/1984	LUZERNE	41.15000	-76.16278	150	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129190	BCH HVN FIRE CO		LUZERNE	41.06806	-76.16167	100	OPEN HOLE	12	UNKNOWN	40.00	DOMESTIC
129187	BEACH HAV COM	1/1/1968	LUZERNE	41.06722	-76.16972	51	OPEN HOLE	40	UNKNOWN	12.00	DOMESTIC
25377	BEACH HAVEN COMMTY. BD	10/21/1968	LUZERNE	41.06722	-76.17167	51	OPEN HOLE	40		12.00	DOMESTIC
25380	BEACH HAVEN FIRE	4/13/1973	LUZERNE	41.06806	-76.16167	100	OPEN HOLE	12	REPORTED, METHOD NOT KNOWN	40.00	COMMERCIAL
129152	BECHTOLD S	6/22/1987	LUZERNE	41.08000	-76.15861	150	OPEN HOLE	40	ESTIMATED	0.00	DOMESTIC
128838	BECK	7/1/1984	LUZERNE	41.08944	-76.09250	345	OPEN HOLE	3	VOLUMETRIC, WATCH & BUCKET	30.00	DOMESTIC
128352	BECK P	9/1/1983	LUZERNE	41.12833	-76.12639	175	OPEN HOLE	15	VOLUMETRIC, WATCH & BUCKET	20.00	DOMESTIC
129027	BENJAMIN ORVILL		LUZERNE	41.04278	-76.19833	125	OPEN HOLE	0	UNKNOWN	0.00	DOMESTIC
25344	BENJAMIN, ORVILLE	7/2/1974	LUZERNE	41.04361	-76.19861	125	OPEN HOLE	0		20.00	DOMESTIC
129141	BENSCOTER L	5/18/1982	LUZERNE	41.07444	-76.15167	128	OPEN HOLE	12	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
250899	BIG B DRIVE IN		LUZERNE	41.06560	-76.19720	100		0		0.00	COMMERCIAL
128975	BLACKBURN ED	8/1/1978	LUZERNE	41.03667	-76.17611	300	OPEN HOLE	20	VOLUMETRIC, WATCH & BUCKET	40.00	DOMESTIC
129223	BLOOM FRANK		LUZERNE	41.11250	-76.19056	150	OPEN HOLE	8	UNKNOWN	0.00	DOMESTIC
25475	BLOOM, FRANK	10/19/1976	LUZERNE	41.11306	-76.18889	150	OPEN HOLE	8	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
25778	BLUE COAL CO	1/1/1966	LUZERNE	41.14500	-76.14083	170	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	57.00	UNUSED
25779	BLUE COAL CO	1/1/1967	LUZERNE	41.14639	-76.12611	305	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	155.00	UNUSED
25780	BLUE COAL CO	1/1/1967	LUZERNE	41.14639	-76.12611	315	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	152.00	UNUSED
25781	BLUE COAL CO	1/1/1966	LUZERNE	41.14778	-76.11472	80	OPEN HOLE	10		1.00	UNUSED
25782	BLUE COAL CO	1/1/1967	LUZERNE	41.14944	-76.11750	115	OPEN HOLE	12	PITOT-TUBE METER	60.00	UNUSED
25783	BLUE COAL CO	1/1/1967	LUZERNE	41.15028	-76.14444	55	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	22.00	UNUSED
25786	BLUE COAL CO	1/1/1967	LUZERNE	41.15194	-76.13278	485	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	185.00	UNUSED
128987	BOENICH J	5/1/1988	LUZERNE	41.04306	-76.14028	200	OPEN HOLE	15	ESTIMATED	40.00	DOMESTIC
129209	BOGART LARUE		LUZERNE	41.09083	-76.20333	125	OPEN HOLE	7	UNKNOWN	0.00	DOMESTIC
25428	BOGART, LARUE	10/25/1976	LUZERNE	41.09250	-76.20667	125	OPEN HOLE	7	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
25424	BOGNAR, RICHARD	6/1/1976	LUZERNE	41.09056	-76.20222	200	OPEN HOLE	25	REPORTED, METHOD NOT KNOWN	60.00	DOMESTIC
25413	BOMBUSHIME HARRY	6/22/1973	LUZERNE	41.08583	-76.22333	300	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129210	BOONER RICHARD		LUZERNE	41.09056	-76.20222	200	OPEN HOLE	25	UNKNOWN	60.00	DOMESTIC
25774	BOSTON, ROBERT	9/20/1973	LUZERNE	41.11861	-76.16611	175	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128996	BOWER K	11/7/1986	LUZERNE	41.05361	-76.17056	420	OPEN HOLE	1	ESTIMATED	0.00	DOMESTIC
129196	BRADER HERB		LUZERNE	41.08944	-76.18056	100	OPEN HOLE	12	UNKNOWN	0.00	DOMESTIC
25768	BRADER, HERB	7/5/1972	LUZERNE	41.08944	-76.18056	100	OPEN HOLE	0		34.70	DOMESTIC
25378	BREISCH CONKLIN	11/22/1976	LUZERNE	41.06750	-76.10361	150	OPEN HOLE	10	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
128993	BREMMER M	6/1/1987	LUZERNE	41.04167	-76.13333	398	OPEN HOLE	1	ESTIMATED	0.00	DOMESTIC
128827	BUCK	12/1/1987	LUZERNE	41.08111	-76.08167	375	OPEN HOLE	2	ESTIMATED	0.00	DOMESTIC
129157	BUCK J	8/15/1986	LUZERNE	41.07722	-76.20694	125	OPEN HOLE	15		0.00	DOMESTIC
129098	BULFORD	12/1/1988	LUZERNE	41.14444	-76.19694	330	OPEN HOLE	4	ESTIMATED	25.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
129189	BURKE RUSSEL		LUZERNE	41.06972	-76.16417	100	OPEN HOLE	8	UNKNOWN	0.00	DOMESTIC
25384	BURKE, RUSSEL	8/8/1973	LUZERNE	41.06972	-76.16361	100	OPEN HOLE	8	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
250937	BUTCH'S ONE STOP		LUZERNE	41.06810	-76.16220	140	OPEN HOLE	0		0.00	COMMERCIAL
25314	CALLAHAN	4/9/1974	LUZERNE	41.02611	-76.18361	300	OPEN HOLE	0		160.00	DOMESTIC
128833	CHAPIN C	11/1/1985	LUZERNE	41.05139	-76.10639	248	OPEN HOLE	30	ESTIMATED	0.00	DOMESTIC
129028	CHAPIN CURTIS		LUZERNE	41.04583	-76.12056	140	OPEN HOLE	30	UNKNOWN	0.00	DOMESTIC
25484	CISCO,MR.		LUZERNE	41.12639	-76.14417	145	OPEN HOLE	25		25.00	DOMESTIC
250854	CITIZENS WATER CO.		LUZERNE	41.07970	-76.11860	375		50	REPORTED, METHOD NOT KNOWN	40.00	PUBLIC SUPPLY
250942	COUNCIL CUP CAMPGROUND		LUZERNE	41.09970	-76.10500	480		10	REPORTED, METHOD NOT KNOWN	0.00	PUBLIC SUPPLY
250847	COUNTRY ESTATES M H COURT		LUZERNE	41.11110	-76.15420	235	OPEN HOLE	20	REPORTED, METHOD NOT KNOWN	54.00	PUBLIC SUPPLY
129211	COWIE ROBERT		LUZERNE	41.09556	-76.19139	615	OPEN HOLE	2	UNKNOWN	375.00	DOMESTIC
129148	CRANE L	10/25/1984	LUZERNE	41.14000	-76.20333	200	OPEN HOLE	4	BAILER	0.00	DOMESTIC
129155	CRANE N	9/26/1986	LUZERNE	41.08556	-76.15306	400	OPEN HOLE	2	ESTIMATED	0.00	DOMESTIC
25481	CRISBELL, WILLIAM	11/22/1972	LUZERNE	41.12278	-76.16778	110	OPEN HOLE	0		35.00	UNUSED
25407	D. SULT	8/1/1980	LUZERNE	41.08278	-76.10889	200	OPEN HOLE	0		150.00	DOMESTIC
129136	DAGOSTINE W	10/11/1982	LUZERNE	41.07278	-76.21194	550	OPEN HOLE	12	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129144	DAGOSTINE W	8/10/1982	LUZERNE	41.08000	-76.19667	350	OPEN HOLE	3	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128831	DAILEY K	7/1/1986	LUZERNE	41.04722	-76.09639	320	OPEN HOLE	15	ESTIMATED	0.00	DOMESTIC
129220	DALBERTO NICK		LUZERNE	41.10694	-76.17444	150	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
25466	DALBERTO, NICK	8/12/1976	LUZERNE	41.10694	-76.18278	150	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	UNUSED
129185	DAVENPORT WM	1/1/1968	LUZERNE	41.06722	-76.17639	66		4	UNKNOWN	14.00	DOMESTIC
25379	DAVENPORT, WELLINGTON		LUZERNE	41.06750	-76.17778	0		0		11.50	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}

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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
129166	DAVIS J	4/28/1983	LUZERNE	41.09083	-76.22333	275	OPEN HOLE	7	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129191	DAVIS WILLIAM		LUZERNE	41.06750	-76.16389	100	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
25759	DAVIS, WILLIAM	7/9/1973	LUZERNE	41.06694	-76.16556	100	OPEN HOLE	0		7.16	DOMESTIC
25381	DAVIS,B.S.	1/1/1930	LUZERNE	41.06889	-76.17500	102	OPEN HOLE	9		14.00	DOMESTIC
129018	DEISCHAINE RLND		LUZERNE	41.03944	-76.13778	275	OPEN HOLE	20	UNKNOWN	0.00	DOMESTIC
25339	DEISCHAINE ROLAND	5/1/1974	LUZERNE	41.03917	-76.13750	275	OPEN HOLE	20	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128978	DEISEHAINE B	4/1/1978	LUZERNE	41.03917	-76.13722	100	OPEN HOLE	8	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128979	DEISEHAINE B	4/1/1978	LUZERNE	41.03778	-76.13750	150	OPEN HOLE	6	ESTIMATED	0.00	DOMESTIC
129151	DELLEGROTTI P	4/13/1987	LUZERNE	41.07056	-76.22778	150	OPEN HOLE	15	ESTIMATED	0.00	DOMESTIC
129213	DENN THOMAS		LUZERNE	41.08333	-76.18556	125	OPEN HOLE	10	UNKNOWN	0.00	DOMESTIC
128839	DENNIS R		LUZERNE	41.08083	-76.10528	300	OPEN HOLE	3	VOLUMETRIC, WATCH & BUCKET	30.00	DOMESTIC
129153	DESCHAINE B	9/16/1987	LUZERNE	41.09139	-76.21528	450	OPEN HOLE	4	ESTIMATED	0.00	DOMESTIC
129154	DESCHAINE B	9/15/1987	LUZERNE	41.09083	-76.21472	450	OPEN HOLE	3	ESTIMATED	0.00	DOMESTIC
25390	DIAUGSTINE NEBBIE	10/14/1974	LUZERNE	41.07167	-76.19667	275	OPEN HOLE	4	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
129198	DIAUGSTINE V		LUZERNE	41.07167	-76.19667	275	OPEN HOLE	4	UNKNOWN	0.00	DOMESTIC
129192	DOLLMAIV WM		LUZERNE	41.06583	-76.16000	150	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
128969	DOUTHAT J	3/2/1983	LUZERNE	41.05194	-76.20500	200	OPEN HOLE	0	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128972	DRIBELLIS W	5/3/1982	LUZERNE	41.04167	-76.19889	225	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128349	DUSKOSKY	12/1/1987	LUZERNE	41.11750	-76.11194	250	OPEN HOLE	6	ESTIMATED	0.00	DOMESTIC
129156	EDWARDS B	7/18/1984	LUZERNE	41.07722	-76.22389	175	OPEN HOLE	6	ESTIMATED	0.00	DOMESTIC
250959	ENERGY INFORMATION CENTER		LUZERNE	41.10190	-76.12080	100	OPEN END	15	REPORTED, METHOD NOT KNOWN	0.00	COMMERCIAL
128970	EROH G	11/1/1982	LUZERNE	41.05278	-76.16389	300	OPEN HOLE	5	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
129221	FATUMA ROMAN		LUZERNE	41.10778	-76.17417	125	OPEN HOLE	8	UNKNOWN	45.00	DOMESTIC
129147	FEDORCO M	8/31/1983	LUZERNE	41.08278	-76.18611	340	OPEN HOLE	1	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129206	FEISSNOR LARRY		LUZERNE	41.08028	-76.22639	175	OPEN HOLE	10	UNKNOWN	100.00	DOMESTIC
25402	FEISSNOR, LARRY	3/9/1973	LUZERNE	41.07972	-76.22611	175	OPEN HOLE	10	REPORTED, METHOD NOT KNOWN	100.00	DOMESTIC
25758	FELIX, RUDY		LUZERNE	41.06222	-76.15639	471	UNKNOWN	0		22.80	DOMESTIC
129020	FILMORE MARTIN		LUZERNE	41.03361	-76.17306	175	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
129365	FOAMANOWSKI S	3/1/1988	LUZERNE	41.10917	-76.13194	300	OPEN HOLE	15	ESTIMATED	45.00	DOMESTIC
25398	FOX, CLARENCE		LUZERNE	41.07611	-76.13500	55	UNKNOWN	0		0.00	DOMESTIC
25480	FRANK BUTZ	3/30/1979	LUZERNE	41.12250	-76.12000	200	OPEN HOLE	30	REPORTED, METHOD NOT KNOWN	30.00	DOMESTIC
128830	FRASSO J	7/1/1986	LUZERNE	41.09972	-76.08306	180	OPEN HOLE	20	ESTIMATED	25.00	DOMESTIC
129184	FULLER MAURICE	1/1/1968	LUZERNE	41.06944	-76.16750	80	OPEN HOLE	32	UNKNOWN	12.00	DOMESTIC
129178	GARRISON IRVIN	1/1/1966	LUZERNE	41.13917	-76.20528	135	OPEN HOLE	30	UNKNOWN	50.00	DOMESTIC
25409	GOLOMB, DEBRA	4/25/1970	LUZERNE	41.08333	-76.18556	125	OPEN HOLE	0		8.75	DOMESTIC
250952	GOOD TIME GOLF		LUZERNE	41.04780	-76.15030	340	OPEN HOLE	8	REPORTED, METHOD NOT KNOWN	220.00	COMMERCIAL
25393	GRIFFIN, GEORGE	1/1/1957	LUZERNE	41.07278	-76.15167	98	UNKNOWN	0		63.00	DOMESTIC
129227	GRISBELL WM		LUZERNE	41.12278	-76.16778	110	OPEN HOLE	10	UNKNOWN	0.00	DOMESTIC
25410	GROBER,A.		LUZERNE	41.08389	-76.10944	142	OPEN HOLE	7		65.00	DOMESTIC
129228	GROOVER	6/1/1988	LUZERNE	41.15361	-76.15500	100	OPEN HOLE	40	ESTIMATED	20.00	DOMESTIC
129182	GUNTHER BART	1/1/1967	LUZERNE	41.10694	-76.21556	215	OPEN HOLE	4	UNKNOWN	80.00	DOMESTIC
25465	GUNTHER, BART	9/9/1967	LUZERNE	41.10667	-76.21556	215	OPEN HOLE	3	VOLUMETRIC, WATCH & BUCKET	80.00	DOMESTIC
129197	GUYER ANTHONY		LUZERNE	41.08500	-76.17333	125	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
251149	H&W OIL CO DBA MOTOR-VU DRIVE		LUZERNE	41.04417	-76.13944	0		0		0.00	COMMERCIAL
418914	HAROLDKLEINSMITH	10/25/2006	LUZERNE	41.14197	-76.21738	450	OPEN HOLE	12	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129164	HART K	10/3/1983	LUZERNE	41.06861	-76.19611	200	OPEN HOLE	5		0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
129181	HAUGH HAROLD W	1/1/1967	LUZERNE	41.07250	-76.19583	193	OPEN HOLE	2	UNKNOWN	75.00	DOMESTIC
129024	HAWK GEORGE		LUZERNE	41.03333	-76.18000	230	OPEN HOLE	18	UNKNOWN	30.00	DOMESTIC
128345	HERRING DOROTHY	7/24/1978	LUZERNE	41.13083	-76.10417	250		0	ESTIMATED	20.00	DOMESTIC
25453	HESS,RALPH	1/1/1950	LUZERNE	41.10083	-76.09806	397	UNKNOWN	0		0.00	UNUSED
250921	HESS'S COUNTRY CONE		LUZERNE	41.09500	-76.11440	100		0		0.00	COMMERCIAL
129208	HILLS COMPANY		LUZERNE	41.08694	-76.22056	250	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
129226	HIXON WILLIAM		LUZERNE	41.11778	-76.16611	175	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
129224	HOLLOWAY THOMAS		LUZERNE	41.11306	-76.18361	125	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
25473	HOLLOWAY, THOMAS	10/3/1974	LUZERNE	41.11278	-76.18250	125	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129216	HONSE GEORGE		LUZERNE	41.10444	-76.17750	150	OPEN HOLE	5	UNKNOWN	0.00	DOMESTIC
129137	HONSE JOE	8/9/1978	LUZERNE	41.10111	-76.17056	100		8	ESTIMATED	0.00	DOMESTIC
25461	HONSE, GEORGE	12/26/1975	LUZERNE	41.10500	-76.17639	150	OPEN HOLE	5	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128973	HOPPY B	7/2/1981	LUZERNE	41.03417	-76.16722	225	OPEN HOLE	8	ESTIMATED	0.00	DOMESTIC
129022	HOUCH HAROLD		LUZERNE	41.03333	-76.17222	140	OPEN HOLE	15	UNKNOWN	0.00	DOMESTIC
129005	HOUGH H	8/30/1984	LUZERNE	41.02472	-76.20667	150	OPEN HOLE	15	ESTIMATED	0.00	DOMESTIC
25463	HUMMEL, FRED	5/7/1976	LUZERNE	41.10667	-76.13806	90	UNKNOWN	10	REPORTED, METHOD NOT KNOWN	0.00	PUBLIC SUPPLY
25493	J. ROBINSON	4/1/1979	LUZERNE	41.14000	-76.21500	200	OPEN HOLE	8	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
129146	JOHNSON B	1/28/1988	LUZERNE	41.10111	-76.22833	150	OPEN HOLE	10	ESTIMATED	0.00	DOMESTIC
129138	JOHNSON R	5/14/1982	LUZERNE	41.11222	-76.16417	200	OPEN HOLE	5	ESTIMATED	0.00	DOMESTIC
129019	JUMPER HARRY		LUZERNE	41.03472	-76.17444	125	OPEN HOLE	8	UNKNOWN	0.00	DOMESTIC
129212	KARCHNER GERALD		LUZERNE	41.08639	-76.19083	130	OPEN HOLE	10	UNKNOWN	25.00	DOMESTIC
25416	KARCHNER, GERALD	11/9/1967	LUZERNE	41.08639	-76.19139	130	OPEN HOLE	10	ESTIMATED	25.00	DOMESTIC
129162	KECK R	10/21/1985	LUZERNE	41.09389	-76.21694	500	OPEN HOLE	3	ESTIMATED	0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
129202	KELLER EARL		LUZERNE	41.10444	-76.21167	125	OPEN HOLE	8	UNKNOWN	0.00	DOMESTIC
25470	KELLER, EARL	6/26/1973	LUZERNE	41.10361	-76.21167	125	OPEN HOLE	8		0.00	DOMESTIC
129167	KEMMER C	8/23/1983	LUZERNE	41.07111	-76.19806	350	OPEN HOLE	4	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
25418	KENNEDY, MICHAEL	7/5/1974	LUZERNE	41.08694	-76.22278	250	OPEN HOLE	7	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129200	KESSLER HAROLD		LUZERNE	41.08972	-76.22361	300	OPEN HOLE	5	UNKNOWN	0.00	DOMESTIC
129007	KESSLER J	7/1/1983	LUZERNE	41.04333	-76.20528	225		9		0.00	
25423	KESSLER, HAROLD	9/14/1973	LUZERNE	41.09028	-76.22333	300	OPEN HOLE	5	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
25385	KILLIAN, GENE	3/30/1967	LUZERNE	41.06972	-76.16750	100	OPEN HOLE	20	BAILER	8.22	DOMESTIC
129017	KLINE LARRY		LUZERNE	41.04944	-76.16528	140	OPEN HOLE	0		0.00	DOMESTIC
25354	KLINE, LARRY	2/19/1974	LUZERNE	41.04944	-76.16556	140	OPEN HOLE	0		0.00	DOMESTIC
25388	KMETOVICZ, GENE	12/9/1967	LUZERNE	41.07056	-76.17611	85	OPEN HOLE	0		22.00	DOMESTIC
129180	KNORR SAMUEL	1/1/1967	LUZERNE	41.08667	-76.19278	117	OPEN HOLE	8	UNKNOWN	20.00	DOMESTIC
25420	KNORR, SAMUEL	6/18/1967	LUZERNE	41.08861	-76.18750	117	OPEN HOLE	0		32.80	DOMESTIC
129214	KOONS ROBERT		LUZERNE	41.07778	-76.18667	125	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
129215	KOONS ROBERT		LUZERNE	41.07750	-76.18556	125	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
129158	KRAMER B	5/29/1986	LUZERNE	41.07361	-76.17889	300	OPEN HOLE	1	ESTIMATED	0.00	DOMESTIC
129217	KRISANDA JOHN		LUZERNE	41.10139	-76.17139	100	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
25455	KRISANDA, JOHN	7/8/1975	LUZERNE	41.10111	-76.17167	100	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129159	KYTTLE O	5/1/1985	LUZERNE	41.11111	-76.19306	200	OPEN HOLE	4	ESTIMATED	0.00	DOMESTIC
128821	LASKOSKY FRANCIS	2/16/1976	LUZERNE	41.05083	-76.08778	140		20	ESTIMATED	30.00	DOMESTIC
129161	LAUBACH B	7/16/1985	LUZERNE	41.10889	-76.21167	225	OPEN HOLE	5	ESTIMATED	0.00	DOMESTIC
128834	LEWIS I	11/1/1984	LUZERNE	41.08556	-76.08833	225	OPEN HOLE	20		20.00	DOMESTIC
128344	LEWIS R	8/1/1977	LUZERNE	41.12889	-76.09083	345	OPEN HOLE	3	VOLUMETRIC, WATCH & BUCKET	50.00	DOMESTIC
128982	LLOYD BILL	4/1/1989	LUZERNE	41.04444	-76.14639	275	OPEN HOLE	7	ESTIMATED	35.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}

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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
129165	LUCIW T	10/10/1984	LUZERNE	41.10694	-76.18611	150		7	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128985	LUNDY CONSTRUCTION	11/23/1988	LUZERNE	41.04944	-76.15778	200	OPEN HOLE	20	ESTIMATED	0.00	DOMESTIC
129150	LUNDY CONSTRUCTION	3/10/1987	LUZERNE	41.06806	-76.16417	325	OPEN HOLE	110	ESTIMATED	0.00	DOMESTIC
128983	LYNN J	4/1/1989	LUZERNE	41.04444	-76.18667	200	OPEN HOLE	25	ESTIMATED	30.00	DOMESTIC
25401	M. PETERS	1/1/1981	LUZERNE	41.07889	-76.09111	250	OPEN HOLE	10	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
128357	MACANAQUA WATER	1/1/1967	LUZERNE	41.14194	-76.13167	307	OPEN HOLE	75	UNKNOWN	15.00	PUBLIC SUPPLY
128990	MADISH M	9/25/1987	LUZERNE	41.03250	-76.21861	340	OPEN HOLE	3	ESTIMATED	0.00	DOMESTIC
128981	MARGARM HOWARD	4/1/1989	LUZERNE	41.04333	-76.18389	360	OPEN HOLE	15	ESTIMATED	70.00	DOMESTIC
25397	MARKOVICH,M.J.	9/3/1930	LUZERNE	41.07444	-76.14861	100	OPEN HOLE	0		30.00	DOMESTIC
129160	MASON JR. R	8/23/1985	LUZERNE	41.07778	-76.22361	250	OPEN HOLE	5	ESTIMATED	0.00	DOMESTIC
128971	MATASH A	7/28/1982	LUZERNE	41.04333	-76.20306	450	OPEN HOLE	4	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
25417	MCCOY, DONALD	7/4/1974	LUZERNE	41.08667	-76.22444	250	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128998	MCCREARY J	6/1/1985	LUZERNE	41.04111	-76.14889	275	OPEN HOLE	5	ESTIMATED	0.00	DOMESTIC
418813	MICHAELROINICK	11/13/2006	LUZERNE	41.03265	-76.14770	300	OPEN HOLE	5	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128991	MILLER G	8/13/1987	LUZERNE	41.04083	-76.19028	300	OPEN HOLE	1	ESTIMATED	0.00	DOMESTIC
25411	MINGLE INN		LUZERNE	41.08417	-76.13972	150	UNKNOWN	0		0.00	COMMERCIAL
25389	MOLNOR, STEVE	9/24/1976	LUZERNE	41.07139	-76.16778	150	OPEN HOLE	6	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
129194	MOLYNEAUX SHLDN		LUZERNE	41.06917	-76.16639	50	OPEN HOLE	15	UNKNOWN	0.00	DOMESTIC
25383	MOLYNEAUX, SHELDON	10/4/1974	LUZERNE	41.06917	-76.16694	50	OPEN HOLE	0		2.46	DOMESTIC
25419	MONT, MICHAIL	10/23/1972	LUZERNE	41.08722	-76.13917	100	OPEN HOLE	0		5.28	DOMESTIC
129199	MORGAN PIERCE		LUZERNE	41.06722	-76.21750	125	OPEN HOLE	8	UNKNOWN	65.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
129203	NAUNCZEK BENNIE		LUZERNE	41.07972	-76.22528	100	OPEN HOLE	12	UNKNOWN	30.00	DOMESTIC
129204	NAUNCZEK BENNIE		LUZERNE	41.07417	-76.22750	100	OPEN HOLE	10	UNKNOWN	0.00	DOMESTIC
129205	NAUNCZEK BENNIE		LUZERNE	41.07417	-76.22611	125	OPEN HOLE	15	UNKNOWN	0.00	DOMESTIC
25395	NAUNCZEK, BENNIE	5/2/1977	LUZERNE	41.07389	-76.22611	125	OPEN HOLE	0		26.00	DOMESTIC
25396	NAUNCZEK, BENNIE	3/16/1976	LUZERNE	41.07389	-76.22750	100	OPEN HOLE	0		14.90	COMMERCIAL
25403	NAUNCZEK, BENNIE	8/19/1971	LUZERNE	41.08000	-76.22472	100	OPEN HOLE	12	REPORTED, METHOD NOT KNOWN	30.00	DOMESTIC
129174	PA POWER &LIGHT	1/1/1973	LUZERNE	41.09250	-76.13167	81	SCREEN	500		8.00	INDUSTRIAL
129175	PA POWER &LIGHT	1/1/1973	LUZERNE	41.09250	-76.13167	96	PERFORATED OR SLOTTED	0		0.00	
129176	PA POWER &LIGHT	1/1/1973	LUZERNE	41.09806	-76.13167	54	PERFORATED OR SLOTTED	0		0.00	
25422	PA. POWER AND LIGHT	10/16/1970	LUZERNE	41.09028	-76.14444	0	OPEN HOLE	0		5.40	UNUSED
25425	PA. POWER AND LIGHT	12/14/1970	LUZERNE	41.09083	-76.14472	0	OPEN HOLE	0		21.00	UNUSED
25426	PA. POWER AND LIGHT	9/29/1970	LUZERNE	41.09194	-76.14417	0	OPEN HOLE	0		17.00	UNUSED
25427	PA. POWER AND LIGHT	11/18/1970	LUZERNE	41.09194	-76.14778	0	OPEN HOLE	0		6.75	UNUSED
25429	PA. POWER AND LIGHT	8/1/1972	LUZERNE	41.09278	-76.13306	55	UNKNOWN	0		0.00	UNUSED
25430	PA. POWER AND LIGHT	10/20/1970	LUZERNE	41.09278	-76.14361	0	OPEN HOLE	0		27.10	UNUSED
25431	PA. POWER AND LIGHT	11/16/1970	LUZERNE	41.09278	-76.14472	0	OPEN HOLE	0		26.10	UNUSED
25432	PA. POWER AND LIGHT	11/20/1970	LUZERNE	41.09278	-76.14778	0	OPEN HOLE	0		34.10	UNUSED

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
25433	PA. POWER AND LIGHT	8/1/1972	LUZERNE	41.09361	-76.13444	23	UNKNOWN	0		0.00	UNUSED
25434	PA. POWER AND LIGHT	11/18/1970	LUZERNE	41.09389	-76.14417	0	OPEN HOLE	0		28.00	UNUSED
25436	PA. POWER AND LIGHT	8/1/1972	LUZERNE	41.09417	-76.13250	75	UNKNOWN	9		24.50	INDUSTRIAL
25437	PA. POWER AND LIGHT	10/6/1970	LUZERNE	41.09417	-76.14333	0	OPEN HOLE	0		31.70	UNUSED
25438	PA. POWER AND LIGHT	10/8/1970	LUZERNE	41.09417	-76.14778	0	OPEN HOLE	0		18.00	UNUSED
25439	PA. POWER AND LIGHT	10/6/1970	LUZERNE	41.09500	-76.14500	0	OPEN HOLE	0		29.70	UNUSED
25440	PA. POWER AND LIGHT	10/14/1970	LUZERNE	41.09528	-76.14361	0	OPEN HOLE	0		14.80	OTHER
25441	PA. POWER AND LIGHT	10/9/1970	LUZERNE	41.09528	-76.14472	0	OPEN HOLE	0		62.30	UNUSED
25442	PA. POWER AND LIGHT	11/9/1970	LUZERNE	41.09556	-76.14472	0	OPEN HOLE	0		35.70	UNUSED
25443	PA. POWER AND LIGHT	10/29/1970	LUZERNE	41.09556	-76.14667	0	OPEN HOLE	0		65.20	UNUSED
25444	PA. POWER AND LIGHT		LUZERNE	41.09583	-76.13028	44	UNKNOWN	0		13.00	UNUSED
25445	PA. POWER AND LIGHT	10/23/1970	LUZERNE	41.09583	-76.14556	0	OPEN HOLE	0		54.50	UNUSED
25446	PA. POWER AND LIGHT	11/12/1970	LUZERNE	41.09611	-76.14417	0	OPEN HOLE	0		29.20	UNUSED
25447	PA. POWER AND LIGHT	10/29/1970	LUZERNE	41.09611	-76.14472	0	OPEN HOLE	0		32.20	UNUSED
25448	PA. POWER AND LIGHT	10/21/1970	LUZERNE	41.09694	-76.14500	0	OPEN HOLE	0		0.00	UNUSED
25450	PA. POWER AND LIGHT	11/10/1970	LUZERNE	41.09778	-76.14500	0	OPEN HOLE	0		0.00	UNUSED
25451	PA. POWER AND LIGHT	1/16/1973	LUZERNE	41.09833	-76.13028	91	UNKNOWN	0		0.00	UNUSED

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
25456	PA. POWER AND LIGHT	10/12/1977	LUZERNE	41.10250	-76.13722	100	OPEN HOLE	0		24.60	DOMESTIC
25458	PA. POWER AND LIGHT	1/11/1973	LUZERNE	41.10361	-76.13194	54	UNKNOWN	0		16.00	UNUSED
25769	PA. POWER AND LIGHT	1/22/1973	LUZERNE	41.09528	-76.13028	58	UNKNOWN	0		7.57	INDUSTRIAL
25770	PA. POWER AND LIGHT	10/1/1973	LUZERNE	41.09528	-76.13528	0		65		9.00	INDUSTRIAL
25771	PA. POWER AND LIGHT	10/1/1973	LUZERNE	41.09556	-76.13528	0		150	REPORTED, METHOD NOT KNOWN	17.00	INDUSTRIAL
129003	PADEN J	7/5/1984	LUZERNE	41.04389	-76.20444	300	OPEN HOLE	5	BAILER	0.00	DOMESTIC
129008	PADEN J	9/15/1983	LUZERNE	41.04472	-76.20611	400	OPEN HOLE	2	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128984	PALERY D	4/1/1989	LUZERNE	41.04417	-76.18667	220	OPEN HOLE	12	ESTIMATED	50.00	DOMESTIC
129218	PETERS FRANK		LUZERNE	41.10556	-76.18056	150	OPEN HOLE	6	UNKNOWN	0.00	DOMESTIC
129219	PETERS FRANK		LUZERNE	41.10556	-76.18056	130	OPEN HOLE	8	UNKNOWN	10.00	DOMESTIC
25462	PETERS, FRANK	1/27/1972	LUZERNE	41.10639	-76.18167	130	OPEN HOLE	0		10.00	DOMESTIC
25464	PETERS, FRANK	8/13/1976	LUZERNE	41.10667	-76.18083	150	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129207	PINTERICH ROBT		LUZERNE	41.07306	-76.22556	175	OPEN HOLE	5	UNKNOWN	0.00	DOMESTIC
25394	PINTERICH, ROBERT	3/12/1976	LUZERNE	41.07389	-76.22528	175	OPEN HOLE	0		35.70	DOMESTIC
128347	PIZIA	4/1/1989	LUZERNE	41.10889	-76.07444	250	OPEN HOLE	10	ESTIMATED	25.00	DOMESTIC
128348	PIZIA	3/1/1989	LUZERNE	41.11000	-76.07444	240	OPEN HOLE	35	ESTIMATED	20.00	DOMESTIC
250843	PLEASANT VIEW M H P		LUZERNE	41.08670	-76.18810	300		13	REPORTED, METHOD NOT KNOWN	0.00	PUBLIC SUPPLY
250844	PLEASANT VIEW M H P		LUZERNE	41.08670	-76.18810	300		60	REPORTED, METHOD NOT KNOWN	0.00	PUBLIC SUPPLY
250845	PLEASANT VIEW M H P		LUZERNE	41.08670	-76.18500	380	OPEN HOLE	19	REPORTED, METHOD NOT KNOWN	300.00	PUBLIC SUPPLY
250926	PMC LIFESTYLE		LUZERNE	41.07170	-76.15670	325		50	REPORTED, METHOD NOT KNOWN	0.00	COMMERCIAL

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}

(Page 16 of 20)

PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
250956	PP&L SUSQUEHANNA S&A WELLS		LUZERNE	41.09170	-76.14860	75		50	REPORTED, METHOD NOT KNOWN	0.00	COMMERCIAL
250957	PP&L SUSQUEHANNA S&A WELLS		LUZERNE	41.09170	-76.14860	75		50	REPORTED, METHOD NOT KNOWN	0.00	COMMERCIAL
129135	PPL COMPANY	8/26/1981	LUZERNE	41.09389	-76.14611	225	OPEN HOLE	35		7.00	PUBLIC SUPPLY
25382	PRICE, ROBERT B	8/25/1973	LUZERNE	41.06917	-76.15194	125	UNKNOWN	9		48.00	DOMESTIC
25391	PRICE, ROBERT P	10/11/1967	LUZERNE	41.07250	-76.15194	160	OPEN HOLE	0		63.00	DOMESTIC
250898	PRIME TIME RESTAURANT		LUZERNE	41.10670	-76.13670	98		0		98.00	COMMERCIAL
128817	READLER C	3/5/1974	LUZERNE	41.04722	-76.11389	200		20	ESTIMATED	18.00	DOMESTIC
128358	READLER HOYT	1/1/1966	LUZERNE	41.14111	-76.13833	217	OPEN HOLE	3	UNKNOWN	24.00	DOMESTIC
129004	READLER K	2/1/1986	LUZERNE	41.03917	-76.18917	223	OPEN HOLE	12	ESTIMATED	0.00	DOMESTIC
25731	READLER, HOYT	1/24/1967	LUZERNE	41.04778	-76.15056	0	OPEN HOLE	15	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
25368	READLER,CALVIN P.		LUZERNE	41.05778	-76.09639	30	OPEN HOLE	0		27.00	DOMESTIC
250897	RED BARN CAFE		LUZERNE	41.10830	-76.13890	265		0		20.00	COMMERCIAL
25468	REICHARD, PAUL	1/7/1973	LUZERNE	41.10778	-76.18250	125	OPEN HOLE	0		45.00	DOMESTIC
128999	REIMARD E	10/1/1986	LUZERNE	41.04361	-76.18278	380	OPEN HOLE	20	ESTIMATED	70.00	DOMESTIC
129177	RHINARD VIRGIL	1/1/1966	LUZERNE	41.09778	-76.21417	95	OPEN HOLE	9	UNKNOWN	25.00	DOMESTIC
25449	RHINARD, VIRGIL	10/27/1966	LUZERNE	41.09750	-76.21556	95	OPEN HOLE	9	VOLUMETRIC, WATCH & BUCKET	25.00	DOMESTIC
128815	RINEHIMER R	12/1/1981	LUZERNE	41.08167	-76.09167	250	OPEN HOLE	5	VOLUMETRIC, WATCH & BUCKET	60.00	DOMESTIC
250958	RIVERLANDS RECREATION CENTER		LUZERNE	41.09940	-76.13580	105		30	REPORTED, METHOD NOT KNOWN	0.00	COMMERCIAL
128840	ROBBINS	3/1/1989	LUZERNE	41.04639	-76.09500	500	OPEN HOLE	20	ESTIMATED	40.00	DOMESTIC
129188	ROMAN HOMES		LUZERNE	41.06944	-76.16500	125	OPEN HOLE	7	UNKNOWN	0.00	PUBLIC SUPPLY
128994	RYMAN FARM	4/1/1988	LUZERNE	41.05417	-76.17472	200	OPEN HOLE	20		60.00	DOMESTIC
128992	RYMAN H	9/1/1987	LUZERNE	41.05500	-76.18833	280	OPEN HOLE	8	ESTIMATED	0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
128997	RYMAN V	10/15/1986	LUZERNE	41.03694	-76.21250	360		3	ESTIMATED	0.00	DOMESTIC
128974	RYMAN W	8/1/1980	LUZERNE	41.05278	-76.16389	360	OPEN HOLE	35	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129015	RYMAN WARREN	1/1/1966	LUZERNE	41.04083	-76.14306	235	OPEN HOLE	10	UNKNOWN	91.00	DOMESTIC
25366	RYMAN, WALTER	1/1/1980	LUZERNE	41.05611	-76.21056	340	OPEN HOLE	35	REPORTED, METHOD NOT KNOWN	81.80	STOCK
129186	SALEM TWP	1/1/1970	LUZERNE	41.08333	-76.14056	175	OPEN HOLE	12	UNKNOWN	0.00	DOMESTIC
25406	SALEM TWP.	1/4/1970	LUZERNE	41.08222	-76.14056	175	OPEN HOLE	12	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
129139	SEELLY E	9/8/1980	LUZERNE	41.09333	-76.16944	100	OPEN HOLE	0	ESTIMATED	0.00	DOMESTIC
129142	SEELY E	9/9/1980	LUZERNE	41.09167	-76.16917	55	OPEN HOLE	0	ESTIMATED	0.00	DOMESTIC
25374	SEIGFRED WILLIAM	6/15/1976	LUZERNE	41.06556	-76.21056	85	UNKNOWN	25		5.00	DOMESTIC
25514	SELECKY,FRANK, M R.	1/1/1955	LUZERNE	41.15722	-76.15583	62	UNKNOWN	40		0.00	DOMESTIC
25732	SELIC, ROBERT	8/21/1975	LUZERNE	41.05000	-76.20750	150	OPEN HOLE	10		0.00	DOMESTIC
128837	SENSON R	9/1/1983	LUZERNE	41.04722	-76.09333	225	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	30.00	DOMESTIC
129023	SEWARD HAROLD		LUZERNE	41.03194	-76.17194	245	OPEN HOLE	22	UNKNOWN	50.00	DOMESTIC
25320	SEWARO, HAROLD	2/17/1976	LUZERNE	41.03139	-76.17167	245	OPEN HOLE	22	VOLUMETRIC, WATCH & BUCKET	50.00	DOMESTIC
128819	SHOBERT RALPH	3/10/1974	LUZERNE	41.06556	-76.10222	480		4	ESTIMATED	0.00	DOMESTIC
129143	SHUMAN S	3/12/1982	LUZERNE	41.06778	-76.17472	410	OPEN HOLE	40	ESTIMATED	0.00	DOMESTIC
421702	SIDBUTLER	9/24/2007	LUZERNE	41.12045	-76.17738	250	OPEN HOLE	15	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
128836	SIEGAL R	8/1/1983	LUZERNE	41.07444	-76.07611	200	OPEN HOLE	8	VOLUMETRIC, WATCH & BUCKET	25.00	DOMESTIC
25469	SIESKO,EMIL	9/3/1930	LUZERNE	41.10806	-76.13833	148	OPEN END	0		48.00	DOMESTIC
25412	SINK, WILLIAM H	18500101	LUZERNE	41.08472	-76.15694	50	WALLED	0		4.85	DOMESTIC
129222	SITLER LEMUEL		LUZERNE	41.10917	-76.17778	100	OPEN HOLE	12	UNKNOWN	0.00	DOMESTIC
25471	SITLER, LEMUEL	9/24/1973	LUZERNE	41.10944	-76.17778	100	OPEN HOLE	12	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
250853	SLEEPY HOLLOW MOBILE HOME PARK		LUZERNE	41.13060	-76.22640	125	OPEN HOLE	25	REPORTED, METHOD NOT KNOWN	0.00	PUBLIC SUPPLY
25348	SLOSSER,MR.		LUZERNE	41.04639	-76.15056	138	UNKNOWN	0		0.00	DOMESTIC
129000	SMITH	8/1/1986	LUZERNE	41.04278	-76.14361	180	OPEN HOLE	12	ESTIMATED	40.00	DOMESTIC
128989	SMITH R	5/1/1988	LUZERNE	41.03500	-76.14028	180	OPEN HOLE	25	ESTIMATED	40.00	DOMESTIC
25761	SMITH, BRAD	2/1/1980	LUZERNE	41.07056	-76.16083	130	OPEN HOLE	0		36.50	DOMESTIC
128346	SPAIDE H	10/1/1982	LUZERNE	41.09333	-76.10389	160	OPEN HOLE	25	VOLUMETRIC, WATCH & BUCKET	10.00	DOMESTIC
128832	STEINBRENNER	2/1/1986	LUZERNE	41.08250	-76.08444	240	OPEN HOLE	15	ESTIMATED	60.00	DOMESTIC
129021	STEINHAUER REV		LUZERNE	41.03306	-76.17389	170	OPEN HOLE	25	UNKNOWN	35.00	DOMESTIC
25326	STEINHAVER DONALD L	4/2/1974	LUZERNE	41.03361	-76.17333	170	OPEN HOLE	25	VOLUMETRIC, WATCH & BUCKET	35.00	DOMESTIC
129006	SUPERKO D	7/1/1983	LUZERNE	41.03889	-76.15194	330	OPEN HOLE	15		40.00	DOMESTIC
250940	SUSQ STEAM ELECTRIC STAT EOF		LUZERNE	41.08720	-76.15440	55		30	REPORTED, METHOD NOT KNOWN	0.00	COMMERCIAL
129201	SWITZER JIM		LUZERNE	41.10361	-76.21167	75	OPEN HOLE	6	UNKNOWN	35.00	DOMESTIC
25459	SWITZER, JIM	11/9/1972	LUZERNE	41.10472	-76.21194	75	OPEN HOLE	0		35.00	DOMESTIC
128986	TYRRELL C	3/11/1988	LUZERNE	41.04444	-76.18806	275	OPEN HOLE	40	ESTIMATED	0.00	DOMESTIC
128976	U S GEOL SURVEY	10/20/1980	LUZERNE	41.05889	-76.19806	200	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	23.00	
128977	U S GEOL SURVEY	10/20/1980	LUZERNE	41.05889	-76.19778	55	PERFORATED OR SLOTTED	36	TOTALING METER	23.00	
25756	U.S. GEOL. SURVEY	10/20/1980	LUZERNE	41.05889	-76.19806	200	OPEN HOLE	0		22.50	UNUSED
25757	U.S. GEOL. SURVEY	10/21/1980	LUZERNE	41.05889	-76.19806	55	UNKNOWN	0		20.40	UNUSED
25760	U.S. GEOL. SURVEY	10/16/1980	LUZERNE	41.06861	-76.15139	300	OPEN HOLE	0		51.10	UNUSED
25762	U.S. GEOL. SURVEY	10/14/1980	LUZERNE	41.07222	-76.15194	102	PERFORATED OR SLOTTED	0		62.40	UNUSED

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
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PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
128350	UTILITY ENGINEERS	11/1/1985	LUZERNE	41.14222	-76.13111	603	OPEN HOLE	25	VOLUMETRIC, WATCH & BUCKET	27.00	PUBLIC SUPPLY
129025	VALENTINO DAN		LUZERNE	41.02861	-76.18278	300	OPEN HOLE	2	UNKNOWN	160.00	DOMESTIC
25421	VANDERMARK WILSON	1/1/1959	LUZERNE	41.08889	-76.19250	90	OPEN HOLE	0		64.80	DOMESTIC
129195	VARNER ARTHUR		LUZERNE	41.08583	-76.19250	125	OPEN HOLE	7	UNKNOWN	0.00	DOMESTIC
25414	VARNER, ARTHUR	7/16/1974	LUZERNE	41.08611	-76.19194	125	OPEN HOLE	7	ESTIMATED	0.00	DOMESTIC
25496	W. KISHBAUGH	5/1/1979	LUZERNE	41.14222	-76.19667	150	OPEN HOLE	12	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
25376	W. ZIMSKI	9/1/1979	LUZERNE	41.06694	-76.11444	245	UNKNOWN	15		45.00	DOMESTIC
25764	WATTS	8/1/1980	LUZERNE	41.07278	-76.18889	230	OPEN HOLE	0		71.60	DOMESTIC
25767	WEADON BILL	7/3/1974	LUZERNE	41.08472	-76.19167	125	OPEN HOLE	0		38.10	DOMESTIC
25399	WEISS,MR.		LUZERNE	41.07722	-76.07944	75	UNKNOWN	12		25.00	DOMESTIC
129001	WENNER R	7/1/1986	LUZERNE	41.04333	-76.17889	280	OPEN HOLE	60	ESTIMATED	70.00	DOMESTIC
250852	WHIPPORWILL MOBILE HOME PARK		LUZERNE	41.12970	-76.22750	100	GRAVEL PACK W/ SCREEN	15	REPORTED, METHOD NOT KNOWN	90.00	PUBLIC SUPPLY
128816	WHITEBREAD D	11/1/1983	LUZERNE	41.07861	-76.08944	200	OPEN HOLE	10	VOLUMETRIC, WATCH & BUCKET	20.00	DOMESTIC
25330	WHITMIRE	10/11/1974	LUZERNE	41.03444	-76.17389	175	OPEN HOLE	6	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
25386	WOLFE, MALVERN	4/15/1970	LUZERNE	41.07000	-76.13611	175	OPEN HOLE	5		0.00	DOMESTIC
129002	WOOD LAND PRODUCT	1/14/1985	LUZERNE	41.05528	-76.12861	508	OPEN HOLE	2	ESTIMATED	0.00	STOCK
129229	WOOD V	12/5/1988	LUZERNE	41.15167	-76.15750	225	OPEN HOLE	7	ESTIMATED	0.00	DOMESTIC
128818	WYDA BOB	1/10/1976	LUZERNE	41.06583	-76.08667	170		20	ESTIMATED	40.00	DOMESTIC
128835	WYDA L	4/1/1985	LUZERNE	41.08750	-76.09694	225	OPEN HOLE	8	VOLUMETRIC, WATCH & BUCKET	30.00	DOMESTIC
129145	YARON D	10/13/1988	LUZERNE	41.07222	-76.14000	450	OPEN HOLE	10	ESTIMATED	0.00	DOMESTIC
25306	YODER,G.		LUZERNE	41.02306	-76.19833	96	OPEN HOLE	6		55.00	DOMESTIC
25375	ZETTLE, WILLIAM	1/1/1958	LUZERNE	41.06639	-76.19694	196	OPEN HOLE	0		93.70	DOMESTIC
129193	ZIETTS ANDY		LUZERNE	41.06611	-76.15778	225	OPEN HOLE	3	UNKNOWN	0.00	DOMESTIC

Table 2.4-47— {Groundwater Wells Located Within a 5-Mile (8 km) Radius of BBNPP}
(Page 20 of 20)

PA Well ID	Owner	Date Drilled	County	Latitude	Longitude	Well Depth	Well Finish	Well Yield	Yield Measure Method	Static Water Level	Water Use
129163	ZWALHUSKI A	4/13/1984	LUZERNE	41.08944	-76.20083	100	OPEN HOLE	1	VOLUMETRIC, WATCH & BUCKET	0.00	DOMESTIC
129183	ZWOLINSKI S	1/1/1967	LUZERNE	41.07194	-76.17556	85	OPEN HOLE	14	UNKNOWN	22.00	DOMESTIC
129179	ZWOLINSKI STEVE	1/1/1967	LUZERNE	41.06944	-76.16750	100	OPEN HOLE	20	UNKNOWN	15.00	DOMESTIC
25387	ZWOLINSKI, STEVEN	8/9/1968	LUZERNE	41.07000	-76.16694	145	OPEN HOLE	20	BAILER	36.01	DOMESTIC
25328		7/18/1974	LUZERNE	41.03389	-76.17222	140	OPEN HOLE	15	REPORTED, METHOD NOT KNOWN	0.00	DOMESTIC
28736	BRYFOGLE, KENNETH	7/1/1980	MONTOUR	41.07583	-76.07639	250	UNKNOWN	25		18.00	COMMERCIAL
190082	SALVATERRA N		SNYDER	41.02278	-76.17556	275	OPEN HOLE	18	UNKNOWN	60.00	DOMESTIC

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
(Page 1 of 9)

SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
1633	SILBERLINE MFG CO INC	SILBERLINE MFG LANSFORD PLT	WELL 1	INDUSTRIAL USE	ACTIVE
1633	SILBERLINE MFG CO INC	SILBERLINE MFG LANSFORD PLT	WELL 2	INDUSTRIAL USE	ACTIVE
1633	SILBERLINE MFG CO INC	SILBERLINE MFG LANSFORD PLT	WELL 3	INDUSTRIAL USE	ACTIVE
2828	DEL MONTE CORP	DEL MONTE BLOOMSBURG PLT	WELL 2	INDUSTRIAL USE	ACTIVE
2828	DEL MONTE CORP	DEL MONTE BLOOMSBURG PLT	WELL 3	INDUSTRIAL USE	ACTIVE
2828	DEL MONTE CORP	DEL MONTE BLOOMSBURG PLT	WELL 5	INDUSTRIAL USE	ACTIVE
2828	DEL MONTE CORP	DEL MONTE BLOOMSBURG PLT	WELL 6	INDUSTRIAL USE	ACTIVE
2828	DEL MONTE CORP	DEL MONTE BLOOMSBURG PLT	WELL 4	INDUSTRIAL USE	ACTIVE
2828	DEL MONTE CORP	DEL MONTE BLOOMSBURG PLT	WELL 7	INDUSTRIAL USE	ACTIVE
2828	DEL MONTE CORP	DEL MONTE BLOOMSBURG PLT	WELL 1	INDUSTRIAL USE	ACTIVE
4280	LEIBYS DAIRY INC	LEIBYS DAIRY	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
4280	LEIBYS DAIRY INC	LEIBYS DAIRY	SPRING	INDUSTRIAL USE	ACTIVE
236805	ALTADIS USA INC	ALTADIS USA MCADOO PLT	WELL 5	INDUSTRIAL USE	ACTIVE
236805	ALTADIS USA INC	ALTADIS USA MCADOO PLT	WELL 6	INDUSTRIAL USE	ACTIVE
238511	BEMIS CO INC	BEMIS	WELL	INDUSTRIAL USE	ACTIVE
238511	STONE CONTAINER CORP	BEMIS	WELL	INDUSTRIAL USE	ACTIVE
240787	CHROMATEX INC	CHROMATEX	WELL 1	INDUSTRIAL USE	ACTIVE
240787	CHROMATEX INC	CHROMATEX	WELL	INDUSTRIAL USE	ACTIVE
243274	OFFSET PAPERBACK MANUFACTURERS INC	OFFSET PAPERBACK MFG	WELL 1	INDUSTRIAL USE	ACTIVE
243274	OFFSET PAPERBACK MANUFACTURERS INC	OFFSET PAPERBACK MFG	WELL 2	INDUSTRIAL USE	ACTIVE
243274	OFFSET PAPERBACK MANUFACTURERS INC	OFFSET PAPERBACK MFG	WELL 3	INDUSTRIAL USE	ACTIVE
243851	ROB BAR INC	BEAR CREEK INN	WELL 1	COMMERCIAL USE	ACTIVE
243972	VALLEY CC	VALLEY CC	PARKING LOT WELL	COMMERCIAL USE	ACTIVE
243972	VALLEY CC	VALLEY CC	DRINKING WATER WELL	COMMERCIAL USE	ACTIVE
243972	VALLEY CC	VALLEY CC	SHOP WELL	COMMERCIAL USE	ACTIVE
244229	LEHMAN GC	LEHMAN GC	WELL	COMMERCIAL USE	ACTIVE
245023	IREM TEMPLE AAONMS	IREM TEMPLE CC	WELL 1	COMMERCIAL USE	ACTIVE
245900	NATIVE TEXTILES	NATIVE TEXTILE	WITHDRAW WELL	INDUSTRIAL USE	INACTIVE
246578	FARMERS COOP DAIRY INC	FARMERS COOP DAIRY	WITHDRAW WELLS	INDUSTRIAL USE	ACTIVE
246657	JEBBON MFG CORP	JEBBON MFG	WITHDRAW WELL	INDUSTRIAL USE	INACTIVE

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
(Page 2 of 9)

SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
247996	AIR PROD & CHEM INC	AIR PROD & CHEM TAMAQUA PLT	BOOSTER PARK 1 NORTH	INDUSTRIAL USE	ACTIVE
248509	HEMLOCK VALLEY CAMPGROUND	HEMLOCK VALLEY CAMPGROUND	WELL 1	COMMERCIAL USE	ACTIVE
249531	UNIVERSAL FOREST PROD INC	UNIVERSAL FOREST PROD EASTERN DIV	PLANT WELL	INDUSTRIAL USE	ACTIVE
249531	UNIVERSAL FOREST PROD INC	UNIVERSAL FOREST PROD EASTERN DIV	OFFICE WELL	INDUSTRIAL USE	ACTIVE
249834	SCHULTZ ELECTROPLATING INC	SCHULTZ ELECTROPLATING	WITHD WELL	INDUSTRIAL USE	ACTIVE
249844	UAE COALCORP ASSOC	UAE COALCORP HARMONY MINE	WITHDRAWAL WELL	MINERAL USE	ACTIVE
250506	DIAMOND COAL CO INC	MAMMOTH ANTHRACITE LATTIMER BASIN MINE	MINE WITHDRAWAL	MINERAL USE	ACTIVE
250630	WHITE BIRCH GC INC	WHITE BIRCH GC	SPRG 1	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 1A	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 1B	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 2A	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 2B	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 2C	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 3A	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 3B	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 3C	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 4A	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 4B	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 4C	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 5A	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 5B	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 6A	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 6B	COMMERCIAL USE	ACTIVE
252185	FED MOGUL CORP	WAGNER MFG	WELL 7B	COMMERCIAL USE	ACTIVE
252415	Unavailable	BODMAN GERALD J	SPRING WITHDRAWAL	AGRICULTURAL USE	ACTIVE
252415	Unavailable	BODMAN GERALD J	SPRING WITHDRAWAL	AGRICULTURAL USE	ACTIVE
253839	SMALL MTN QUARRY INC	PENNSY SUPPLY SMALL MTN QUARRY & SLUSSER BROS PLT	WELL 1	MINERAL USE	ACTIVE
253839	SMALL MTN QUARRY INC	PENNSY SUPPLY SMALL MTN QUARRY & SLUSSER BROS PLT	MINE DIV	MINERAL USE	ACTIVE
253994	SILVERBROOK ANTHRACITE INC	SILVERBROOK ANTHRACITE ALDEN BANK 1 MINE	A- SUR MINE WITHDRAWAL	MINERAL USE	ACTIVE

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
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SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
254020	SILVERBROOK ANTHRACITE INC	SILVERBROOK ANTHRACITE LAFLIN BANK MINE	MINE	MINERAL USE	ACTIVE
254524	WISE FOODS INC	WISE FOODS BERWICK SNACK FOOD PLT	WELL	INDUSTRIAL USE	ACTIVE
254535	BLOOMSBURG CARPET IND INC	BLOOMSBURG CARPET IND	TWO WITHDR WELLS	INDUSTRIAL USE	ACTIVE
254735	BRIAR HEIGHTS INC	ROLLING PINES GC WATER SYS	WELL 1	COMMERCIAL USE	ACTIVE
254735	BRIAR HEIGHTS INC	ROLLING PINES GC WATER SYS	WELL 2	COMMERCIAL USE	ACTIVE
254764	MILL RACE GOLF & CAMP RESORT INC	MILL RACE GC	CLUBHOUSE WELL	COMMERCIAL USE	ACTIVE
254764	MILL RACE GOLF & CAMP RESORT INC	MILL RACE GC	UPPER CAMPGROUND WELL	COMMERCIAL USE	ACTIVE
254764	MILL RACE GOLF & CAMP RESORT INC	MILL RACE GC	LOWER CAMPGROUND WELL	COMMERCIAL USE	ACTIVE
254764	MILL RACE GOLF & CAMP RESORT INC	MILL RACE GC	MAINTENANCE BUILDING WELL	COMMERCIAL USE	ACTIVE
254833	KLEERDEX CO	KLEERDEX	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
256133	SPRING HILL FARM INC	SPRINGHILL FARMS	WITH WELL	INDUSTRIAL USE	ACTIVE
257281	FROSTY VALLEY CC	FROSTY VALLEY CC WELL 1	WELL 1	COMMERCIAL USE	ACTIVE
257281	FROSTY VALLEY CC	FROSTY VALLEY CC WELL 1	WELL 2	COMMERCIAL USE	ACTIVE
257281	FROSTY VALLEY CC	FROSTY VALLEY CC WELL 1	CLUB HOUSE WELL	COMMERCIAL USE	ACTIVE
257281	FROSTY VALLEY CC	FROSTY VALLEY CC WELL 1	BARN WELL	COMMERCIAL USE	ACTIVE
257290	AMETEK CORPORATE OFC	AMETEK WESTCHESTER PLASTICS DIV	WELL 1	INDUSTRIAL USE	ACTIVE
257290	AMETEK CORPORATE OFC	AMETEK WESTCHESTER PLASTICS DIV	WELL 2	INDUSTRIAL USE	ACTIVE
257290	AMETEK CORPORATE OFC	AMETEK WESTCHESTER PLASTICS DIV	WELL 3	INDUSTRIAL USE	ACTIVE
257290	AMETEK CORPORATE OFC	AMETEK WESTCHESTER PLASTICS DIV	WELL 4	INDUSTRIAL USE	ACTIVE
257484	ALCOA KAMA INC	ALCOA KAMA	WELL	INDUSTRIAL USE	ACTIVE
257494	COATES ELECTROGRAPHICS INC	COATES ELECTROGRAPHICS	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
257496	CHEROKEE GC	CHEROKEE GC	CLUBHOUSE WELL	COMMERCIAL USE	ACTIVE
257496	CHEROKEE GC	CHEROKEE GC	MAINTENANCE BUILDING WELL	COMMERCIAL USE	ACTIVE
257496	CHEROKEE GC	CHEROKEE GC	RESTROOMS WELL	COMMERCIAL USE	ACTIVE
257496	CHEROKEE GC	CHEROKEE GC	ARARTMENT SOURCE WELL	COMMERCIAL USE	ACTIVE
257519	VALLEY ORDANCE	VALLEY ORDNANCE	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
257704	CARBONITE FILTER CORP	CARBONITE FILTER	WELL 1	MINERAL USE	ACTIVE
257704	CARBONITE FILTER CORP	CARBONITE FILTER	WELL	INDUSTRIAL USE	ACTIVE
258037	Unavailable	HETHERINGTON RAYMOND	SPRING	AGRICULTURAL USE	ACTIVE
258067	BARRETT HAENTJENS & CO	BARRETT HAENTJENS	WELL	INDUSTRIAL USE	ACTIVE
258134	OI NEG TV PROD INC	OI NEG TV PROD	WELL 1	INDUSTRIAL USE	ACTIVE
258153	COLUMBIA PORCH SHADE CO INC	COLUMBIA PORCH SHADE MFG	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
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SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
258164	BIROS IRON WORKS	BIROS IRON WORKS	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
258181	GEN CRUSHED STONE CO	GEN CRUSHED STONE WHITE HAVEN	WITHDRAWAL WELL	MINERAL USE	ACTIVE
258221	DRESHER FARMS	DRESHER FARMS	SPRING	AGRICULTURAL USE	ACTIVE
258288	FIBERITE INC	FIBERITE	WELL	INDUSTRIAL USE	ACTIVE
258664	DEL BAR SHEET METAL CO	DEL BAR SHEET METAL	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
258671	QUALITY METAL PROD INC	QUALITY METAL PROD MFG	WELL	INDUSTRIAL USE	ACTIVE
258676	AUDIMATION CORP	AUDIMATION	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
258700	BEAR RIDGE SHOPS INC	BEAR RIDGE SHOPS	WITHDR WELL	INDUSTRIAL USE	ACTIVE
258705	BOLYS IRON WORKS	BOLYS IRON WORKS	WITHDR SPRING	INDUSTRIAL USE	ACTIVE
258706	BRIEL TOOL & MACH WORKS	BRIEL TOOL & MACH WORKS PLT	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
258728	WILLIAM WENTZ INC	WILLIAM WENTZ	WELL	INDUSTRIAL USE	ACTIVE
258765	A & E RINGTOWN INC	A & E RINGTOWN	WELL	INDUSTRIAL USE	ACTIVE
258767	HILLAS FASHIONS	HILLAS FASHIONS	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
258842	HARMONY ASSOC INC	HARMONY ASSOC	WELL	INDUSTRIAL USE	ACTIVE
258870	TAMAQUA TRUCK & TRAILER INC	TAMAQUA TRUCK & TRAILER	WITH WELL	INDUSTRIAL USE	ACTIVE
258882	LIFESTYLE HOMES INC	LIFESTYE HOMES	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
258916	METCALF STEEL SVC	METCALF STEEL SVC	WITH WELL	INDUSTRIAL USE	ACTIVE
258918	R MARTIN PLASTIC SPECIALTIES	R MARTIN PLASTIC SPECIALTIES	WELL	INDUSTRIAL USE	ACTIVE
258951	FIMBEL DOOR CORP	FIMBEL DOOR	WELL	INDUSTRIAL USE	ACTIVE
259004	MTN VALLEY GC	MT VALLEY GC	WELL 9	COMMERCIAL USE	ACTIVE
259004	MTN VALLEY GC	MT VALLEY GC	WELL 7	COMMERCIAL USE	ACTIVE
259004	MTN VALLEY GC	MT VALLEY GC	WELL 15	COMMERCIAL USE	ACTIVE
259013	JEDDO HIGHLAND COAL CO	ROSA BREAKER COAL PREP PLT	RAW MINE WATERING	MINERAL USE	INACTIVE
259018	READING ANTHRACITE CO	OLD ST NICHOLAS 4 & 5 READING ANTH	MINE WITHDRAWAL	MINERAL USE	ACTIVE
259029	THREE PONDS GC	THREE PONDS GOLF SHOP	CLUB HOUSE WELL	COMMERCIAL USE	ACTIVE
259047	Unavailable	LEIBY ROBERT C	SPRING	AGRICULTURAL USE	ACTIVE
259517	GROUSE HUNT FARMS INC	GROUSE HUNT FARMS	WELL	INDUSTRIAL USE	ACTIVE
259532	DRUMS SASH & DOOR CO INC	DRUMS SASH & DOOR MFG	WELL	INDUSTRIAL USE	ACTIVE
259635	CTL ASPHALT MATERIALS INC	CTL ASPHALT MATERIALS	TWO WITHDRAW WELLS	INDUSTRIAL USE	ACTIVE
260322	ROBERT W HART & SON INC	ROBERT W HART & SON MFG	WITH WELL	INDUSTRIAL USE	ACTIVE
260442	WYOMING VALLEY CC	WYOMING VALLEY CC POND	WELL 1	COMMERCIAL USE	ACTIVE
260505	GEN TANK INC	GEN TANK	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
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SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
260513	FOUNTAIN SPRINGS CC	FOUNTAIN SPRINGS WELL	WELL	COMMERCIAL USE	ACTIVE
260527	CUSTOM METAL PROD INC	CUSTOM METAL PROD	WITH WELL	INDUSTRIAL USE	ACTIVE
261208	HAZEL PARK PACKING CO	HAZEL PARK PACKING	WELL	INDUSTRIAL USE	ACTIVE
261223	THREE SPRINGS WATER CO	THREE SPRINGS BOTTLED WATER PLT	SPRING 1	INDUSTRIAL USE	ACTIVE
261815	GERALD & LEWIS NAUGLE	READING MAT PIT 1 QUARRY	WITHDRAWAL WELL	MINERAL USE	ACTIVE
262675	ST JUDE POLYMER CORP	ST JUDE POLYMER FILW & CW	WELL	INDUSTRIAL USE	ACTIVE
263358	COLUMBIA ASPHALT CORP	HANSON AGGREGATES PA BLOOMSBURG QUARRY	WELL 1	INDUSTRIAL USE	ACTIVE
263358	HANSON AGGREGATES PENNSYLVANIA INC	HANSON AGGREGATES PA BLOOMSBURG QUARRY	DUST CONTROL WELL	MINERAL USE	ACTIVE
263358	HANSON AGGREGATES PENNSYLVANIA INC	HANSON AGGREGATES PA BLOOMSBURG QUARRY	SANITARY WELL	MINERAL USE	ACTIVE
263363	HANSON AGGREGATES PENNSYLVANIA INC	HANSON AGGREGATES PA BLOOMSBURG S & G QUARRY	S & G PIT WATER	MINERAL USE	ACTIVE
263363	HANSON AGGREGATES PENNSYLVANIA INC	HANSON AGGREGATES PA BLOOMSBURG S & G QUARRY	WELLS	MINERAL USE	ACTIVE
263385	FOX HILL CC	FOX HILL CC FILW	HALF WAY WELL	COMMERCIAL USE	ACTIVE
264419	Unavailable	SWEET VALLEY GC	WITHDRAW WELL	COMMERCIAL USE	ACTIVE
271128	BEAR GAP STONE INC	BEAR GAP QUARRY	FRESH WATER	MINERAL USE	ACTIVE
271224	BARLETTA MATERIALS & CONST INC	BARLETTA HONEY HOLE QUARRY	LAB WELL 2	INDUSTRIAL USE	ACTIVE
445219	NORTHAMPTON FUEL SUPPLY CO INC	NORTHAMPTON FUEL SUPPLY PROSPECT MINE	LOCAL MINE POOL	MINERAL USE	ACTIVE
445826	KELLY INVESTORS INC	KELLY INVESTORS KELLY 1 MINE	WELL WITHDRAWAL	MINERAL USE	INACTIVE
446877	NORTHAMPTON FUEL SUPPLY CO INC	NORTHAMPTON FUEL SUPPLY LOOMIS MINE	UNDERGROUND WELL	MINERAL USE	ACTIVE
447086	BALD EAGLE COAL CO INC	BALD EAGLE COAL WHITE PINE MINE	DEWATERING	MINERAL USE	INACTIVE
447145	BLASCHAK COAL CORP	BLASCHAK COAL ST NICHOLAS MINE	MINE POOL	MINERAL USE	ACTIVE
447978	LEHIGH COAL & NAVIGATION CO	LEHIGH COAL & NAVIGATION LCN MINE	MINE 10 DIV	MINERAL USE	ACTIVE
447978	LEHIGH COAL & NAVIGATION CO	LEHIGH COAL & NAVIGATION LCN MINE	MINE SPRINGDALE WELL	MINERAL USE	ACTIVE
447978	LEHIGH COAL & NAVIGATION CO	LEHIGH COAL & NAVIGATION LCN MINE	MINE 14	MINERAL USE	ACTIVE
447978	LEHIGH COAL & NAVIGATION CO	LEHIGH COAL & NAVIGATION LCN MINE	RT 309 DISCHARGE	MINERAL USE	ACTIVE
448087	JAC MAR COAL CO TA L & E COAL	L & E COAL JAC MAR MINE	WITHDRAWAL SURFACE MINE	MINERAL USE	ACTIVE
448323	AMER ASPHALT PAVING CO	AMER ASPHALT CHASE QUARRY	MINE WITHDRAWAL	MINERAL USE	ACTIVE
448936	ANDREAS LUMBER INC	ANDREAS LUMBER	SPRING	INDUSTRIAL USE	ACTIVE

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
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SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
448937	BARTSEN MEDIA INC	BARTSEN MEDIA	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
448963	GRANT CONCRETE PROD	GRANT CONCRETE PROD	WITH WELL	INDUSTRIAL USE	ACTIVE
448964	PRECISION TOOL & MACH CO	PRECISION TOOL & MACH	WITH WELL	INDUSTRIAL USE	ACTIVE
448965	COUNTRY COUSINS SHOES INC	COUNTRY COUSINS SHOES	WELL	INDUSTRIAL USE	ACTIVE
448968	BRUCH EYE CARE ASSOCS	BRUCH EYE CARE ASSOCS	WITH WELL	INDUSTRIAL USE	ACTIVE
449001	RIVERVIEW VIBRATED BLOCK CO	RIVERVIEW BLOCK MFG	WITH WELL	INDUSTRIAL USE	ACTIVE
449006	WEATHERLY CASTING & MACH CO	WEATHERLY CASTING & MACH MFG	WELL	INDUSTRIAL USE	ACTIVE
449057	INTERCOAL INC	INTERCOAL COAL PREP PLT	WELL	MINERAL USE	ACTIVE
450346	GALE COAL CO INC	GALE COAL E KASKA MINE	DEWATERING	MINERAL USE	INACTIVE
450409	BEAVER BROOK COAL CO	BEAVER BROOK COAL MINE	QUARRY WITHDRAWAL	MINERAL USE	ACTIVE
450734	HUNLOCK SAND & GRAVEL CO	HUNLOCK QUARRY	WELL 1	MINERAL USE	ACTIVE
457134	BLOOMSBURG MILLS INC	BLOOMSBURG MILLS	THREE WITHDR WELLS	INDUSTRIAL USE	ACTIVE
457138	MILLVILLE PROD	MILLVILLE PROD	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457207	PA ALUM	PA ALUM	WITHDR WELL	INDUSTRIAL USE	ACTIVE
457208	BRUCE CHARLES SAWMILL	BRUCE CHARLES SAWMILL	WITHDR WELL	INDUSTRIAL USE	ACTIVE
457267	NATL SELECT FABRICS CORP	NATL SELECT FABRICS	WELL 1	INDUSTRIAL USE	ACTIVE
457267	NATL SELECT FABRICS CORP	NATL SELECT FABRICS	WELL 2	INDUSTRIAL USE	ACTIVE
457268	CATAWISSA LUMBER & SPECIALTY CO	CATAWISSA LUMBER MILL	WELL	INDUSTRIAL USE	ACTIVE
457269	BOSTON FARM PROD	BOSTON FARM PROD	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457270	DEIHL VAULT & PRECAST	DEIHL VAULT & PRECAST	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457272	BRIAR KNITTING MILLS	BRIAR KNITTING MILLS	WELL	INDUSTRIAL USE	ACTIVE
457273	WILKES POOL CORP	WILKES POOL	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457274	HESS READY MIX INC	HESS READY MIX	WELL	INDUSTRIAL USE	ACTIVE
457275	S & B FOUNDRY CO	BLOOMSBURG FOUNDRY	WELL	INDUSTRIAL USE	ACTIVE
457276	HOCK TRANSIT MIX CONCRETE INC	HOCK TRANSIT MIX CONCRETE	WELL	INDUSTRIAL USE	ACTIVE
457288	GREENLEAF CROP PROD SVC	GREENLEAF CROP PROD SVC	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457336	FRONT STREET FASHIONS	FRONT STREET FASHIONS	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457337	BROCKMAN SHEET METAL	BROCKMAN SHEET METAL	WITHD SPRING	INDUSTRIAL USE	ACTIVE
457338	FARR LUMBER	FARR LUMBER	WELL	INDUSTRIAL USE	ACTIVE
457339	CROP PROD SVC INC	CROP PROD SVC	WITH WELL	INDUSTRIAL USE	ACTIVE
457340	PA COMBINING CORP	PA COMBINING	WITH WELL	INDUSTRIAL USE	ACTIVE
457341	RANGER IND	RANGER IND	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
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SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
457347	CUSTOM FABRICATION CO	CUSTOM FABRICATION	WITH WELL	INDUSTRIAL USE	ACTIVE
457349	GENSEMERS CUSTOM PROC	GENSEMERS CUSTOM PROC	WELL	INDUSTRIAL USE	ACTIVE
457426	LITTLE LUMBER CO INC	LITTLE LUMBER	WELL	INDUSTRIAL USE	ACTIVE
457430	CALIFORNIA EAST	CA EAST	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457444	EXPLO TECH	EXPLO TECH	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457529	R & R ENERGY CORP	R & R ENERGY COAL PREP PLT	MINE WATER WITHDRAWAL	MINERAL USE	INACTIVE
457564	KLINGERMAN GALLICK AG SVC INC	MAINVILLE AG SVC	WITH WELL	INDUSTRIAL USE	ACTIVE
457609	BERWICK WEAVING INC	BERWICK WEAVING	WELL 1	INDUSTRIAL USE	ACTIVE
457629	COLUMBIA GRAPHICS INC	COLUMBIA GRAPHICS	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
457642	HARRELL AUTOMATIC SPRINKLER CO	HARRELL AUTOMATIC SPRINKLER	WELL	INDUSTRIAL USE	ACTIVE
458364	WAGNERS FRUIT FARM	WAGNERS FRUIT FARM	WELL WITHDRAWAL	AGRICULTURAL USE	ACTIVE
458364	WAGNERS FRUIT FARM	WAGNERS FRUIT FARM	SPRING WITHDRAWAL	AGRICULTURAL USE	ACTIVE
458368	STREATER & SON INC	STREATER & SON	GROUND WITHDRAWA	AGRICULTURAL USE	ACTIVE
458370	SEESHOLTZ BROS INC	SEESHOLTZ BROS	SPRING WITHDRAWAL	AGRICULTURAL USE	ACTIVE
458370	SEESHOLTZ BROS INC	SEESHOLTZ BROS	QUARRY WITHDRAWAL	AGRICULTURAL USE	ACTIVE
458374	Unavailable	FETTERMAN EUGENE	SPRING WITHDRAWAL	AGRICULTURAL USE	ACTIVE
458592	BENTON FOUNDRY INC	BENTON FOUNDRY	WELL 1	INDUSTRIAL USE	ACTIVE
458703	IA CONST CORP	GROVANIA ASPHALT PLT	WELL	INDUSTRIAL USE	INACTIVE
459332	PHILA CITY TRUSTEE GIRARD ESTATE	PHILA CONTINENTAL MINE	MINE DEWATERING PUMP 1	MINERAL USE	ACTIVE
459332	PHILA CITY TRUSTEE GIRARD ESTATE	PHILA CONTINENTAL MINE	MINE DEWATERING PUMP 2	MINERAL USE	ACTIVE
461656	Unavailable	COLLINS TOOL CORP	WELL	INDUSTRIAL USE	ACTIVE
471870	INTERSIL CORP	FAIRCHILD SEMICONDUCTOR MOUNTAINTOP PLT	RCA WELL	INDUSTRIAL USE	ACTIVE
481054	EMERALD ANTHRACITE II	HUD TA EMERALD ANTHRACITE	WITHDRAWAL WELLS	MINERAL USE	ACTIVE
481054	EMERALD ANTHRACITE II	HUD TA EMERALD ANTHRACITE	MINE WITHDRAWAL	MINERAL USE	ACTIVE
490902	TEE TO GREEN GOLF CTR	TEE TO GREEN GC MFG	WELL	INDUSTRIAL USE	ACTIVE
490961	HOLOVIAKS CH SUPPLY INC	HOLOVIAKS CH SUPPLY MFG	WELL	INDUSTRIAL USE	ACTIVE
491027	DAVIS TROPHIES	DAVIS TROPHIES MFG	WELL	INDUSTRIAL USE	ACTIVE
491078	BURTAM CORP	BLUE RIDGE TRAIL GC	WELL 2	COMMERCIAL USE	ACTIVE
491078	BURTAM CORP	BLUE RIDGE TRAIL GC	WELL 1	COMMERCIAL USE	ACTIVE
491096	HIGHWAY EQUIP & SUPPLY CO	HWY EQUIP & SUPPLY MFG	WELL	INDUSTRIAL USE	ACTIVE
491105	DURABOND CORP	DURABOND CARPET UNDERLAY MFG	WELL	INDUSTRIAL USE	ACTIVE
495513	EAGLE ROCK COMM ASSOC INC	EAGLE ROCK RESORT	WELL C	COMMERCIAL USE	ACTIVE

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
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SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
495513	EAGLE ROCK COMM ASSOC INC	EAGLE ROCK RESORT	WELL A	COMMERCIAL USE	ACTIVE
508540	GENECO SVC INC	GENECO SVC	WITHDR WELL	INDUSTRIAL USE	ACTIVE
511126	WEIR HAZLETON INC	HAZLETON CASTING	WELL	INDUSTRIAL USE	ACTIVE
515571	CASTEK INC	CASTEK	WELL 1	INDUSTRIAL USE	ACTIVE
517060	BRADFORD CLOCKS LTD	BRADFORD CLOCKS	WITHD WELL	INDUSTRIAL USE	ACTIVE
533454	READING MATERIALS INC	HAINES & KIBBLEHOUSE PIKES CREEK ASPHALT	POND MAKEUP WELL	MINERAL USE	ACTIVE
533454	READING MATERIALS INC	HAINES & KIBBLEHOUSE PIKES CREEK ASPHALT	PRIMARY PLANT WELL	MINERAL USE	ACTIVE
533454	READING MATERIALS INC	HAINES & KIBBLEHOUSE PIKES CREEK ASPHALT	SCALEHOUSE WELL	MINERAL USE	ACTIVE
533454	READING MATERIALS INC	HAINES & KIBBLEHOUSE PIKES CREEK ASPHALT	GARAGE WELL	MINERAL USE	ACTIVE
533454	READING MATERIALS INC	HAINES & KIBBLEHOUSE PIKES CREEK ASPHALT	PORTABLE PLANT WELL	MINERAL USE	ACTIVE
542892	FABCON EAST CORP LLC	FABCON E	WELL 2	INDUSTRIAL USE	ACTIVE
543444	GROUP MTN SPRINGS	TULPEHOCKEN SPRINGS	BH-1	INDUSTRIAL USE	ACTIVE
549903	HOLLYWOOD MILLWORK	HOLLYWOOD MILLWORK	WELL	INDUSTRIAL USE	ACTIVE
549917	PRECISION LITHO GRAPHICS	PRECISION LITHO GRAPHICS	WELL	INDUSTRIAL USE	ACTIVE
549930	MC BON CORP	MC BON	WELL	INDUSTRIAL USE	ACTIVE
549934	SUGARLOAF PRINT SHOP	SUGARLOAF PRINT SHOP	WELL	INDUSTRIAL USE	ACTIVE
549960	BEACH MACH & GEAR	BEACH MACH & GEAR	WELL	INDUSTRIAL USE	ACTIVE
571024	DILLON FLORAL CORP	DILLON FLORAL	WELL 1	AGRICULTURAL USE	ACTIVE
580619	KAREN MFG CO INC	KAREN MFG	WITHDRAW WELL	INDUSTRIAL USE	INACTIVE
656391	KOCHS TURKEY FARM	KOCHS TURKEY FARM WALKER TWP SCHUYLKILL CNTY	GROUND WATER HATCHERY	AGRICULTURAL USE	ACTIVE
656391	KOCHS TURKEY FARM	KOCHS TURKEY FARM WALKER TWP SCHUYLKILL CNTY	GROUND WATER WELL 4	AGRICULTURAL USE	ACTIVE
656391	KOCHS TURKEY FARM	KOCHS TURKEY FARM WALKER TWP SCHUYLKILL CNTY	GROUNDWATER UPPER	AGRICULTURAL USE	ACTIVE
658498	PA FISH & BOAT COMM FISHERIES BUR	BEAVER TWP ROD & GUN CLUB COLUMBIA CNTY	UNNAMED SPRING TRIBUTARY TO SCOTCH RUN	AGRICULTURAL USE	ACTIVE
659375	Unavailable	RAY LEVAN FARM LOCUST TWP COLUMBIA CNTY	SPRING 1	AGRICULTURAL USE	ACTIVE

Table 2.4-48— {Groundwater Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}
(Page 9 of 9)

SITE ID	ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
659375	Unavailable	RAY LEVAN FARM LOCUST TWP COLUMBIA CNTY	WELL 1	AGRICULTURAL USE	ACTIVE
659800	Unavailable	ROBERT E KARNES FARM LOCUST TWP COLUMBIA CNTY	WELL AT HOUSE	AGRICULTURAL USE	ACTIVE
659800	Unavailable	ROBERT E KARNES FARM LOCUST TWP COLUMBIA CNTY	WELL AT BARN	AGRICULTURAL USE	ACTIVE
659877	Unavailable	PAUL R LEVAN & SONS FARM LOCUST TWP COLUMBIA CNTY	WELL 1	AGRICULTURAL USE	ACTIVE
660023	BISON MEADOWS LLC	BISON MEADOWS FARM BLYTHE TWP SCHUYLKILL CNTY	SPRING 1	AGRICULTURAL USE	ACTIVE
660303	HAZLETON MATERIALS LLC	HAZLETON MATERIALS FOSTER TWP LUZERNE CNTY	PRODUCTION WELL	MINERAL USE	ACTIVE
660303	HAZLETON MATERIALS LLC	HAZLETON MATERIALS FOSTER TWP LUZERNE CNTY	SCALEHOUSE WELL	MINERAL USE	ACTIVE
660303	HAZLETON MATERIALS LLC	HAZLETON MATERIALS FOSTER TWP LUZERNE CNTY	WASH PLANT WELL	MINERAL USE	ACTIVE
660687	Unavailable	WINSTON A JARRARD FARM ROARING CREEK TWP COLUMBIA CNTY	WELL 1	AGRICULTURAL USE	ACTIVE
660969	R VALLEY FARMS	R VALLEY FARMS BEAVER TWP COLUMBIA CNTY	WELL 1	AGRICULTURAL USE	ACTIVE
661881	SETON MANOR INC	SETON MANOR RUSH TWP SCHUYLKILL CNTY	BOOSTER PARK 1 NORTH (WELL)	COMMERCIAL USE	ACTIVE
661881	SETON MANOR INC	SETON MANOR RUSH TWP SCHUYLKILL CNTY	BOOSTER PARK 2 SOUTH (WELL)	COMMERCIAL USE	ACTIVE
677497	GROUP MTN SPRINGS	SUGARLOAF MTN SPRINGS BENTON TWP COLUMBIA CNTY	SUGARLOAF MOUNTAIN SPRING	INDUSTRIAL USE	ACTIVE

Table 2.4-49— {Groundwater Withdrawals Located Within a 5-Mile (8-km) Radius of BBNPP}

ORGANIZATION	SITE NAME	SUB FACILITY	USE TYPE	SITE STATUS
ROBERT W HART & SON INC	ROBERT W HART & SON MFG	WITH WELL	INDUSTRIAL USE	ACTIVE
LIFESTYLE HOMES INC	LIFESTYE HOMES	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
GEN TANK INC	GEN TANK	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
BERWICK WEAVING INC	BERWICK WEAVING	WELL 1	INDUSTRIAL USE	ACTIVE
RIVERVIEW VIBRATED BLOCK CO	RIVERVIEW BLOCK MFG	WITH WELL	INDUSTRIAL USE	ACTIVE
BROCKMAN SHEET METAL	BROCKMAN SHEET METAL	WITHD SPRING	INDUSTRIAL USE	ACTIVE
BEACH MACH & GEAR	BEACH MACH & GEAR	WELL	INDUSTRIAL USE	ACTIVE
BARLETTA MATERIALS & CONST INC	BARLETTA HONEY HOLE QUARRY	LAB WELL 2	INDUSTRIAL USE	ACTIVE
AUDIMATION CORP	AUDIMATION	WITHDRAW WELL	INDUSTRIAL USE	ACTIVE
ANDREAS LUMBER INC	ANDREAS LUMBER	SPRING	INDUSTRIAL USE	ACTIVE
COUNTRY COUSINS SHOES INC	COUNTRY COUSINS SHOES	WELL	INDUSTRIAL USE	ACTIVE
DURABOND CORP	DURABOND CARPET UNDERLAY MFG	WELL	INDUSTRIAL USE	ACTIVE
CASTEK INC	CASTEK	WELL 1	INDUSTRIAL USE	ACTIVE

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
Luzerne County				
2400001	RIVERVIEW VILLAGE MHP	ACTIVE	COMMUNITY	175
2400002	NOCCHI'S TRAILER COURT	INACTIVE	COMMUNITY	117
2400003	ECHO VALLEY MHP	ACTIVE	COMMUNITY	240
2400004	SUNSET TERRACE	INACTIVE	COMMUNITY	38
2400005	PINE VALLEY	INACTIVE	COMMUNITY	23
2400006	HIGH POINT ACRES ASSN	INACTIVE	COMMUNITY	52
2400007	BRYANTS MHP	ACTIVE	COMMUNITY	50
2400008	TOWER 80 81 LLC	ACTIVE	COMMUNITY	115
2400010	BARRINGTON APARTMENT	INACTIVE	COMMUNITY	42
2400011	ALWAYS WATER CO %WM DEANGELO	INACTIVE	COMMUNITY	63
2400012	AQUA PA FIELDCREST	ACTIVE	COMMUNITY	110
2400014	PINE GROVE APARTMENTS	INACTIVE	COMMUNITY	52
2400015	MILNESVILLE #7 WATER ASSOC.	INACTIVE	COMMUNITY	23
2400016	PARDEESVILLE WATER SYS	INACTIVE	COMMUNITY	220
2400017	CHASE MANOR WATER ASSOC.	ACTIVE	COMMUNITY	95
2400018	AQUA PA MAPLECREST	INACTIVE	COMMUNITY	56
2400019	AG-MAR ESTATES	INACTIVE	COMMUNITY	34
2400021	LAUREL RUN WATER ASSOC	INACTIVE	COMMUNITY	100
2400022	SKYWAY MHP	ACTIVE	COMMUNITY	40
2400023	KEYSTONE JOB CORPS CENTER	ACTIVE	COMMUNITY	950
2400024	BONHAM NURSING CENTER	ACTIVE	COMMUNITY	76
2400026	PENN ST WILKES BARRE CAMPUS	ACTIVE	COMMUNITY	1,278
2400027	LAKESIDE NURSING HOME	ACTIVE	COMMUNITY	91
2400029	AQUA PA SHICKSHINNY LAKE	ACTIVE	COMMUNITY	126
2400030	MAPLE KNOLL ASSN	INACTIVE	COMMUNITY	91
2400031	4 SEASONS ESTATES	ACTIVE	COMMUNITY	98
2400032	HOWARD IDE	INACTIVE	COMMUNITY	5
2400033	COUNTRY MANOR	INACTIVE	COMMUNITY	31
2400034	LAUREL RUN ESTATES	ACTIVE	COMMUNITY	340
2400035	LAKEVIEW MANOR	INACTIVE	COMMUNITY	27
2400036	COUNTRY CREST MHP	ACTIVE	COMMUNITY	150
2400037	LAND FARM, INC.	INACTIVE	COMMUNITY	42
2400038	VALLEY STREAM MHP	ACTIVE	COMMUNITY	300
2400039	HANSON PARK MHP	ACTIVE	COMMUNITY	126
2400040	HOLLY LYNN MOBILE HOME COURT	INACTIVE	COMMUNITY	80
2400041	COUNTRY VILLAGE MHP	ACTIVE	COMMUNITY	140
2400042	BEECHCREST MHP	ACTIVE	COMMUNITY	33
2400043	PLEASANT VIEW MHP	ACTIVE	COMMUNITY	75
2400044	R KASHMER MOBILEHOME PARK	INACTIVE	COMMUNITY	8
2400045	AQUA PA SHICKSHINNY APACHE	ACTIVE	COMMUNITY	140
2400046	COUNTRY ESTATES MHP	ACTIVE	COMMUNITY	33
2400047	BEECH MOUNTAIN LAKES	INACTIVE	COMMUNITY	3,930
2400048	CONYNGHAM WATER CO	ACTIVE	COMMUNITY	1,932
2400049	EVERGREEN MHP	ACTIVE	COMMUNITY	140

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}

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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400050	COUNTRY PINE ESTATES	ACTIVE	COMMUNITY	90
2400051	VALLEY VIEW MHP	ACTIVE	COMMUNITY	846
2400052	DALLAS MHP	ACTIVE	COMMUNITY	65
2400053	AQUA PA HEX ACRES	ACTIVE	COMMUNITY	278
2400054	FREELAND BORO MUNI WATER AUTH	ACTIVE	COMMUNITY	4,610
2400055	MAPLE LANE ESTATE	ACTIVE	COMMUNITY	200
2400056	WHITEBREAD WATER CO	INACTIVE	COMMUNITY	50
2400057	KAWON INC D. YANUZZI OPER MAN	INACTIVE	COMMUNITY	90
2400060	SWEET VALLEY MHP	ACTIVE	COMMUNITY	43
2400063	WHIPPORWILL MHP	ACTIVE	COMMUNITY	25
2400064	SLEEPY HOLLOW MOBILE HOME PARK	INACTIVE	COMMUNITY	21
2400066	AQUA PA WAPWALLOPEN	ACTIVE	COMMUNITY	239
2400067	AQUA PA TAMBUR	ACTIVE	COMMUNITY	110
2400068	HYLAND MHP	ACTIVE	COMMUNITY	70
2400070	PAWC HILLCREST	ACTIVE	COMMUNITY	125
2400072	PAWC HOMESITE	ACTIVE	COMMUNITY	55
2400073	BROWN MANOR	ACTIVE	COMMUNITY	91
2400074	GRANDVIEW WATER COMPANY	INACTIVE	COMMUNITY	300
2400075	PARKWAY WCO.	INACTIVE	COMMUNITY	750
2400076	UNITED WATER PA DALLAS	ACTIVE	COMMUNITY	5,113
2400078	AQUA PA FOREST PARK	ACTIVE	COMMUNITY	335
2400079	AQUA PA PENN LAKE	ACTIVE	COMMUNITY	70
2400081	MOCANAQUA WATER COMPANY	INACTIVE	COMMUNITY	960
2400082	OVERBROOK WATER COMPANY	ACTIVE	COMMUNITY	298
2400083	AQUA PA APPLEWOOD	ACTIVE	COMMUNITY	82
2400084	HADDONFIELD HILLS WATER CO.	INACTIVE	COMMUNITY	40
2400085	AQUA PA BARRETT	ACTIVE	COMMUNITY	150
2400086	INDIAN SPRINGS WATER CO	ACTIVE	COMMUNITY	133
2400089	AQUA PA GARBUSH	ACTIVE	COMMUNITY	160
2400090	SCI DALLAS	ACTIVE	COMMUNITY	2,488
2400091	UNITED WATER PA SHAVERTOWN	ACTIVE	COMMUNITY	3,035
2400092	PAWC SHAVERTOWN/KINGSTON W. CO	INACTIVE	COMMUNITY	323
2400093	AQUA PA MEADOWCREST	INACTIVE	COMMUNITY	1,000
2400095	AQUA PA OAKHILL	ACTIVE	COMMUNITY	486
2400096	TOWN & COUNTRY MANOR ASSOC	ACTIVE	COMMUNITY	76
2400101	AQUA PA RHODES TERRACE	ACTIVE	COMMUNITY	50
2400102	AQUA PA WARDEN PLACE	ACTIVE	COMMUNITY	275
2400103	UNITED WATER PA HARVEY'S LAKE	ACTIVE	COMMUNITY	200
2400104	AQUA PA MIDWAY SYSTEM	ACTIVE	COMMUNITY	1,793
2400105	MIDAY MANOR HARRIS HILL	INACTIVE	COMMUNITY	75
2400107	ORCHARD EAST WATER ASSOC	ACTIVE	COMMUNITY	100
2400108	AQUA PA WHITE HAVEN	ACTIVE	COMMUNITY	1,200
2400109	WHITE HAVEN CENTER	ACTIVE	COMMUNITY	620
2400110	COUNTRY CLUB APTS	ACTIVE	COMMUNITY	240
2400111	AQUA PA LAUREL LAKES VILLAGE	ACTIVE	COMMUNITY	380

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400113	ORCHARD WEST WATER ASSOC.	ACTIVE	COMMUNITY	90
2400114	BEECH MOUNTAIN	ACTIVE	COMMUNITY	1,375
2400115	MEADOWS COMPLEX	ACTIVE	COMMUNITY	280
2400116	FRITZINGERTOWN SR LIV COMM #1	ACTIVE	COMMUNITY	66
2400117	BUTLER VALLEY MANOR	ACTIVE	COMMUNITY	90
2400118	BEAR CREEK HEALTH CARE CENTER	INACTIVE	COMMUNITY	36
2400119	MAPLE HILL MANOR	INACTIVE	COMMUNITY	26
2400120	MOUNTAINSIDE MANOR	INACTIVE	COMMUNITY	60
2400121	LAKEVIEW TERRACE ASSN	INACTIVE	COMMUNITY	150
2400122	NORTH LAKE WATER TRUST	INACTIVE	COMMUNITY	25
2400123	HICKORY LANE MANOR	INACTIVE	COMMUNITY	38
2400124	MEADOWS 1 NEWBERRY ESTATES	INACTIVE	COMMUNITY	50
2400125	AQUA PA SUNRISE ESTATES	ACTIVE	COMMUNITY	162
2400126	VALLEY GORGE MOBILE HOME PARK	ACTIVE	COMMUNITY	58
2400128	SUTTON HILLS LTD	ACTIVE	COMMUNITY	210
2400129	LAUREL PERSONAL CARE CENTER	INACTIVE	COMMUNITY	60
2400131	FERNWOOD MANOR	ACTIVE	COMMUNITY	26
2400132	WOODHAVEN WATER COMPANY	INACTIVE	COMMUNITY	47
2400134	CHERONES MOBILEHOME PARK	INACTIVE	COMMUNITY	74
2400135	AQUA PA CEDAR LANE	INACTIVE	COMMUNITY	98
2400136	SANDY RUN ASSOC	ACTIVE	COMMUNITY	47
2400138	COLLEGE MISERICORDIA	INACTIVE	COMMUNITY	1,400
2400139	FRITZINGERTOWN SR LIV COMM #2	ACTIVE	COMMUNITY	118
2400140	SAND SPRINGS	ACTIVE	COMMUNITY	630
2400141	SLEEPY HOLLOW	ACTIVE	COMMUNITY	45
2400142	HILLSIDE CONDOMINIUMS	ACTIVE	COMMUNITY	50
2400143	ZACKS ROCK GLEN MANOR	ACTIVE	COMMUNITY	36
2400144	AQUA PA ST JOHNS ESTATES	ACTIVE	COMMUNITY	75
2400145	SISTERS OF MERCY	ACTIVE	COMMUNITY	135
2400146	PROVIDENCE PLACE OF HAZLETON	ACTIVE	COMMUNITY	140
2400147	AQUA PA GREENBRIAR	ACTIVE	COMMUNITY	28
2400300	ANNA’S PLACE	INACTIVE	TRANSIENT NONCOMM	40
2400301	SMITTY’S MIDWAY	ACTIVE	TRANSIENT NONCOMM	50
2400302	MARGLE’S RESTAURANT	INACTIVE	TRANSIENT NONCOMM	40
2400303	SALLY PURSELL’S COUNTRY INN	ACTIVE	TRANSIENT NONCOMM	25
2400304	SUGARLOAF GOLF CLUB	ACTIVE	TRANSIENT NONCOMM	75
2400305	MEL ROE’S RESTAURANT	ACTIVE	TRANSIENT NONCOMM	100
2400306	LAKEVIEW LOG CABIN	INACTIVE	TRANSIENT NONCOMM	25
2400307	SHADY REST RESTAURANT & BAR	INACTIVE	TRANSIENT NONCOMM	100
2400308	DAMENTIS RESTAURANT	ACTIVE	TRANSIENT NONCOMM	50
2400309	STAGE COACH INN	ACTIVE	TRANSIENT NONCOMM	30
2400310	ANGELA PARK	INACTIVE	TRANSIENT NONCOMM	85
2400311	VALLEY HOTEL	INACTIVE	TRANSIENT NONCOMM	50
2400312	SUN VALLEY DINER	INACTIVE	TRANSIENT NONCOMM	100
2400313	EVANS ROADHOUSE	ACTIVE	TRANSIENT NONCOMM	55

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400314	DANOS BAR	ACTIVE	TRANSIENT NONCOMM	25
2400316	PARTNER'S LOUNGE	INACTIVE	TRANSIENT NONCOMM	30
2400318	MOUNTAINVIEW RESTAURANT	INACTIVE	TRANSIENT NONCOMM	230
2400319	BUTLER TWP FIRE CO	ACTIVE	TRANSIENT NONCOMM	40
2400320	SNYDERS BACKSTREET PUB	ACTIVE	TRANSIENT NONCOMM	35
2400321	PLANET POCONO	ACTIVE	TRANSIENT NONCOMM	25
2400322	RED BARN INC	ACTIVE	TRANSIENT NONCOMM	25
2400323	WILKES BARRE MUNIC GOLF COURSE	ACTIVE	TRANSIENT NONCOMM	225
2400324	INDIAN TRAIL INN	INACTIVE	TRANSIENT NONCOMM	25
2400325	GIULIANOS RESTAURANT INC	INACTIVE	TRANSIENT NONCOMM	170
2400326	BEAR CREEK INNE	ACTIVE	TRANSIENT NONCOMM	60
2400327	CASINO COUNTRYSIDE INN	ACTIVE	TRANSIENT NONCOMM	44
2400328	KNOTTY PINE INN	INACTIVE	TRANSIENT NONCOMM	70
2400329	JOSEPH AND FLORENCE ROMANOSKI	INACTIVE	TRANSIENT NONCOMM	40
2400330	VALLEY COUNTRY CLUB	INACTIVE	NONTRANSIENT NONCOMM	100
2400331	TOP OF THE 90'S	INACTIVE	TRANSIENT NONCOMM	100
2400332	VALLEY BOWLING LANES	ACTIVE	TRANSIENT NONCOMM	70
2400333	DONAHUE'S FROGTOWNE GRILL	ACTIVE	TRANSIENT NONCOMM	60
2400334	SUGARLOAF FIRE DEPT WATER SYS	INACTIVE	TRANSIENT NONCOMM	50
2400335	SUGARLOAF INN INC	INACTIVE	TRANSIENT NONCOMM	75
2400336	SUNSET GRILLE	INACTIVE	TRANSIENT NONCOMM	50
2400337	DORRANCE INN	ACTIVE	TRANSIENT NONCOMM	25
2400338	THE RUSTIC TAVERN	INACTIVE	TRANSIENT NONCOMM	25
2400339	ST JAMES EVANGELIST LUTHERAN	INACTIVE	TRANSIENT NONCOMM	25
2400340	SQUIGS PLACE	ACTIVE	TRANSIENT NONCOMM	25
2400341	LILY LAKE HOTEL	ACTIVE	TRANSIENT NONCOMM	25
2400342	SLOCUM RESTAURANT	INACTIVE	TRANSIENT NONCOMM	25
2400343	ALBERDEEN INN	ACTIVE	TRANSIENT NONCOMM	25
2400344	SLOCUM TWP MEM VFW POST 7918	INACTIVE	TRANSIENT NONCOMM	40
2400345	UNITED CHURCH OF CHRIST	INACTIVE	TRANSIENT NONCOMM	25
2400346	ST MARYS CHURCH	INACTIVE	TRANSIENT NONCOMM	25
2400347	ST PETERS EVANGELIST CHURCH	INACTIVE	TRANSIENT NONCOMM	25
2400348	ROSSI BAR AND RESTAURANT	INACTIVE	TRANSIENT NONCOMM	90
2400349	DORRANCE SUNOCO	ACTIVE	TRANSIENT NONCOMM	100
2400350	CHESTER F AND HELEN MICA	INACTIVE	TRANSIENT NONCOMM	50
2400351	AMER LEGION MTN POST 781	ACTIVE	TRANSIENT NONCOMM	25
2400354	JILLY'S	INACTIVE	TRANSIENT NONCOMM	100
2400355	TRAILS END RESTAURANT	ACTIVE	TRANSIENT NONCOMM	50
2400356	SPENCER'S WESTERN CAFE	ACTIVE	TRANSIENT NONCOMM	30
2400357	RICKETTS GLEN HOTEL	ACTIVE	TRANSIENT NONCOMM	100
2400358	RICKETTS GLEN STATE PARK	ACTIVE	TRANSIENT NONCOMM	950
2400360	DEER OAK LOUNGE	ACTIVE	TRANSIENT NONCOMM	50
2400361	JOSEPH DERVINIS DERVINS REST	INACTIVE	TRANSIENT NONCOMM	35
2400362	ZELL AND ER'S	INACTIVE	TRANSIENT NONCOMM	45
2400363	GOOD'S CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	35

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400364	NEW BACK MOUNTAIN BOWL	ACTIVE	TRANSIENT NONCOMM	150
2400366	HANSON’S LAKESHORE CAMPGROUND	INACTIVE	TRANSIENT NONCOMM	65
2400367	DALLAS SENIOR HIGH SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	637
2400368	DALLAS SCH DIST ADMIN BLDG	ACTIVE	NONTRANSIENT NONCOMM	50
2400369	LAKE LEHMAN HIGH SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	750
2400370	LEHMAN JACKSON ELEMENTARY	ACTIVE	NONTRANSIENT NONCOMM	875
2400371	LAKE LEHMAN JR. HIGH SCHOOL	INACTIVE	NONTRANSIENT NONCOMM	475
2400372	SWEET VALLEY GOLF COURSE	INACTIVE	TRANSIENT NONCOMM	60
2400373	RACE’S PIZZA BARN	INACTIVE	TRANSIENT NONCOMM	50
2400374	ROSS ELEMENTARY SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	130
2400375	LAKE-NOXEN ELEMENTARY SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	450
2400377	HUNLOCK CREEK TAVERN	ACTIVE	TRANSIENT NONCOMM	50
2400378	O’HAWLEY’S BAR & GRILL	INACTIVE	TRANSIENT NONCOMM	80
2400379	JIM MIL	ACTIVE	TRANSIENT NONCOMM	65
2400380	VILLAGE TAVERN	ACTIVE	TRANSIENT NONCOMM	25
2400382	GROFF’S GROVE	INACTIVE	TRANSIENT NONCOMM	25
2400384	COUNTRY GENTLEMAN	ACTIVE	TRANSIENT NONCOMM	200
2400387	HUNLOCK CREEK VOL FIRE DEPT	ACTIVE	TRANSIENT NONCOMM	30
2400388	LAKESIDE PIZZERIA & DELI	ACTIVE	TRANSIENT NONCOMM	60
2400389	DOC’S PIZZA & SUBS	INACTIVE	TRANSIENT NONCOMM	25
2400390	JOHNNY’S	INACTIVE	TRANSIENT NONCOMM	25
2400391	G WHITTAKERS	INACTIVE	TRANSIENT NONCOMM	100
2400392	NINOS PIZZA PAPPYS PLACE	ACTIVE	TRANSIENT NONCOMM	50
2400393	AMERICAN LEGION POST 495	ACTIVE	TRANSIENT NONCOMM	50
2400394	NORTHWEST SENIOR HIGH SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	650
2400395	HUNTINGTON MILLS ELEM. SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	410
2400396	HUNLOCK ELEMENTARY SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	375
2400397	RED BARN CAFE	INACTIVE	TRANSIENT NONCOMM	125
2400399	PRIME TIME RESTAURANT	INACTIVE	TRANSIENT NONCOMM	25
2400401	BIG B DRIVE IN	ACTIVE	TRANSIENT NONCOMM	125
2400402	DANNYS	ACTIVE	TRANSIENT NONCOMM	25
2400403	THE OFFICE OF LEE VALLEY	ACTIVE	TRANSIENT NONCOMM	25
2400404	MORGAN HILLS GOLF COURSE	ACTIVE	TRANSIENT NONCOMM	35
2400406	TC RILEYS	ACTIVE	TRANSIENT NONCOMM	60
2400407	FRANCES SLOCUM STATE PARK	ACTIVE	TRANSIENT NONCOMM	2,000
2400408	IREM COUNTRY CLUB	ACTIVE	NONTRANSIENT NONCOMM	800
2400409	SHADYSIDE TAVERN	ACTIVE	TRANSIENT NONCOMM	30
2400410	BEAUMONT INN	INACTIVE	TRANSIENT NONCOMM	50
2400413	SPORTSMAN’S BAR	ACTIVE	TRANSIENT NONCOMM	30
2400414	SUNFLOWER SPROUTS LEARNING CTR	ACTIVE	TRANSIENT NONCOMM	30
2400415	MARINA CAFE	INACTIVE	TRANSIENT NONCOMM	50
2400416	SANDY BEACH INN %MR.BEDELACH	INACTIVE	TRANSIENT NONCOMM	25
2400417	JOHN BANIS THE DOG HOUSE	INACTIVE	TRANSIENT NONCOMM	40
2400418	PINE BROOK INN INC	INACTIVE	TRANSIENT NONCOMM	30
2400420	JAMES O MCGAFFREY	INACTIVE	TRANSIENT NONCOMM	25

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400421	RICH & CHARLOTTE'S	ACTIVE	TRANSIENT NONCOMM	30
2400422	MA MA GUILIANI'S PASTA HOUSE	INACTIVE	TRANSIENT NONCOMM	200
2400423	COLLEGE MISERICORDIA	ACTIVE	NONTRANSIENT NONCOMM	1,400
2400424	ROLLAWAY	ACTIVE	TRANSIENT NONCOMM	125
2400426	BILL'S CAFE	INACTIVE	TRANSIENT NONCOMM	40
2400427	NELL RINKEN RINKEN CAFE	INACTIVE	TRANSIENT NONCOMM	40
2400428	CASTLE INN	ACTIVE	TRANSIENT NONCOMM	50
2400429	COSCIA'S HIGHLANDS AT NEWBERRY	ACTIVE	TRANSIENT NONCOMM	100
2400430	NEWBERRY ESTATE HOMEOWNERS	ACTIVE	TRANSIENT NONCOMM	50
2400431	OVERBROOK RESTAURANT	INACTIVE	TRANSIENT NONCOMM	25
2400434	FARMERS INN	ACTIVE	TRANSIENT NONCOMM	35
2400435	HOLIDAY HOUSE-JEWISH COMM.CTR.	ACTIVE	TRANSIENT NONCOMM	50
2400437	LEHMAN GOLF CLUB	ACTIVE	TRANSIENT NONCOMM	25
2400439	SHELDONS LUNCH	ACTIVE	TRANSIENT NONCOMM	50
2400440	OUTPOST INN	ACTIVE	TRANSIENT NONCOMM	50
2400441	ELEANOR JONES--JONES CAFE	INACTIVE	TRANSIENT NONCOMM	40
2400443	WILLIAM H EVANS REFRESH STAND	INACTIVE	TRANSIENT NONCOMM	30
2400445	REDMOND'S TAVERN	INACTIVE	TRANSIENT NONCOMM	25
2400446	SARAH J DYMOND ELEM SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	240
2400447	TWIN OAKS GOLF COURSE	ACTIVE	TRANSIENT NONCOMM	50
2400448	JENNIE F KUDERKA FANTIS PARK	INACTIVE	TRANSIENT NONCOMM	40
2400449	APPLE TREE HOUSE	ACTIVE	TRANSIENT NONCOMM	50
2400451	CARRIAGE STOP INN INC	INACTIVE	TRANSIENT NONCOMM	100
2400452	BEAR CREEK COMM CHARTER SCH	ACTIVE	NONTRANSIENT NONCOMM	300
2400453	PLEASURE DOME	ACTIVE	TRANSIENT NONCOMM	30
2400454	KIRBY EPISCOPAL HOUSE	ACTIVE	TRANSIENT NONCOMM	25
2400455	LAUREL RUN INN	INACTIVE	TRANSIENT NONCOMM	25
2400456	COSENZA PIZZERIA	ACTIVE	TRANSIENT NONCOMM	25
2400457	JOSEPH SPANO SPANOS DRIVE IN	INACTIVE	TRANSIENT NONCOMM	80
2400458	COUNTRY PUB	ACTIVE	TRANSIENT NONCOMM	25
2400459	THE INN AT NUANGOLA	INACTIVE	TRANSIENT NONCOMM	75
2400460	RICE ELEMENTARY SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	838
2400461	UNI MART DRUMS	ACTIVE	TRANSIENT NONCOMM	550
2400462	DRUMS ELEMENTARY SCHOOL	INACTIVE	NONTRANSIENT NONCOMM	390
2400463	ANNE MCLAUGHLIN'S CHILD CARE	ACTIVE	NONTRANSIENT NONCOMM	50
2400464	ROCK GLEN JR.HIGH SCHOOL	INACTIVE	NONTRANSIENT NONCOMM	300
2400465	NUANGOLA BORO FIRE DEPT ASSN	INACTIVE	TRANSIENT NONCOMM	25
2400466	SORRELLS PIZZA %WALTER SORRELL	INACTIVE	TRANSIENT NONCOMM	25
2400467	NATHANS FAMILY RESTAURANT	INACTIVE	TRANSIENT NONCOMM	250
2400470	POCO HAVEN INN	INACTIVE	TRANSIENT NONCOMM	25
2400471	FOUR FELLAS BAR & GRILL	ACTIVE	TRANSIENT NONCOMM	50
2400472	CHARLIE WEAVER'S BAR & REST.	ACTIVE	TRANSIENT NONCOMM	50
2400473	INDEPENDENT EXPLOSIVES CO	INACTIVE	TRANSIENT NONCOMM	76
2400474	AMERICAN ASPHALT	INACTIVE	NONTRANSIENT NONCOMM	50
2400475	PA STATE UNIVERSITY W B CAMPUS	INACTIVE	NONTRANSIENT NONCOMM	700

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400477	KAREN MFG. CO. INC.	INACTIVE	NONTRANSIENT NONCOMM	60
2400479	CLEARBROOK LODGE	ACTIVE	TRANSIENT NONCOMM	65
2400480	L & P BERWICK	ACTIVE	NONTRANSIENT NONCOMM	102
2400481	BARONS SUNOCO GAS STATION	INACTIVE	TRANSIENT NONCOMM	30
2400482	TEXACO FOOD MART	INACTIVE	TRANSIENT NONCOMM	70
2400483	ARONSON MFG CORP	INACTIVE	TRANSIENT NONCOMM	75
2400484	VALLEY WOOD PRODUCTS	INACTIVE	TRANSIENT NONCOMM	30
2400485	ECONO LODGE	ACTIVE	TRANSIENT NONCOMM	35
2400487	BFB AMERICA	INACTIVE	NONTRANSIENT NONCOMM	98
2400491	LIBERTY MART	INACTIVE	TRANSIENT NONCOMM	300
2400492	KELLY SERVICE STATION	INACTIVE	TRANSIENT NONCOMM	50
2400493	GOLDSWORTHY COUNTRY STORE	INACTIVE	TRANSIENT NONCOMM	200
2400494	FIRLEY GARAGE	INACTIVE	TRANSIENT NONCOMM	30
2400495	LURGAN CORP	INACTIVE	TRANSIENT NONCOMM	25
2400496	SHINERS SERVICE STATION	INACTIVE	TRANSIENT NONCOMM	50
2400501	CAMP ORCHARD HILL	ACTIVE	TRANSIENT NONCOMM	100
2400502	BARBACCI GROVE	ACTIVE	TRANSIENT NONCOMM	25
2400504	TRUCKSVILLE FREE METHODIST CH.	INACTIVE	TRANSIENT NONCOMM	50
2400505	FIRST ASSEMBLY OF GOD CHURCH %	INACTIVE	TRANSIENT NONCOMM	90
2400506	EAST DALLAS METHODIST %	INACTIVE	TRANSIENT NONCOMM	70
2400507	WILKES BARRE FREE METHODI CAMP	INACTIVE	TRANSIENT NONCOMM	100
2400509	ALPERSON UNITED METH CHURCH	INACTIVE	TRANSIENT NONCOMM	100
2400511	ST FRANCIS CABRINI CHURCH	INACTIVE	TRANSIENT NONCOMM	100
2400512	CARVERTON UNITED METHODIST	INACTIVE	TRANSIENT NONCOMM	90
2400513	NOON TEXACO GAS STATION %	INACTIVE	TRANSIENT NONCOMM	45
2400516	LEHMAN UNITED METHODIST CHURCH	INACTIVE	TRANSIENT NONCOMM	25
2400517	HUNTSVILLE CHRISTIAN CHURCH	ACTIVE	TRANSIENT NONCOMM	100
2400521	CAMP PATTERSON GROVE	ACTIVE	TRANSIENT NONCOMM	300
2400522	ST.MARTHA’S CHURCH % REV.	INACTIVE	TRANSIENT NONCOMM	500
2400523	NEW HIDDEN LAKE CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	150
2400524	CALVARY BIBLE CHAPEL	ACTIVE	NONTRANSIENT NONCOMM	68
2400525	MOON LAKE PARK	ACTIVE	TRANSIENT NONCOMM	500
2400526	PAPPY’S PONDEROSA	INACTIVE	TRANSIENT NONCOMM	25
2400527	SAINT CHRISTOPHER CHURCH	INACTIVE	TRANSIENT NONCOMM	200
2400528	KRUMSKY SERVICE STATION	INACTIVE	TRANSIENT NONCOMM	200
2400530	BEAR CREEK CAMP	ACTIVE	TRANSIENT NONCOMM	235
2400531	ST ELIZABETH R CATHOLIC CHURCH	INACTIVE	TRANSIENT NONCOMM	500
2400532	WILKES BARRE TWP SETTLEMENT CP	ACTIVE	TRANSIENT NONCOMM	25
2400533	COBOSCO SERVICE STA J COBOSCO	INACTIVE	TRANSIENT NONCOMM	40
2400534	CHARNEY MARKET GAS STATION	INACTIVE	TRANSIENT NONCOMM	60
2400536	UNITED METHODIST CHURCH %	INACTIVE	TRANSIENT NONCOMM	100
2400537	SANDY VALLEY CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	35
2400538	ST.PAUL’S UNITED METHODIST CH.	ACTIVE	TRANSIENT NONCOMM	60
2400539	PHILHARMONIC WORKSHOP	INACTIVE	TRANSIENT NONCOMM	45
2400540	SEVENTH DAY ADVENTIST CHURCH	INACTIVE	TRANSIENT NONCOMM	25

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400541	HAZLETON WILKES BARRE KOA CAMP	INACTIVE	TRANSIENT NONCOMM	250
2400542	CAMP DAVIDOWITZ JEWISH COM CNT	INACTIVE	TRANSIENT NONCOMM	50
2400543	MOYERS GROVE CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	165
2400544	THE CAMP AT WAPWALLOPEN	INACTIVE	TRANSIENT NONCOMM	25
2400545	SHERWOOD FOREST CAMPGROUND	INACTIVE	TRANSIENT NONCOMM	25
2400546	LOOKOUT HOUSE	ACTIVE	TRANSIENT NONCOMM	25
2400547	SACRED HEART R CATHOLIC CHURCH	INACTIVE	TRANSIENT NONCOMM	100
2400548	PENNDOT DISTRICT OFFICE NO 4	INACTIVE	TRANSIENT NONCOMM	1,000
2400800	NORTH LAKE WATER TRUST	INACTIVE	NONTRANSIENT NONCOMM	42
2400802	LAKEVIEW TERRACE	INACTIVE	NONTRANSIENT NONCOMM	38
2400803	BEAR CREEK HEALTH CARE CTR.	INACTIVE	TRANSIENT NONCOMM	32
2400804	NATIVE TEXTILE	INACTIVE	NONTRANSIENT NONCOMM	160
2400806	HUMBOLDT INDUSTRIAL PARK	ACTIVE	NONTRANSIENT NONCOMM	3,000
2400807	IDETOWN UNITED METHODIST CHURC	INACTIVE	TRANSIENT NONCOMM	65
2400809	MOTOR VU DRIVE IN	INACTIVE	TRANSIENT NONCOMM	300
2400810	HAZLETON DRIVE-IN THEATER	INACTIVE	TRANSIENT NONCOMM	100
2400812	RANCH HOUSE LOUNGE	INACTIVE	TRANSIENT NONCOMM	50
2400813	EDGEWOOD PINES GOLF CLUB	ACTIVE	TRANSIENT NONCOMM	150
2400814	VALLEYBROOK INN	INACTIVE	TRANSIENT NONCOMM	50
2400815	SONNY'S INN	INACTIVE	TRANSIENT NONCOMM	50
2400816	CASCADES % DONALD P MACAR	INACTIVE	TRANSIENT NONCOMM	50
2400817	VILLAGE HOMESTYLE BAKE SHOP	INACTIVE	TRANSIENT NONCOMM	50
2400818	HARVEYS LAKE PUB	INACTIVE	TRANSIENT NONCOMM	50
2400819	T.J.'S LAKESIDE	INACTIVE	TRANSIENT NONCOMM	50
2400822	OUT OF TOWN INN	INACTIVE	TRANSIENT NONCOMM	50
2400823	TOM'S KITCHEN	ACTIVE	TRANSIENT NONCOMM	225
2400824	UNI MART	ACTIVE	TRANSIENT NONCOMM	400
2400825	SHINDIG INN	ACTIVE	TRANSIENT NONCOMM	50
2400826	ST MARYS CHURCH & HALL	INACTIVE	TRANSIENT NONCOMM	50
2400827	HESS'S COUNTRY CONE	INACTIVE	TRANSIENT NONCOMM	25
2400828	SAFETY REST AREA SITE #39	ACTIVE	TRANSIENT NONCOMM	860
2400829	SAFETY REST AREA SITE #53	ACTIVE	TRANSIENT NONCOMM	840
2400830	SAFTEY REST AREA SITE #54	ACTIVE	TRANSIENT NONCOMM	840
2400831	PENN DOT LUZ CO MAINT FAC.	INACTIVE	NONTRANSIENT NONCOMM	30
2400832	PENNDOT-SITE 34 PRIM SAFE REST	INACTIVE	TRANSIENT NONCOMM	100
2400833	NESCOPECK STATE PARK	INACTIVE	TRANSIENT NONCOMM	100
2400835	JCC DAY CAMP RT 415	ACTIVE	TRANSIENT NONCOMM	45
2400836	JOHN HEINZ REHAB	ACTIVE	TRANSIENT NONCOMM	40
2400837	RED ROCK CAMPGROUND	INACTIVE	TRANSIENT NONCOMM	100
2400838	LILY LAKE STORE	INACTIVE	TRANSIENT NONCOMM	100
2400839	CULVER LABOR CAMP	INACTIVE	TRANSIENT NONCOMM	54
2400840	RED ROOSTER	ACTIVE	TRANSIENT NONCOMM	80
2400841	TECH PACKAGING	ACTIVE	NONTRANSIENT NONCOMM	120
2400842	DON'S MARKET 1 PASTIE LADY	INACTIVE	TRANSIENT NONCOMM	125
2400843	PP&L RECREATIONAL AREA	INACTIVE	TRANSIENT NONCOMM	50

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400844	VALLEY HOUSE % RICHARD REES	INACTIVE	TRANSIENT NONCOMM	75
2400845	LI'L SICILY PIZZA	INACTIVE	TRANSIENT NONCOMM	25
2400846	FOOTHILLS	INACTIVE	TRANSIENT NONCOMM	50
2400847	J & R LUNCHEONETTE	INACTIVE	TRANSIENT NONCOMM	40
2400848	GOULDS SUPERMARKET	ACTIVE	TRANSIENT NONCOMM	500
2400849	FRIEDMAN'S EXPRESS INC.	INACTIVE	NONTRANSIENT NONCOMM	130
2400850	THE BRITTANY HOUSE	INACTIVE	TRANSIENT NONCOMM	50
2400851	BURGER KING RESTAURANT	ACTIVE	TRANSIENT NONCOMM	900
2400852	HAZLE TOWNSHIP COMMUNITY PARK	ACTIVE	TRANSIENT NONCOMM	25
2400853	UNIMART 94338	ACTIVE	TRANSIENT NONCOMM	700
2400854	COUNTRY CARRY OUTS	INACTIVE	TRANSIENT NONCOMM	50
2400855	HICKORY CORNERS	INACTIVE	TRANSIENT NONCOMM	100
2400856	TRIPLE B STEAKS & MORE	INACTIVE	TRANSIENT NONCOMM	600
2400857	SUNSET GROCERY	INACTIVE	TRANSIENT NONCOMM	60
2400858	CARMEN'S COUNTRY INN	ACTIVE	TRANSIENT NONCOMM	200
2400859	STEWARTS DRIVE IN	ACTIVE	TRANSIENT NONCOMM	500
2400860	MILLER'S BAR	ACTIVE	TRANSIENT NONCOMM	25
2400861	KG % GEORGE YUHAS	INACTIVE	TRANSIENT NONCOMM	500
2400862	COUNTRYSIDE QUIK MART	ACTIVE	TRANSIENT NONCOMM	50
2400863	NEW EVERGREEN SPEEDWAY	INACTIVE	TRANSIENT NONCOMM	350
2400864	DRUMS FUEL STOP WATER SYS	INACTIVE	TRANSIENT NONCOMM	600
2400865	DALLAS DAIRY % J.YENASON	INACTIVE	TRANSIENT NONCOMM	25
2400866	VERIZON COMMUNICATIONS	ACTIVE	TRANSIENT NONCOMM	41
2400867	FERNBROOK GUEST HOME	INACTIVE	NONTRANSIENT NONCOMM	25
2400868	HARVEYS LAKE PFC ACCESS AREA	ACTIVE	TRANSIENT NONCOMM	200
2400869	TRAILING PINE CAMPGROUND	INACTIVE	TRANSIENT NONCOMM	25
2400870	CLEARBROOK MANOR	ACTIVE	NONTRANSIENT NONCOMM	75
2400871	DALLAS SHOPPING CENTER	ACTIVE	NONTRANSIENT NONCOMM	2,000
2400872	VILLA ROMA	ACTIVE	TRANSIENT NONCOMM	100
2400873	COMMONWEALTH TELEPHONE CO. %	INACTIVE	TRANSIENT NONCOMM	150
2400874	CHILDREN'S LEARNING CENTER %	INACTIVE	TRANSIENT NONCOMM	30
2400875	TOKYO JAPANESE CUISINE	INACTIVE	TRANSIENT NONCOMM	63
2400876	OLD CANNERY MINI MART	INACTIVE	TRANSIENT NONCOMM	20
2400877	RACE'S PIZZA BARN	INACTIVE	TRANSIENT NONCOMM	50
2400878	LENAHANS RESTAURANT	ACTIVE	TRANSIENT NONCOMM	35
2400879	LEAVE IT TO BEAVERS	INACTIVE	TRANSIENT NONCOMM	25
2400880	GOLDY'S MINI MART	INACTIVE	TRANSIENT NONCOMM	250
2400881	BRENNAN'S STEAKS & SAAKE	INACTIVE	TRANSIENT NONCOMM	25
2400882	FAITH UNITED METHODIST CHURCH	INACTIVE	TRANSIENT NONCOMM	25
2400883	HARVEY'S LAKE YACHT CLUB	ACTIVE	TRANSIENT NONCOMM	50
2400884	FARMER'S CO-OP	INACTIVE	TRANSIENT NONCOMM	28
2400885	FORKS CLUB AND BISTRO	ACTIVE	TRANSIENT NONCOMM	50
2400886	ZOLA'S LAMP POST	ACTIVE	TRANSIENT NONCOMM	25
2400887	GUS GENETTI HOTEL & RESTAURANT	ACTIVE	NONTRANSIENT NONCOMM	350
2400888	309 & 415 PLAZA	INACTIVE	TRANSIENT NONCOMM	145

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400890	CHATTERBOX SPORTS BAR	INACTIVE	TRANSIENT NONCOMM	25
2400891	BROTHERS SHIMS	ACTIVE	TRANSIENT NONCOMM	25
2400893	J & J DELI & BAKERY	INACTIVE	TRANSIENT NONCOMM	75
2400894	HILLSIDE FARMS DAIRY	ACTIVE	TRANSIENT NONCOMM	200
2400895	SOUTHDALE CAMP	INACTIVE	TRANSIENT NONCOMM	49
2400896	CONYNGHAM CHILDREN'S ACADEMY	INACTIVE	TRANSIENT NONCOMM	40
2400897	ROCK GLEN PARK & POOL COMPLEX	ACTIVE	TRANSIENT NONCOMM	25
2400898	CAMP KRESGE ON BEAVER LAKE	ACTIVE	TRANSIENT NONCOMM	40
2400899	MEATING HOUSE	ACTIVE	TRANSIENT NONCOMM	35
2400900	THE SURF AND TURF CLUB	INACTIVE	TRANSIENT NONCOMM	100
2400901	UNI MART MOUNTAINTOP	ACTIVE	TRANSIENT NONCOMM	500
2400902	LESANTE'S PLACE	INACTIVE	TRANSIENT NONCOMM	25
2400903	DYMOND'S FARM MARKET	ACTIVE	TRANSIENT NONCOMM	100
2400904	KNOTTY PINE CAFE	INACTIVE	TRANSIENT NONCOMM	25
2400905	LOU'S PIZZA & DELI	INACTIVE	TRANSIENT NONCOMM	25
2400906	VALLEY TENNIS & SWIM CLUB	ACTIVE	TRANSIENT NONCOMM	200
2400907	JEBBON MFG CORP	INACTIVE	NONTRANSIENT NONCOMM	54
2400908	OFFSET PAPER BACK MFGS. INC.	INACTIVE	NONTRANSIENT NONCOMM	560
2400910	TURKEY HILL STORE #180	ACTIVE	TRANSIENT NONCOMM	350
2400911	PENN MART PIKES CREEK	ACTIVE	TRANSIENT NONCOMM	150
2400912	PP & L'S CONSTRUCTION DEPT.	INACTIVE	NONTRANSIENT NONCOMM	40
2400913	ARBY'S	INACTIVE	TRANSIENT NONCOMM	1,600
2400914	SLOCUM DELI	INACTIVE	TRANSIENT NONCOMM	25
2400915	FARMER'S C0-OP DAIRY INC	INACTIVE	NONTRANSIENT NONCOMM	39
2400917	KARCHNER REF. SERVICE INC.	ACTIVE	TRANSIENT NONCOMM	25
2400919	HAZLE PARK PACKING	ACTIVE	NONTRANSIENT NONCOMM	50
2400920	J L MARKET	ACTIVE	TRANSIENT NONCOMM	115
2400921	LOOKOUT MOTOR LODGE	ACTIVE	TRANSIENT NONCOMM	25
2400922	PANTRY QUIK	ACTIVE	TRANSIENT NONCOMM	291
2400923	MOUNTAIN SPEEDWAY	INACTIVE	TRANSIENT NONCOMM	200
2400924	FAHRINGER'S MARKET	INACTIVE	TRANSIENT NONCOMM	440
2400925	RITTENHOUSE PLACE WATER SYS	ACTIVE	NONTRANSIENT NONCOMM	279
2400926	PEN MART SUBWAY	ACTIVE	TRANSIENT NONCOMM	50
2400927	SMALL WONDERS DAY CARE	INACTIVE	NONTRANSIENT NONCOMM	45
2400928	PALUCK'S FOOD CONCESSION'S	INACTIVE	TRANSIENT NONCOMM	25
2400929	MAPLE KNOLL WATER ASSOCIATION	INACTIVE	NONTRANSIENT NONCOMM	82
2400930	CROSSROADS COUNTRY STORE	INACTIVE	TRANSIENT NONCOMM	50
2400931	93 PLAZA	INACTIVE	TRANSIENT NONCOMM	60
2400932	LAKEVIEW MANOR	INACTIVE	NONTRANSIENT NONCOMM	25
2400933	RED ROCK GENERAL STORE	ACTIVE	TRANSIENT NONCOMM	50
2400934	PETRO QUICK	ACTIVE	TRANSIENT NONCOMM	25
2400935	AMERICAS BEST VALUE INN	ACTIVE	TRANSIENT NONCOMM	35
2400936	PIZZA BOYZ	INACTIVE	TRANSIENT NONCOMM	50
2400937	BACK M MOUNTAIN MEDICAL CENTER	INACTIVE	TRANSIENT NONCOMM	55
2400938	PPL WEST BUILDING	ACTIVE	TRANSIENT NONCOMM	35

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400939	CEASE TERRACE WATER ASSOC	ACTIVE	TRANSIENT NONCOMM	40
2400940	COUNCIL CUP CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	25
2400941	PILOT TRAVEL CENTER #298	ACTIVE	TRANSIENT NONCOMM	400
2400942	JONES PANCAKE HOUSE	INACTIVE	TRANSIENT NONCOMM	150
2400943	CARONE’S SUPERMARKET	INACTIVE	TRANSIENT NONCOMM	100
2400944	MICKEY’S GOLF CENTER	ACTIVE	TRANSIENT NONCOMM	125
2400945	MOTOR AGE	INACTIVE	TRANSIENT NONCOMM	30
2400946	COOKS VARIETY STORE	ACTIVE	TRANSIENT NONCOMM	75
2400947	LAUREL RESTAURANT	INACTIVE	TRANSIENT NONCOMM	30
2400948	ANDY’S MINI MARKET	ACTIVE	TRANSIENT NONCOMM	160
2400949	GEORGE ERNST MEMORIAL POOL	ACTIVE	TRANSIENT NONCOMM	150
2400950	THE HARDING TAVERN	INACTIVE	TRANSIENT NONCOMM	28
2400951	MUHLENBURG GENERAL STORE	INACTIVE	TRANSIENT NONCOMM	26
2400952	VALLEY VIEW HOTEL	INACTIVE	TRANSIENT NONCOMM	45
2400953	COOLBAUGH GULF FOOD MART	ACTIVE	TRANSIENT NONCOMM	40
2400954	MOUNTAIN FRESH SUPERMARKET	ACTIVE	TRANSIENT NONCOMM	100
2400956	SITKO’S BARN	ACTIVE	TRANSIENT NONCOMM	60
2400957	JACKIES RESTAURANT AND DELI	ACTIVE	TRANSIENT NONCOMM	25
2400958	HUNTSVILLE GOLF CLUB	ACTIVE	TRANSIENT NONCOMM	400
2400959	MARYS RESTAURANT	ACTIVE	TRANSIENT NONCOMM	108
2400960	REDS SUBS & PIZZA	ACTIVE	TRANSIENT NONCOMM	100
2400961	LUZERNE COUNTY FAIRGROUNDS	ACTIVE	TRANSIENT NONCOMM	1,000
2400962	ROD’S DELI	ACTIVE	TRANSIENT NONCOMM	45
2400963	GERRIE’S FITNESS CENTER	ACTIVE	TRANSIENT NONCOMM	100
2400964	SUGARLOAF TWP MUNIC BUILDING	ACTIVE	TRANSIENT NONCOMM	25
2400965	THE CHR AC OF GR IND BAP CH SL	INACTIVE	TRANSIENT NONCOMM	60
2400966	BROWNS SNACKS AND MORE	INACTIVE	TRANSIENT NONCOMM	25
2400967	CHECKERBOARD INN	ACTIVE	TRANSIENT NONCOMM	50
2400968	OUR COUNTRY SPOT	INACTIVE	TRANSIENT NONCOMM	10
2400970	SONRAE MARKET	ACTIVE	TRANSIENT NONCOMM	30
2400971	RAINBOW HILL SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	34
2400972	INDIAN LAKE INN	ACTIVE	TRANSIENT NONCOMM	25
2400973	UNIMART DALLAS	ACTIVE	TRANSIENT NONCOMM	150
2400974	TURNPIKE MOBIL	ACTIVE	TRANSIENT NONCOMM	50
2400975	BLUE RIDGE PLAZA	ACTIVE	TRANSIENT NONCOMM	100
2400976	PAMELAS	ACTIVE	TRANSIENT NONCOMM	60
2400978	SUNRISE RESTAURANT	ACTIVE	TRANSIENT NONCOMM	25
2400979	BALIETS COUNTRY CORNERS STORE	ACTIVE	TRANSIENT NONCOMM	400
2400980	RED ROCK MINI MART	INACTIVE	TRANSIENT NONCOMM	200
2400981	3J’S PIZZA	INACTIVE	TRANSIENT NONCOMM	25
2400982	BEAR CREEK CAFE	ACTIVE	TRANSIENT NONCOMM	25
2400983	SMITHS MKT	ACTIVE	TRANSIENT NONCOMM	30
2400984	GOOD TIME GOLF	INACTIVE	TRANSIENT NONCOMM	25
2400985	PUMP N PANTRY PIKES CREEK	ACTIVE	TRANSIENT NONCOMM	250
2400986	SUN HWA KOREAN BBQ RESTAURANT	ACTIVE	TRANSIENT NONCOMM	100

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2400987	COMMUNITY BIBLE CHURCH	INACTIVE	NONTRANSIENT NONCOMM	50
2400988	ROSSICK'S SOUTH MOUNTAIN DELI	INACTIVE	TRANSIENT NONCOMM	100
2400989	GROWING YEARS CHILD CARE CTR	ACTIVE	NONTRANSIENT NONCOMM	83
2400990	COMET FOOD MART	ACTIVE	TRANSIENT NONCOMM	125
2400991	BLUE RIDGE TRAIL GOLF CLUB	ACTIVE	TRANSIENT NONCOMM	100
2400992	SANDY BEACH INN	INACTIVE	TRANSIENT NONCOMM	100
2400993	KUNKLE FIRE CO.SOCIAL HALL	INACTIVE	TRANSIENT NONCOMM	50
2400994	PPL SUSQUEHANNA S&A WELLS	ACTIVE	NONTRANSIENT NONCOMM	2,200
2400995	RIVERLANDS RECREATION CENTER	ACTIVE	TRANSIENT NONCOMM	504
2400996	CREW QUARTERS BEACH HAVEN PP&L	INACTIVE	TRANSIENT NONCOMM	35
2400997	SUSQUEHANNA-SIMULATOR BLD PP&L	INACTIVE	TRANSIENT NONCOMM	50
2400999	PPL ENERGY INFORMATION CENTER	ACTIVE	TRANSIENT NONCOMM	50
2401000	TWIST N' SHAKE	ACTIVE	TRANSIENT NONCOMM	100
2401001	BLUE RIDGE PIZZA AND SUBS	ACTIVE	TRANSIENT NONCOMM	50
2401002	UNI MART BEAR CREEK	ACTIVE	TRANSIENT NONCOMM	400
2401003	J & N MINI MART	ACTIVE	TRANSIENT NONCOMM	500
2401004	POND HILL LILY LAKE FIRE CLUB	INACTIVE	TRANSIENT NONCOMM	25
2401005	SWIRES COUNTRY MARKET & DELI	INACTIVE	TRANSIENT NONCOMM	75
2401006	STREAMSIDE INN	INACTIVE	TRANSIENT NONCOMM	100
2401007	PIKES CREEK BEVERAGE	ACTIVE	TRANSIENT NONCOMM	100
2401008	SCATTONS RESTAURANT	ACTIVE	TRANSIENT NONCOMM	25
2401009	FOUR CORNERS MARKET & DELI	ACTIVE	TRANSIENT NONCOMM	26
2401010	NEW DRUMS ELEMENTARY SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	400
2401011	WENDYS RESTAURANT DRUMS	ACTIVE	TRANSIENT NONCOMM	1,000
2401012	KISHBAUGHS GENERAL STORE	INACTIVE	TRANSIENT NONCOMM	150
2401013	MARIANNE S HANIFY CATERING	INACTIVE	TRANSIENT NONCOMM	25
2401019	SAND SPRINGS GOLF COURSE	INACTIVE	TRANSIENT NONCOMM	75
2401020	VESUVIOS PIZZERIA	ACTIVE	TRANSIENT NONCOMM	100
2401021	CAN DO CORPORATE CENTER	ACTIVE	COMMUNITY	300
2401022	THE ICE HOUSE PUB	ACTIVE	TRANSIENT NONCOMM	25
2401023	STONE MEADOWS GOLF COURSE	INACTIVE	TRANSIENT NONCOMM	200
2401024	THE MORRIS FAMILY MARKET	INACTIVE	TRANSIENT NONCOMM	50
2401025	BIG TEN SUBS AND PIZZA	ACTIVE	TRANSIENT NONCOMM	50
2401026	BERYL ANNS BAKERY	INACTIVE	TRANSIENT NONCOMM	25
2401027	EDIBLE ART	INACTIVE	TRANSIENT NONCOMM	25
2401028	TOBYS CREEK ANTIQUES	INACTIVE	TRANSIENT NONCOMM	50
2401029	VFW 6615	ACTIVE	TRANSIENT NONCOMM	25
2401030	ITS A LIFESAVER	ACTIVE	TRANSIENT NONCOMM	25
2401031	VALLEY BROOK ARCADE	INACTIVE	TRANSIENT NONCOMM	25
2401032	ROCK RECREATION CENTER	ACTIVE	TRANSIENT NONCOMM	71
2401033	C J CITGO & SONS	INACTIVE	TRANSIENT NONCOMM	50
2401034	APPLEWOOD GOLF COURSE	ACTIVE	TRANSIENT NONCOMM	50
2401035	HOT DIGGITTY DOG	ACTIVE	TRANSIENT NONCOMM	25
2401036	FINE EUROPEAN CATERING	INACTIVE	TRANSIENT NONCOMM	25
2401038	ST PAULS LUTHERAN CHURCH	ACTIVE	TRANSIENT NONCOMM	200

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
2401039	COUNTRY PLACE RETREAT	ACTIVE	TRANSIENT NONCOMM	25
2401040	HARVEYS LAKE COUNTRY STORE	ACTIVE	TRANSIENT NONCOMM	3
2401041	ST JOHNS DELI	INACTIVE	TRANSIENT NONCOMM	25
2401042	DELI CAFE	INACTIVE	TRANSIENT NONCOMM	25
2401047	NESCOPECK STATE PARK	ACTIVE	TRANSIENT NONCOMM	50
2401048	LAKE SILKWORTH SEAFOOD	ACTIVE	TRANSIENT NONCOMM	5
2401050	PROSHOT BASKETBALL CAMP	INACTIVE	TRANSIENT NONCOMM	250
2401051	SORBERS CATERING	ACTIVE	TRANSIENT NONCOMM	2
2401052	KATHYS SUBS	INACTIVE	TRANSIENT NONCOMM	25
2401053	JANETS KRAZY KONE	ACTIVE	TRANSIENT NONCOMM	25
2401054	NOTHING BUT DUMPLINGS	INACTIVE	TRANSIENT NONCOMM	25
2401055	SWEET VALLEY DO IT BEST HOTDOG	INACTIVE	TRANSIENT NONCOMM	25
2401056	SUSIES BAKED GOODIES	INACTIVE	TRANSIENT NONCOMM	25
2401057	PAST PRESENT FUTURE CUISINE	ACTIVE	TRANSIENT NONCOMM	25
2401058	CHILDRENS WONDERLAND	ACTIVE	NONTRANSIENT NONCOMM	60
2401059	ROSIES KITCHEN	ACTIVE	TRANSIENT NONCOMM	25
2401060	1 2 3 SCOOPS	ACTIVE	TRANSIENT NONCOMM	25
2401061	FC HARMONY PCH	ACTIVE	NONTRANSIENT NONCOMM	26
2401062	PARADISE CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	25
2401063	PATIO BAR AND GRILL	INACTIVE	TRANSIENT NONCOMM	25
2401065	SHADY RILL FARM & BAKERY	ACTIVE	TRANSIENT NONCOMM	25
2401066	WHEELS BAR AND GRILL	ACTIVE	TRANSIENT NONCOMM	25
2401067	HOLY PROTECTION MONASTERY	ACTIVE	TRANSIENT NONCOMM	25
2401068	LIBERTY EXXON	ACTIVE	TRANSIENT NONCOMM	25
2401070	COOKIES CAFE	ACTIVE	TRANSIENT NONCOMM	25
2401071	THE BENJAMIN HARVEY INN	INACTIVE	TRANSIENT NONCOMM	1
2406006	GLEN SUMMIT SPRINGS WATER	ACTIVE	BOTTLED WATER	5,500
2406035	THREE SPRINGS BOTTLED WATER	ACTIVE	BOTTLED WATER	3,500
2406233	TAYLOR SPRINGS BOTTLED WATER	INACTIVE	BOTTLED WATER	3,500
2406258	MONROE BOTTLING CO	ACTIVE	BOTTLED WATER	3,500
2406272	SUTTON SPRINGS	ACTIVE	BOTTLED WATER	555
2406424	SAND SPRINGS	INACTIVE	BULK WATER HAULER	25
2406498	TULPEHOCKEN SPRINGS WATER CO	ACTIVE	BULK WATER HAULER	5,000
2406524	HAZLETON AREA WATER CO	ACTIVE	BULK WATER HAULER	25
2406545	WHITE HAVEN MOUNTAIN SPRINGS	ACTIVE	BULK WATER HAULER	25
2408006	HAZLETON CITY AUTH WATER DEPT.	INACTIVE	COMMUNITY	1,975
2408007	HCA DELANO PARK PLACE	ACTIVE	COMMUNITY	1,017
2408009	HAZLETON CITY AUTH WATER DEPT.	INACTIVE	COMMUNITY	1,083
2408010	HAZLETON CITY AUTH WATER DEPT.	INACTIVE	COMMUNITY	642
2408011	HCA TOMHICKEN	ACTIVE	COMMUNITY	123
2408012	HCA DERRINGER FERN GLEN	ACTIVE	COMMUNITY	276
2450920	BLUE RIDGE REAL ESTATE OFFICE	INACTIVE	TRANSIENT NONCOMM	25
Columbia County				
4190002	NUTAITIS MOBILE HOME PARK	INACTIVE	COMMUNITY	19
4190004	BELLWOOD TRAILER COURT	INACTIVE	COMMUNITY	15

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}

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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
4190005	BERLIN’S MOBILE HOME PARK	INACTIVE	COMMUNITY	31
4190006	HIDDEN HEIGHTS MOBILE HOME PK.	INACTIVE	COMMUNITY	84
4190007	J M MOBILE HOME PK %J&M REALTY	INACTIVE	COMMUNITY	42
4190010	BREECHS MOBILE HOME PARK	INACTIVE	COMMUNITY	28
4190011	CATAWISSA MUNICIPAL WATER AUTH	ACTIVE	COMMUNITY	1,580
4190012	ORANGEVILLE MUNICIPAL WATER AU	ACTIVE	COMMUNITY	480
4190013	PA AMERICAN WATER BERWICK	ACTIVE	COMMUNITY	16,000
4190015	WONDERVIEW WATER CO	ACTIVE	COMMUNITY	320
4190016	MIFFLIN TWP MA	ACTIVE	COMMUNITY	900
4190018	SCENIC KNOLLS	INACTIVE	COMMUNITY	140
4190019	BROOKSIDE VILLAGE MHP	ACTIVE	COMMUNITY	475
4190020	STONY BROOK CIRCLE MHP	ACTIVE	COMMUNITY	400
4190021	MOUNTAIN VIEW ESTATES	ACTIVE	COMMUNITY	80
4190024	RIDGECREST HOMES	INACTIVE	COMMUNITY	150
4190025	LEHET TRAILER COURT	INACTIVE	COMMUNITY	25
4190026	BALANCED CARE AT BLOOMSBURG II	ACTIVE	COMMUNITY	60
4190282	NEWHARTS MOBILE HOME PARK	INACTIVE	COMMUNITY	30
4190283	BERLIN’S TRAILER COURT	INACTIVE	COMMUNITY	25
4190284	CREEKSIDE HEALTH CARE CENTER	INACTIVE	COMMUNITY	36
4190285	ORANGEVILLE N & R CENTER	ACTIVE	COMMUNITY	118
4190286	HELLER’S MOBILE HOME PARK	ACTIVE	COMMUNITY	47
4190287	COUNTRY ESTATE COURT	INACTIVE	COMMUNITY	60
4190288	OUTLOOK PT COMM AT EYERS GROVE	INACTIVE	COMMUNITY	60
4190289	HERITAGE HILLSIDE ESTATES	ACTIVE	COMMUNITY	90
4190290	CLOSSEN MOBILE HOME PARK	INACTIVE	COMMUNITY	32
4190291	COUNTRY ACRES MOBILE HOME PARK	INACTIVE	COMMUNITY	42
4190293	KARNES TRAILER COURT	INACTIVE	COMMUNITY	25
4190294	BRIAR CREEK MANOR	INACTIVE	COMMUNITY	75
4190295	MATRIX DEVELOPMENT INC.	INACTIVE	COMMUNITY	59
4190296	PLEASANT VIEW ESTATES	ACTIVE	COMMUNITY	390
4190297	WALTERS MOBILE HOME COURT	INACTIVE	COMMUNITY	23
4190298	COUNTRY TERRACE ESTATES	ACTIVE	COMMUNITY	61
4190300	CENTRAL PARK HOTEL	ACTIVE	TRANSIENT NONCOMM	25
4190301	JAMISON CITY HOTEL	ACTIVE	TRANSIENT NONCOMM	25
4190302	ELK GROVE INN	ACTIVE	TRANSIENT NONCOMM	25
4190304	WATER WHEEL CAMPGROUND	INACTIVE	TRANSIENT NONCOMM	450
4190305	3 SPRINGS LAKE CAMPGROUND	INACTIVE	TRANSIENT NONCOMM	45
4190306	WHISPERING PINES CAMPING EST	ACTIVE	TRANSIENT NONCOMM	55
4190307	HICKORY JOE’S	INACTIVE	TRANSIENT NONCOMM	25
4190308	NEWHARTS MOBILE HOME PARK	INACTIVE	COMMUNITY	5
4190309	DIGGERS DIVERSION	ACTIVE	TRANSIENT NONCOMM	25
4190311	CREEKSIDE FAMILY RESTAURANT	ACTIVE	TRANSIENT NONCOMM	25
4190313	STREVIGS RESTAURANT	ACTIVE	TRANSIENT NONCOMM	25
4190314	THE INN UNDER	ACTIVE	TRANSIENT NONCOMM	25
4190316	THE STANLEY CENTER	ACTIVE	NONTRANSIENT NONCOMM	70

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}

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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
4190317	DEIHL'S CAMPING RESORT	ACTIVE	TRANSIENT NONCOMM	100
4190318	HERITAGE HOUSE FAMILY REST	ACTIVE	TRANSIENT NONCOMM	25
4190320	BECKY'S PLACE	ACTIVE	TRANSIENT NONCOMM	25
4190321	DENNY'S	INACTIVE	TRANSIENT NONCOMM	25
4190322	THE INN AT BUCKHORN	INACTIVE	TRANSIENT NONCOMM	120
4190323	NUTAITIS INN	INACTIVE	TRANSIENT NONCOMM	25
4190324	OLYMPIC FLAME DINER	INACTIVE	TRANSIENT NONCOMM	75
4190325	SCOREBOARD SPORTS TAVERN	ACTIVE	TRANSIENT NONCOMM	25
4190326	WONDER YEARS PRESCHOOL	ACTIVE	NONTRANSIENT NONCOMM	25
4190327	COBBLESTONE INN	ACTIVE	TRANSIENT NONCOMM	25
4190328	BURGER KING	INACTIVE	TRANSIENT NONCOMM	25
4190329	HUD'S RESTAURANT	INACTIVE	TRANSIENT NONCOMM	25
4190330	ROMEO'S DRIVE IN	INACTIVE	TRANSIENT NONCOMM	25
4190332	COLUMBIA MONTOUR AREA VO TECH	INACTIVE	NONTRANSIENT NONCOMM	741
4190333	TENNY TOWN MOTEL	ACTIVE	TRANSIENT NONCOMM	40
4190334	KEMLER'S RESTAURANT	ACTIVE	TRANSIENT NONCOMM	25
4190335	RED MAPLE MOTEL	INACTIVE	TRANSIENT NONCOMM	30
4190336	TAPS SPORTS BAR & GRILL	ACTIVE	TRANSIENT NONCOMM	25
4190337	ZEPHYR DINER	INACTIVE	TRANSIENT NONCOMM	250
4190340	HASKELL TRAILER COURT	INACTIVE	COMMUNITY	40
4190341	FRAN'S DAIRY BAR	ACTIVE	TRANSIENT NONCOMM	25
4190343	HOTEL IOLA	ACTIVE	TRANSIENT NONCOMM	25
4190345	BASSETT'S	ACTIVE	TRANSIENT NONCOMM	25
4190346	PARADISE ISLE	INACTIVE	TRANSIENT NONCOMM	25
4190349	MAY'S DRIVE IN	ACTIVE	TRANSIENT NONCOMM	25
4190351	STONE CASTLE MOTEL	ACTIVE	TRANSIENT NONCOMM	80
4190352	CATAWISSA AMERICAN LEGION	ACTIVE	TRANSIENT NONCOMM	25
4190353	TOM'S FAMILY RESTAURANT	ACTIVE	TRANSIENT NONCOMM	25
4190355	LAKE GLORY CAMPSITES	ACTIVE	TRANSIENT NONCOMM	80
4190356	BOB'S DAIRY BAR	INACTIVE	TRANSIENT NONCOMM	200
4190357	THE LARIAT	INACTIVE	TRANSIENT NONCOMM	75
4190360	SOUTHERN COLUMBIA AREA SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	1,650
4190361	J & D CREE MEE FREEZE	ACTIVE	TRANSIENT NONCOMM	25
4190363	CATACOVE CAMPGROUND	INACTIVE	TRANSIENT NONCOMM	100
4190364	SCOTCH VALLEY RESTAURANT	ACTIVE	TRANSIENT NONCOMM	25
4190365	KEYSERS CAFE	INACTIVE	TRANSIENT NONCOMM	25
4190368	LIGHTSTREET HOTEL	ACTIVE	TRANSIENT NONCOMM	25
4190369	TRAVEL CENTERS OF AMERICA	INACTIVE	NONTRANSIENT NONCOMM	100
4190370	DEL MONTE CORPORATION	ACTIVE	NONTRANSIENT NONCOMM	600
4190372	ROLLING PINES GOLF COURSE	ACTIVE	TRANSIENT NONCOMM	25
4190377	JERSEYTOWN TAVERN	ACTIVE	TRANSIENT NONCOMM	25
4190378	WALTERS MOBILE HOME COURT	INACTIVE	COMMUNITY	45
4190379	TURNERS HIGH VIEW CAMPING AREA	ACTIVE	TRANSIENT NONCOMM	92
4190381	CAMP LAVIGNE	ACTIVE	TRANSIENT NONCOMM	150
4190383	GRASSMERE PARK CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	70

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
4190384	IDEAL PARK	ACTIVE	TRANSIENT NONCOMM	100
4190392	THE VILLAGE INN	ACTIVE	TRANSIENT NONCOMM	25
4190398	KNOEBELS GROVE PARK	ACTIVE	NONTRANSIENT NONCOMM	4,000
4190801	BENTON VFW	ACTIVE	TRANSIENT NONCOMM	25
4190802	PONDUCE FARMS	ACTIVE	TRANSIENT NONCOMM	25
4190803	PENNDOT-SITE 37 MODERN REST AR	ACTIVE	TRANSIENT NONCOMM	800
4190804	PENNDOT-SITE 38 MODERN REST AR	ACTIVE	TRANSIENT NONCOMM	800
4190805	INDIAN HEAD CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	25
4190808	SEASONS DADS	ACTIVE	TRANSIENT NONCOMM	25
4190810	VAL’S SCOOP & SERVE	INACTIVE	TRANSIENT NONCOMM	25
4190811	MADISON COMM.CTR. %	INACTIVE	TRANSIENT NONCOMM	25
4190812	GREENWOOD FRIENDS SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	100
4190815	J & D CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	225
4190816	THE SURGERY CENTER	ACTIVE	TRANSIENT NONCOMM	25
4190817	JDS INN	ACTIVE	TRANSIENT NONCOMM	25
4190819	FOUGHT’S LABOR CAMP	INACTIVE	TRANSIENT NONCOMM	25
4190820	CAMP EPACHISECA	ACTIVE	TRANSIENT NONCOMM	50
4190821	CAMP LOUISE	ACTIVE	TRANSIENT NONCOMM	25
4190822	BRIAR CREEK PARK	ACTIVE	TRANSIENT NONCOMM	25
4190823	BERWICK GOLF CLUB	ACTIVE	TRANSIENT NONCOMM	25
4190824	BER-VAUGHN PARK	ACTIVE	TRANSIENT NONCOMM	25
4190825	BEAVER-MAIN ELEM. SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	131
4190826	ROMIG’S FIVE STAR SALOON	INACTIVE	TRANSIENT NONCOMM	25
4190827	CHINA QUEEN	ACTIVE	TRANSIENT NONCOMM	25
4190828	WEST CREEK GAP CAMPSITES	INACTIVE	TRANSIENT NONCOMM	25
4190830	TERRAPIN’S CANTINA	ACTIVE	TRANSIENT NONCOMM	25
4190831	SHADY REST CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	86
4190832	RIDGWAY’S	INACTIVE	TRANSIENT NONCOMM	25
4190833	PINE PRIMARY CENTER	INACTIVE	NONTRANSIENT NONCOMM	140
4190834	BUSTERS OUTBACK BAR & GRILL	ACTIVE	TRANSIENT NONCOMM	25
4190836	MILL RACE GOLF & CAMP. RESORT	ACTIVE	TRANSIENT NONCOMM	25
4190837	TWIN BRIDGES PARK	ACTIVE	TRANSIENT NONCOMM	25
4190838	TIKI LOUNGE	ACTIVE	TRANSIENT NONCOMM	25
4190839	GARDELLO RESTAURANT	ACTIVE	TRANSIENT NONCOMM	25
4190840	UNITED WATER PA COL CO IND PK	ACTIVE	COMMUNITY	138
4190844	INN AT TURKEY HILL	INACTIVE	TRANSIENT NONCOMM	25
4190845	FORT MCCLURE VFW POST 804	INACTIVE	TRANSIENT NONCOMM	25
4190846	BERWICK AREA POOL	ACTIVE	TRANSIENT NONCOMM	25
4190847	BLOOMSBURG STATE POLICE STAT.	INACTIVE	TRANSIENT NONCOMM	25
4190848	WESTERN SIZZLIN STEAK HOUSE	INACTIVE	TRANSIENT NONCOMM	200
4190849	BONANZA FAMILY RESTAURANT	INACTIVE	TRANSIENT NONCOMM	100
4190850	WOLFEY’S PIZZA DEN	INACTIVE	TRANSIENT NONCOMM	25
4190851	MIKEYS ROADHOUSE	INACTIVE	TRANSIENT NONCOMM	25
4190852	PARR’S PIZZA	INACTIVE	TRANSIENT NONCOMM	25
4190853	SUNOCO 2341	INACTIVE	TRANSIENT NONCOMM	25

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
4190854	SUNOCO A 2343	INACTIVE	TRANSIENT NONCOMM	25
4190855	ARNOLD'S GOLF COURSE	ACTIVE	TRANSIENT NONCOMM	25
4190856	WENDY'S OLD FASH HAMBURGERS	INACTIVE	TRANSIENT NONCOMM	25
4190857	BIG EARL AUTO-TRUCK STOP	INACTIVE	TRANSIENT NONCOMM	100
4190858	PARAGON LABOR CAMP 2.	INACTIVE	TRANSIENT NONCOMM	45
4190859	PARAGON LABOR CAMP 1	INACTIVE	TRANSIENT NONCOMM	56
4190860	RAINBOW HILL SCHOOL	INACTIVE	TRANSIENT NONCOMM	25
4190861	BRASS PELICAN	ACTIVE	TRANSIENT NONCOMM	25
4190862	ECONO LODGE OF BLOOMSBURG	ACTIVE	TRANSIENT NONCOMM	50
4190863	GUMP'S COUNTRY STORE	INACTIVE	TRANSIENT NONCOMM	25
4190864	MONTESSORI CHILDREN'S HOUSE	INACTIVE	NONTRANSIENT NONCOMM	25
4190865	HESS MARKET	ACTIVE	TRANSIENT NONCOMM	25
4190866	RUTH'S	INACTIVE	TRANSIENT NONCOMM	50
4190867	BLOOMSBURG CLINIC	INACTIVE	TRANSIENT NONCOMM	30
4190868	NUMIDIA RACEWAY	INACTIVE	TRANSIENT NONCOMM	25
4190869	LONG JOHN SILVER'S 3655	INACTIVE	TRANSIENT NONCOMM	25
4190870	QUAKER STEAK AND LUBE	ACTIVE	TRANSIENT NONCOMM	25
4190871	COLUMBIA MALL	ACTIVE	NONTRANSIENT NONCOMM	2,000
4190872	J&B COUNTRY STORE	ACTIVE	TRANSIENT NONCOMM	25
4190873	KENTUCKY FRIED CHICKEN	ACTIVE	TRANSIENT NONCOMM	25
4190874	VITAL LIFE	INACTIVE	TRANSIENT NONCOMM	25
4190875	MILLVILLE AMERICAN LEGION	ACTIVE	TRANSIENT NONCOMM	25
4190876	GEISINGER OFFICE BUILDING 2	ACTIVE	NONTRANSIENT NONCOMM	165
4190877	PORKY'S BAR-B-Q	INACTIVE	TRANSIENT NONCOMM	75
4190878	PATRIOT INN	INACTIVE	TRANSIENT NONCOMM	48
4190879	HAMLET'S FAMILY RESTAURANT	INACTIVE	TRANSIENT NONCOMM	150
4190880	SHORT STOP MART	ACTIVE	TRANSIENT NONCOMM	25
4190881	RISHELS FARM MARKET	INACTIVE	TRANSIENT NONCOMM	25
4190882	MOUNT ZION FAMILY CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	40
4190883	MELONIE'S KOLD KUP	ACTIVE	TRANSIENT NONCOMM	25
4190884	BENTON RIVERSIDE MARKET	ACTIVE	TRANSIENT NONCOMM	25
4190885	THE PAMPERED PALATE	INACTIVE	TRANSIENT NONCOMM	10
4190886	THE CANNERY STORE	INACTIVE	TRANSIENT NONCOMM	28
4190887	YOST FARM MARKET & DELI	INACTIVE	TRANSIENT NONCOMM	50
4190888	SAM'S GRAND	INACTIVE	TRANSIENT NONCOMM	25
4190889	KLEERDEX CO.	ACTIVE	NONTRANSIENT NONCOMM	93
4190890	BLOOMSBURG CARPET IND., INC.	INACTIVE	NONTRANSIENT NONCOMM	190
4190891	DOMINOS PIZZA	INACTIVE	TRANSIENT NONCOMM	25
4190892	WISE FOODS INC.	ACTIVE	NONTRANSIENT NONCOMM	600
4190893	ROHBACH'S FARM MARKET	INACTIVE	TRANSIENT NONCOMM	25
4190895	DAIRY QUEEN	INACTIVE	TRANSIENT NONCOMM	25
4190896	MAUSTELLER'S MARKET	INACTIVE	TRANSIENT NONCOMM	25
4190897	SUBWAY	INACTIVE	TRANSIENT NONCOMM	25
4190898	CAMP VICTORY	ACTIVE	TRANSIENT NONCOMM	150
4190899	BURGER KING 8697	ACTIVE	TRANSIENT NONCOMM	25

Table 2.4-50— {Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}
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PWSID	SYSTEM NAME	STATUS	SYSTEM TYPE	POPULATION SERVED
4190900	WENDY'S	ACTIVE	TRANSIENT NONCOMM	25
4190901	BENTON FOUNDRY, INC.	ACTIVE	NONTRANSIENT NONCOMM	175
4190902	TRAVEL CENTERS OF AMER SUBWAY	INACTIVE	TRANSIENT NONCOMM	25
4190903	WELLERS	INACTIVE	TRANSIENT NONCOMM	25
4190904	PENNA STATE POLICE BLOOMSBURG	ACTIVE	TRANSIENT NONCOMM	25
4190905	BLOOMSBURG CHRISTIAN SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	80
4190906	SAW MILL ROAD OFFICE BLDG	ACTIVE	NONTRANSIENT NONCOMM	150
4190907	DIEHL'S COUNTRY GIFTS	INACTIVE	TRANSIENT NONCOMM	25
4190908	UNI MART 4340	INACTIVE	TRANSIENT NONCOMM	25
4190909	NEENA PETROLEUM INC	ACTIVE	TRANSIENT NONCOMM	25
4190910	CRACKER BARREL OLD CT STO 435	INACTIVE	NONTRANSIENT NONCOMM	118
4190911	COLUMBIA CO CHRISTIAN SCHOOL	ACTIVE	NONTRANSIENT NONCOMM	214
4190912	CINEMA CENTER	ACTIVE	TRANSIENT NONCOMM	25
4190913	FRESH N QUIK	ACTIVE	TRANSIENT NONCOMM	25
4190914	BLOOMSBURG SHOPPING CENTER	INACTIVE	TRANSIENT NONCOMM	25
4190915	PORTABELLA CATERING	ACTIVE	TRANSIENT NONCOMM	25
4190916	WINDSOR HEIGHTS CLUBHOUSE	ACTIVE	TRANSIENT NONCOMM	40
4190917	ACORN ACRES CAMPGROUND	ACTIVE	TRANSIENT NONCOMM	25
4190918	RITAS ITALIAN ICE	ACTIVE	TRANSIENT NONCOMM	25
4190919	FAIRTYME FOOD AND FUN	INACTIVE	TRANSIENT NONCOMM	25
4190920	MUSTANG SALLYS	ACTIVE	TRANSIENT NONCOMM	25
4190921	THE BARBQ PIT	INACTIVE	TRANSIENT NONCOMM	25
4190999	PPL ELECTRIC UTILITIES CORP	ACTIVE	NONTRANSIENT NONCOMM	50
4410926	SHULTZ COFFEE HOUSE	INACTIVE	TRANSIENT NONCOMM	

Table 2.4-51— {Horizontal Hydraulic Gradients}

Groundwater Flow Pathline	Upgradient Point	Downgradient Point	Pathline Distance (ft)	Head Loss Along Flowline (ft)				Horizontal Gradient (ft/ft)			
				Oct. 2007	Jan. 2008	Mar. 2008	July 2008	Oct. 2007	Jan. 2008	Mar. 2008	July 2008
Glacial Overburden Aquifer											
GO1	MW304A	MW302A1	2,000	10.36	9.48	8.31	10.51	0.0052	0.0047	0.0042	0.00526
GO2	MW302A1	MW301A	1,500	2.67	3.89	4.52	2.77	0.0018	0.0026	0.0030	0.00185
GO3	MW301A	Pond G8	450	1.85	3.64	5.03	2.38	0.0041	0.0081	0.0112	0.00528
Shallow Bedrock Aquifer											
SB1	MW319B	MW310B	900	44.21	54.38	55.47	50.70	0.0491	0.0604	0.0616	0.0563
SB2	MW301B	MW312B	300	7.35	2.38	2.42	2.50	0.0245	0.0079	0.0081	0.0083
SB3	MW315B	MW316B	450	25.43	25.73	24.27	24.70	0.0565	0.0572	0.0539	0.0549
SB4	MW316B	MW317B	490	32.18	32.76	30.87	33.48	0.0657	0.0669	0.0630	0.0683
SB5	MW317B	MW308B	1425	65.20	60.30	74.22	67.04	0.0458	0.0423	0.0521	0.0471
SB6	MW313B	MW308B	600	60.96	57.76	71.28	65.09	0.1016	0.0963	0.1188	0.1085
Deep Bedrock Aquifer											
DB1	MW303C	MW306C	2,700	48.20	47.39	46.88	41.60	0.0179	0.0176	0.0174	0.0154
DB2	MW303C	MW307B	4,050	92.35	77.32	67.18	85.83	0.0228	0.0191	0.0166	0.0212

Table 2.4-52— {Vertical Hydraulic Gradients and Flow Directions}

(Page 1 of 2)

Well Pair	Date	Gradient A to B	Gradient A to C	Gradient B to C	Gradient A1 to A2	Flow Direction
MW301A - MW301B1	11/29/2007	-0.0182	-----	-----	-----	upward
	1/26/2008	-0.0330	-----	-----	-----	upward
	3/24/2008	-0.0111	-----	-----	-----	upward
	7/23/2008	-0.0147	-----	-----	-----	upward
MW302A1 - MW302B[1,2]	11/29/2007	-----	-0.0376	-----	-----	upward
	1/26/2008	-----	-0.0330	-----	-----	upward
	3/24/2008	-----	-0.0201	-----	-----	upward
	7/23/2008	-----	-0.0499	-----	-----	upward
MW303A - MW303B	11/29/2007	-0.0860	-----	-----	-----	upward
	1/26/2008	-0.0514	-----	-----	-----	upward
	3/24/2008	-0.0490	-----	-----	-----	upward
	7/23/2008	-0.0332	-----	-----	-----	upward
MW303A - MW303C	11/29/2007	-----	0.0379	-----	-----	downward
	1/26/2008	-----	0.0465	-----	-----	downward
	3/24/2008	-----	0.0569	-----	-----	downward
	7/23/2008	-----	-0.0709	-----	-----	downward
MW303B - MW303C	11/29/2007	-----	-----	0.0900	-----	downward
	1/26/2008	-----	-----	0.0876	-----	downward
	3/24/2008	-----	-----	0.1013	-----	downward
	7/23/2008	-----	-----	0.1145	-----	downward
MW304A - MW304B	11/29/2007	0.0017	-----	-----	-----	downward
	1/26/2008	0.0031	-----	-----	-----	downward
	3/24/2008	0.0042	-----	-----	-----	downward
	7/23/2008	0.0040	-----	-----	-----	downward
MW304A - MW304C	11/29/2007	-----	0.0095	-----	-----	downward
	1/26/2008	-----	0.0018	-----	-----	downward
	3/24/2008	-----	0.0029	-----	-----	downward
	7/23/2008	-----	0.0012	-----	-----	downward
MW304B - MW304C	11/29/2007	-----	-----	0.0148	-----	downward
	1/26/2008	-----	-----	0.0008	-----	downward
	3/24/2008	-----	-----	0.0020	-----	downward
	7/23/2008	-----	-----	0.0007	-----	downward
MW305A1 - MW305B	11/29/2007	0.0026	-----	-----	-----	downward
	1/26/2008	0.0153	-----	-----	-----	downward
	3/24/2008	0.0094	-----	-----	-----	downward
	7/23/2008	0.0032	-----	-----	-----	downward
MW305A2 - MW305B	11/29/2007	0.0012	-----	-----	-----	downward
	1/26/2008	0.0014	-----	-----	-----	downward
	3/24/2008	0.0022	-----	-----	-----	downward
	7/23/2008	0.0005	-----	-----	-----	downward
MW305A1 - MW305A2	11/29/2007	-----	-----	-----	0.0054	downward
	1/26/2008	-----	-----	-----	0.0126	downward
	3/24/2008	-----	-----	-----	0.0234	downward
	7/23/2008	-----	-----	-----	0.0084	downward

Table 2.4-52— {Vertical Hydraulic Gradients and Flow Directions}
(Page 2 of 2)

Well Pair	Date	Gradient A to B	Gradient A to C	Gradient B to C	Gradient A1 to A2	Flow Direction
MW306A - MW306C	11/29/2007	-----	-0.0023	-----	-----	upward
	1/26/2008	-----	-0.0031	-----	-----	upward
	3/24/2008	-----	-0.0027	-----	-----	upward
	7/23/2008	-----	-0.0075	-----	-----	upward
MW307A - MW307B(1)	11/29/2007	-----	0.2921	-----	-----	downward
	1/26/2008	-----	0.2506	-----	-----	downward
	3/24/2008	-----	0.2094	-----	-----	downward
	7/23/2008	-----	0.3113	-----	-----	downward
MW308A - MW308B	11/29/2007	1.3143	-----	-----	-----	downward
	1/26/2008	1.2232	-----	-----	-----	downward
	3/24/2008	1.4998	-----	-----	-----	downward
	7/23/2008	1.4089	-----	-----	-----	downward
MW309A - MW309B	11/29/2007	0.0176	-----	-----	-----	downward
	1/26/2008	0.0196	-----	-----	-----	downward
	3/24/2008	0.0241	-----	-----	-----	downward
	7/23/2008	0.0029	-----	-----	-----	downward
MW310A - MW310B	11/29/2007	-0.0732	-----	-----	-----	upward
	1/26/2008	-0.0862	-----	-----	-----	upward
	3/24/2008	-0.0799	-----	-----	-----	upward
	7/23/2008	-0.0920	-----	-----	-----	downward
MW310A - MW310C (2)	11/29/2007	-----	-0.1117	-----	-----	upward
	1/26/2008	-----	-0.1132	-----	-----	upward
	3/24/2008	-----	-0.1023	-----	-----	upward
	7/23/2008	-----	-0.1272	-----	-----	downward
MW310B - MW310C (2)	11/29/2007	-----	-----	-0.1355	-----	upward
	1/26/2008	-----	-----	-0.1300	-----	upward
	3/24/2008	-----	-----	-0.1162	-----	upward
	7/23/2008	-----	-----	-0.1491	-----	downward

Notes:
(1) Monitoring wells MW302B and MW307B were drilled deeper than originally planned; as a result, the wells have been reclassified as a Deep Bedrock wells (i.e., "C" wells)
(2) Monitoring wells MW302B and MW307B are artesian with water flowing from the wells. Hydraulic heads for wells MW302B and MW310C were set at the top of riser pipe for purposes of calculating vertical gradients.

Table 2.4-53— {Hydraulic Conductivity Values Based on Slug Tests}

Well ID	Kh (ft/day)	Kh (ft/s)	Kh (cm/s)
Glacial Overburden Wells			
MW301A	3.39E+01	3.92E-04	1.20E-02
MW302A1	7.36E+01	8.52E-04	2.60E-02
MW302A2	5.69E+01	6.59E-04	2.01E-02
MW302A3	7.25E+01	8.39E-04	2.56E-02
MW302A4	7.92E+01	9.17E-04	2.79E-02
MW303A	3.70E-02	4.28E-07	1.31E-05
MW304A	3.07E+01	3.55E-04	1.08E-02
MW305A1	6.04E+00	6.99E-05	2.13E-03
MW305A2	7.18E+00	8.31E-05	2.53E-03
MW306A	9.63E+01	1.11E-03	3.40E-02
MW307A	3.38E-02	3.91E-07	1.19E-05
MW308A	3.43E+00	3.97E-05	1.21E-03
MW309A	1.51E+01	1.75E-04	5.33E-03
MW310A	2.38E+01	2.75E-04	8.40E-03
Geometric Mean	1.03E+01	1.20E-04	3.65E-03
Shallow Bedrock Wells			
MW301B1	1.05E+00	1.22E-05	3.70E-04
MW303B	6.99E+00	8.09E-05	2.47E-03
MW304B	3.85E+01	4.46E-04	1.36E-02
MW305B	2.80E+00	3.24E-05	9.88E-04
MW309B	2.23E+00	2.58E-05	7.87E-04
MW310B	2.36E+00	2.73E-05	8.33E-04
Geometric Mean	4.01E+00	4.64E-05	1.41E-03
Deep Bedrock Wells			
MW302B	3.94E-01	4.56E-06	1.39E-04
MW303C	1.48E+00	1.71E-05	5.22E-04
MW304C	5.19E-02	6.01E-07	1.83E-05
MW306C	3.25E-02	3.76E-07	1.15E-05
MW307B	4.27E+00	4.94E-05	1.51E-03
Geometric Mean	3.35E-01	3.87E-06	1.18E-04

Table 2.4-54— {Hydraulic Properties Based on Pumping Tests}

Observation Well ID	Test Type	Transmissivity		Hydraulic Conductivity		Storage Coefficient, S (unitless)	Specific Yield, Sy (unitless)
		(ft^2/day)	(cm^2/s)	(ft/day)	(cm/s)		
Glacial Overburden Pumping Test (Pumping Well = MW302A1)							
MW302A2	Pumping Test	1.98E+03	2.13E+01	1.10E+02	3.88E-02	NA	5.00E-01
	Recovery Test	3.00E+03	3.23E+01	1.67E+02	5.89E-02	NA	NA
MW302A3	Pumping Test	1.85E+03	1.99E+01	1.03E+02	3.63E-02	NA	2.53E-01
	Recovery Test	6.43E+03	6.91E+01	3.57E+02	1.26E-01	NA	NA
MW302A4	Pumping Test	2.03E+03	2.18E+01	1.13E+02	3.99E-02	NA	3.22E-01
	Recovery Test	5.26E+03	5.66E+01	2.92E+02	1.03E-01	NA	NA
Geometric Mean		3.02E+03	3.24E+01	1.68E+02	5.92E-02	NA	3.44E-01
Median		2.52E+03	2.70E+01	1.40E+02	4.94E-02	NA	3.22E-01
Bedrock Pumping Test (Pumping Well = MW301B1)							
MW301B2	Pumping Test	1.31E+01	1.41E-01	2.38E-01	8.40E-05	8.37E-05	NA
	Recovery Test	1.38E+02	1.48E+00	2.51E+00	8.85E-04	5.50E-04	NA
MW301B3	Pumping Test	1.42E+01	1.53E-01	2.58E-01	9.10E-05	5.37E-05	NA
	Recovery Test	1.13E+02	1.22E+00	2.05E+00	7.23E-04	2.52E-04	NA
MW301B4	Pumping Test	3.01E+00	3.24E-02	5.46E-02	1.93E-05	1.25E-05	NA
	Recovery Test	3.17E+01	3.41E-01	5.77E-01	2.04E-04	7.41E-05	NA
Geometric Mean		2.55E+01	2.74E-01	4.64E-01	1.64E-04	9.12E-05	NA
Median		2.30E+01	2.47E-01	4.18E-01	1.47E-04	7.89E-05	NA

Table 2.4-55— {Hydraulic Conductivity Values of Bedrock (Mahantango Shale) Based on Packer Tests}

(Page 1 of 2)

Test Time Interval	Depth to Top of Test Zone	Depth to Bottom of Test Zone	Length of Test Interval	Constant Rate of Flow	Hydraulic Conductivity	
? T (s)	L 2 (ft)	L 1 (ft)	L (cm)	q (cm^3/s)	K K=ft/day	K K=cm/s
Monitoring Well MW301C tested on 11/6/2007						
600	55.7	76.7	640.08	27.1287	5.99E-02	2.11E-05
300	76.7	97.7	640.08	0.0	0.0	0.0
300	97.7	118.7	640.08	0.0	0.0	0.0
300	118.7	139.7	640.08	0.0	0.0	0.0
300	139.7	160.7	640.08	0.0	0.0	0.0
600	160.7	181.7	640.08	1.2618	9.42E-04	3.32E-07
300	181.7	202.7	640.08	0.0	0.0	0.0
300	202.7	223.7	640.08	0.0	0.0	0.0
300	223.7	244.7	640.08	0.0	0.0	0.0
600	244.7	265.7	640.08	10.0944	4.93E-03	1.74E-06
300	265.7	286.7	640.08	0.0	0.0	0.0
600	286.7	307.7	640.08	13.8798	5.78E-03	2.04E-06
600	307.7	328.7	640.08	135.0126	5.23E-02	1.85E-05
600	338.7	349.7	335.28	176.652	1.05E-01	3.71E-05
600	349.7	370.7	640.08	169.7121	5.78E-02	2.04E-05
600	370.7	391.7	640.08	141.3216	4.54E-02	1.60E-05
600	391.7	397.7	182.88	174.1284	1.43E-01	5.04E-05
Monitoring Well MW304C tested on 11/2/2007 and 11/3/2007						
600	117	140	701.04	0.0	0.0	0.0
600	140	163	701.04	0.0	0.0	0.0
600	163	186	701.04	5.0472	2.95E-03	1.04E-06
600	230	253	701.04	5.6781	2.35E-03	8.30E-07
600	253	276	701.04	0.0	0.0	0.0
600	290	313	701.04	3.1545	1.04E-03	3.66E-07
600	347	370	701.04	25.236	6.93E-03	2.45E-06
600	370	393	701.04	47.9484	1.24E-02	4.36E-06
300	471	442	701.04	0.0	0.0	0.0
600	522	545	701.04	17.0343	3.11E-03	1.10E-06
Monitoring Well MW306C tested on 11/5/2007						
600	56.5	76.5	609.6	17.6652	3.24E-02	1.14E-05
600	76.5	96.5	609.6	2.5236	3.44E-03	1.21E-06
600	96.5	116.5	609.6	37.854	4.11E-02	1.45E-05
300	116.5	136.5	609.6	0.0	0.0	0.0
300	136.5	156.5	609.6	0.0	0.0	0.0
600	156.5	176.5	609.6	83.2788	5.60E-02	1.98E-05
300	176.5	196.5	609.6	0.0	0.0	0.0
600	196.5	216.5	609.6	1.2618	6.78E-04	2.39E-07
300	216.5	236.5	609.6	0.0	0.0	0.0
300	236.5	256.5	609.6	0.0	0.0	0.0
600	256.5	276.5	609.6	10.7253	4.42E-03	1.56E-06
600	276.5	296.5	609.6	12.618	4.83E-03	1.70E-06
600	296.5	316.5	609.6	12.618	4.50E-03	1.59E-06

Table 2.4-55— {Hydraulic Conductivity Values of Bedrock (Mahantango Shale) Based on Packer Tests}
(Page 2 of 2)

Test Time Interval	Depth to Top of Test Zone	Depth to Bottom of Test Zone	Length of Test Interval	Constant Rate of Flow	Hydraulic Conductivity	
? T (s)	**L 2 (ft)**	**L 1 (ft)**	**L (cm)**	**q (cm^3/s)**	**K K=ft/day**	**K K=cm/s**
300	317.5	327.5	304.8	0.0	0.0	0.0
Monitoring Well MW310C (geotechnical boring B327) tested on 11/4/2007						
600	68.5	88.5	609.6	182.961	3.00E-01	1.06E-04
300	88.5	108.5	609.6	0.0	0.0	0.0
300	108.5	128.5	609.6	0.0	0.0	0.0
600	128.5	148.5	609.6	18.927	1.73E-02	6.09E-06
300	148.5	168.5	609.6	0.0	0.0	0.0
300	168.5	188.5	609.6	442.8918	3.12E-01	1.10E-04
300	178.5	198.5	609.6	502.1964	3.34E-01	1.18E-04
Monitoring Well MW313C (geotechnical boring B322) tested on 11/9/2007						
600	72.5	93.5	640.08	318.6045	4.63E-01	1.63E-04
600	93.5	114.5	640.08	20.8197	2.40E-02	8.47E-06
300	107.5	138.5	640.08	0.0	0.0	0.0
600	114.5	135.5	640.08	83.9097	8.04E-02	2.84E-05
300	128.5	149.5	640.08	0.0	0.0	0.0
300	149.5	170.5	640.08	0.0	0.0	0.0
300	170.5	191.5	640.08	0.0	0.0	0.0
300	178.5	199.5	640.08	0.0	0.0	0.0

Table 2.4-56— {Summary of Hydraulic Property Testing at the SSES}
(Page 1 of 2)

Type of Test	Location of Test(s)	Geologic Material Tested	Hydraulic Conductivity			
			Horizontal		Vertical	
			(ft/day)	(cm/s)	(ft/day)	(cm/s)
Pumping Tests	Wells TW-1, TW2	Kame Terrace Deposits, lower 40 ft	3.3 to 15.0	1.16E-03 to 5.29E-03		
	Well C	Kame Terrace Deposits, lower 43 ft	200 (1)	7.06E-02(1)		
	Well CPW	Kame Terrace Deposits, 37 ft	194 (1)	6.84E-02 (1)		
	Well 1210	Kame Terrace Deposits and upper 2 to 3 ft of bedrock	7.8	2.75E-03		
	Well 1204	Kame Terrace Deposits and upper 2 to 3 ft of bedrock	21.7 to 29.2	7.66E-03 to 1.03E-02		
Slug Tests	Well 1208	Kame Terrace Deposits and upper 2 to 3 ft of bedrock	1.8	6.35E-04		
	Well 1210	Kame Terrace Deposits and upper 2 to 3 ft of bedrock	6.6	2.33E-03		
Packer Tests	Borings 929-935 and 937-940, near railway bridge over Rt. 11	Mahantango siltstone and black shale, upper 50 ft of rock (41 intervals tested)	0.013 to 0.76(median = 0.22)	4.59E-06 to 2.68E-04(median = 7.76E-05)		
	Reactor and Retention Pond Areas	Mahantango siltstone, less than 20 ft bgs	0.85	3.00E-04		
		Mahantango siltstone, more than 20 ft bgs	1.00E-06	3.53E-10		
	Boring 305	Mahantango siltstone, 7 to 52 ft bgs	0.0061 to 0.41	2.15E-06 to 1.45E-04		
	Well 1201	Mahantango siltstone, 6.7 to 35.3 ft bgs	0 to 0.063	0 to 2.22E-05		
	Well 1209A	Mahantango siltstone, 5.7 to 34 ft bgs	0 to 0.028	0 to 9.88E-06		
Open-End Testsin Borings	Retention Pond Area	Kame Terrace deposits; tests performed in 29 borings	5.7	0.00201	13 to 63	0.00459 to 2.22E-02
	Spray Pond Area	Kame Terrace deposits; tests performed in 7 borings	0.022 to 11.8+	7.76E-06 to 4.16E-03		
	Spray Pond Area (borings 1113 and 1114)	Kame Terrace Deposits and upper 2 to 3 ft of bedrock	1.0 to 3.8	3.52E-04 to 1.34E-03		
	Spray Pond Area (borings 1117)	Mahantango siltstone, 12 to 20 ft below top of rock	2.5	8.82E-04		
LaboratoryPermeabilityTests	Approximately 1,500 ft (460 m) northeast of plant center	Upper Silty Soil			0.028	9.88E-06
	Boring 1200A at 27 ft bgs	Kame Terrace Deposits			2.3	8.11E-04

Table 2.4-56— {Summary of Hydraulic Property Testing at the SSES}
(Page 2 of 2)

Type of Test	Location of Test(s)	Geologic Material Tested	Hydraulic Conductivity			
			Horizontal		Vertical	
			(ft/day)	(cm/s)	(ft/day)	(cm/s)

Notes:
(1) Based on specific capacity data, assuming wells were 85% efficient
bgs = below ground surface

Table 2.4-57— {Reactor Coolant Storage Tank Radionuclide Inventory}

Radioisotope	Half-life $t^{1/2}$ (days)	Concentration (µCi/mL)	Radioisotope	Half-life $t^{1/2}$ (days)	Concentration (µCi/mL)
H-3	4.51E+03	1.0E+00	Te-127m	1.09E+02	4.4E-04
Na-24	6.25E-01	3.7E-02	Te-127*	3.90E-01	0.0E+00
Cr-51	2.77E+01	2.0E-03	I-129	5.73E+09	4.6E-08
Mn-54	3.13E+02	1.0E-03	I-130	5.15E-01	5.0E-02
Fe-55	9.86E+02	7.6E-04	Te-129m	3.36E+01	1.5E-03
Fe-59	4.45E+01	1.9E-04	Te-129*	4.83E-02	2.4E-03
Co-58	7.08E+01	2.9E-03	Te-131m	1.25E+00	3.7E-03
Co-60	1.93E+03	3.4E-04	Te-131*	1.74E-02	2.6E-03
Zn-65	2.44E+02	3.2E-04	I-131*	8.04E+00	7.4E-01
Br-83	9.96E-02	3.2E-02	Te-132	3.26E+00	4.1E-02
Kr-83m*	7.63E-02	0.0E+00	I-132*	9.58E-02	3.7E-01
Br-84	2.21E-02	1.7E-02	I-133	8.67E-01	1.3E+00
Br-85	2.01E-03	2.0E-03	Xe-133m*	2.19E+00	0.0E+00
Kr-85*	1.87E-01	0.0E+00	Xe-133*	5.25E+00	0.0E+00
Rb-88	1.24E-02	1.0E+00	Te-134	2.90E-02	6.7E-03
Rb-89	1.06E-02	4.7E-02	I-134*	3.65E-02	2.4E-01
Sr-89*	5.05E+01	6.3E-04	I-135	2.75E-01	7.9E-01
Sr-90	1.06E+04	3.3E-05	Xe-135m*	1.06E-02	0.0E+00
Y-90*	2.67E+00	7.7E-06	Xe-135*	3.79E-01	0.0E+00
Sr-91	3.96E-01	1.0E-03	Cs-134	7.53E+02	1.7E-01
Y-91m*	3.45E-02	5.2E-04	Cs-136	1.31E+01	5.3E-02
Y-91*	5.85E+01	8.1E-05	Cs-137	1.10E+04	1.1E-01
Sr-92	1.13E-01	1.7E-04	Ba-137m*	1.77E-03	1.0E-01
Y-92*	1.48E-01	1.4E-04	Cs-138	2.24E-02	2.2E-01
Y-93	4.21E-01	6.5E-05	Ba-140	1.27E+01	6.2E-04
Zr-95	6.40E+01	9.3E-05	La-140*	1.68E+00	1.6E-04
Nb-95m*	3.61E+00	0.0E+00	Ce-141	3.25E+01	8.9E-05
Nb-95*	3.52E+01	9.3E-05	Ce-143	1.38E+00	7.6E-05
Mo-99	2.75E+00	1.1E-01	Pr-143*	1.36E+01	8.8E-05
Tc-99m*	2.51E-01	4.6E-02	Ce-144	2.84E+02	6.9E-05
Ru-103	3.93E+01	7.7E-05	Pr-144m*	5.07E-03	0.0E+00
Rh-103m	3.90E-02*	6.8E-05	Pr-144*	1.20E-02	6.9E-05
Ru-106	3.68E+02	2.7E-05	W-187	9.96E-01	1.8E-03
Rh-106*	3.45E-04	2.7E-05	Np-239	2.36E+00	8.7E-04
Ag-110m	2.50E+02	2.0E-07	Pu-239*	8.79E+06	0.0E+00
Ag-110*	2.85E-04	0.0E+00			

Note:
* Decay chain progeny

Source: U.S. EPR Final Safety Analysis Report, Tier 2, Rev.3, Table 2.1-2

Table 2.4-58— {Transport Analysis Considering Advection and Radioactive Decay - Equation Inputs}

(Page 1 of 3)

Parent Radionuclide	Progeny in Chain	Half-life (days)	d_{12}	d_{13}	d_{23}	Decay Rate (days-1)	Reactor Coolant Conc. (µCi/cm³)	K1	K2	K3
H-3		4.51E+03				1.54E-04	1.00E+00			
Na-24		6.25E-01				1.11E+00	3.70E-02			
Cr-51		2.77E+01				2.50E-02	2.00E-03			
Mn-54		3.13E+02				2.21E-03	1.00E-03			
Fe-55		9.86E+02				7.03E-04	7.60E-04			
Fe-59		4.45E+01				1.56E-02	1.90E-04			
Co-58		7.08E+01				9.79E-03	2.90E-03			
Co-60		1.93E+03				3.59E-04	3.40E-04			
Zn-65		2.44E+02				2.84E-03	3.20E-04			
Br-83		9.96E-02				6.96E+00	3.20E-02			
	Kr-83m	7.63E-02	1			9.08E+00	0.00E+00	1.37E-01	-1.37E-01	
Br-84		2.21E-02				3.14E+01	1.70E-02			
Br-85		2.01E-03				3.44E+02	2.00E-03			
	Kr-85	1.87E-01	1			3.71E+00	0.00E+00	-2.18E-05	2.18E-05	
Rb-88		1.24E-02				5.59E+01	1.00E+00			
Rb-89		1.06E-02				6.54E+01	4.70E-02			
	Sr-89	5.05E+01	1			1.37E-02	6.30E-04	-9.85E-06	6.40E-04	
Sr-90		1.06E+04				6.54E-05	3.30E-05			
	Y-90	2.67E+00	1			2.60E-01	7.70E-06	3.30E-05	-2.53E-05	
Sr-91		3.96E-01				1.75E+00	1.00E-03			
	Y-91m	3.45E-02	0.578			2.01E+01	5.20E-04	6.33E-04	-1.13E-04	
	Y-91	5.85E+01		0.422	1	1.18E-02	8.10E-05	-7.91E-06	9.23E-08	9.38E-05
Sr-92		1.13E-01				6.14E+00	1.70E-04			
	Y-92	1.48E-01	1			4.68E+00	1.40E-04	-5.45E-04	6.85E-04	
Y-93		4.21E-01				1.65E+00	6.50E-05			
Zr-95		6.40E+01				1.08E-02	9.30E-05			
	Nb-95m	3.61E+00	0.007			1.92E-01	0.00E+00	6.90E-07	-6.90E-07	
	Nb-95	3.52E+01		0.993	1	1.97E-02	9.30E-05	2.20E-04	8.39E-08	-1.21E-04
Mo-99		2.75E+00				2.52E-01	1.10E-01			
	Tc-99m	2.51E-01	0.876			2.76E+00	4.60E-02	1.06E-01	-6.00E-02	
Ru-103		3.93E+01				1.76E-02	7.70E-05			

Table 2.4-58— {Transport Analysis Considering Advection and Radioactive Decay - Equation Inputs}

(Page 2 of 3)

Parent Radionuclide	Progeny in Chain	Half-life (days)	d_{12}	d_{13}	d_{23}	Decay Rate (days-1)	Reactor Coolant Conc. (μCi/cm^3)	K1	K2	K3
	Rh-103m	3.90E-02	0.997			1.78E+01	6.80E-05	7.68E-05	-8.84E-06	
Ru-106		3.68E+02				1.88E-03	2.70E-05			
	Rh-106	3.45E-04	1			2.01E+03	2.70E-05	2.70E-05	-2.53E-11	
Ag-110m		2.50E+02				2.77E-03	2.00E-07			
	Ag-110	2.85E-04	0.0133			2.43E+03	0.00E+00	2.66E-09	-2.66E-09	
Te-127m		1.09E+02				6.36E-03	4.40E-04			
	Te-127	3.90E-01	0.976			1.78E+00	0.00E+00	4.31E-04	-4.31E-04	
I-129		5.73E+09				1.21E-10	4.60E-08			
I-130		5.15E-01				1.35E+00	5.00E-02			
Te-129m		3.36E+01				2.06E-02	1.50E-03			
	Te-129	4.83E-02	0.65			1.44E+01	2.40E-03	9.76E-04	1.42E-03	
Te-131m		1.25E+00				5.55E-01	3.70E-03			
	Te-131	1.74E-02	0.222			3.98E+01	2.60E-03	8.33E-04	1.77E-03	
	I-131	8.04E+00		0.778	1	8.62E-02	7.40E-01	-8.49E-04	-4.26E-06	7.41E-01
Te-132		3.26E+00				2.13E-01	4.10E-02			
	I-132	9.58E-02	1			7.24E+00	3.70E-01	4.22E-02	3.28E-01	
I-133		8.67E-01				7.99E-01	1.30E+00			
	Xe-133m	2.19E+00	0.029			3.17E-01	0.00E+00	-2.48E-02	2.48E-02	
	Xe-133	5.25E+00		0.971	1	1.32E-01	0.00E+00	-2.45E-01	-1.77E-02	2.63E-01
Te-134		2.90E-02				2.39E+01	6.70E-03			
	I-134	3.65E-02	1			1.90E+01	2.40E-01	-2.60E-02	2.66E-01	
I-135		2.75E-01				2.52E+00	7.90E-01			
	Xe-135m	1.06E-02	0.154			6.53E+01	0.00E+00	1.27E-01	-1.27E-01	
	Xe-135	3.79E-01		0.846	1	1.83E+00	0.00E+00	-2.10E+00	3.65E-03	2.10E+00
Cs-134		7.53E+02				9.21E-04	1.70E-01			
Cs-136		1.31E+01				5.29E-02	5.30E-02			
Cs-137		1.10E+04				6.30E-05	1.10E-01			
	Ba-137m	1.77E-03	0.946			3.91E+02	1.00E-01	1.61E-01	-6.08E-02	
Cs-138		2.24E-02				3.09E+01	2.20E-01			
Ba-140		1.27E+01				5.46E-02	6.20E-04			
	La-140	1.68E+00	1			4.13E-01	1.60E-04	7.14E-04	-5.54E-04	

Table 2.4-58— {Transport Analysis Considering Advection and Radioactive Decay - Equation Inputs}
(Page 3 of 3)

Parent Radionuclide	Progeny in Chain	Half-life (days)	d_{12}	d_{13}	d_{23}	Decay Rate (days-1)	Reactor Coolant Conc. (µCi/cm^3)	K1	K2	K3
Ce-141		3.25E+01				2.13E-02	8.90E-05			
Ce-143		1.38E+00				5.02E-01	7.60E-05			
	Pr-143	1.36E+01	1			5.11E-02	8.80E-05	-8.61E-06	9.66E-05	
Ce-144		2.84E+02				2.44E-03	6.90E-05			
	Pr-144m	5.07E-03	0.0178			1.37E+02	0.00E+00	1.23E-06	-1.23E-06	
	Pr-144	1.20E-02		0.9822	0.999	5.78E+01	6.90E-05	7.30E-05	9.50E-07	-9.51E-07
W-187		9.96E-01				6.96E-01	1.80E-03			
Np-239		2.36E+00				2.94E-01	8.70E-04			
	Pu-239	8.79E+06	1			7.89E-08	0.00E+00	-2.33E-10	2.33E-10	

Table 2.4-59— {Transport Analysis Considering Advection and Radioactive Decay - Results}
(Page 1 of 2)

Parent Radionuclide	Progeny in Chain	Effluent Concentration Limit (μCi/cm^3)	Maximum Predicted Ground-Water Concentration Near Walker Run (μCi/cm^3)	Maximum Predicted Ground-Water Concentration / ECL
H-3		1.00E-03	9.69E-01	9.69E+02
Na-24		5.00E-05	5.55E-101	1.11E-96
Cr-51		5.00E-04	1.19E-05	2.38E-02
Mn-54		3.00E-05	6.36E-04	2.12E+01
Fe-55		1.00E-04	6.58E-04	6.58E+00
Fe-59		1.00E-05	7.76E-06	7.76E-01
Co-58		2.00E-05	3.90E-04	1.95E+01
Co-60		3.00E-06	3.16E-04	1.05E+02
Zn-65		5.00E-06	1.79E-04	3.58E+01
Br-83		9.00E-04	0.00E+00	0.00E+00
	Kr-83m	NA	0.00E+00	NA
Br-84		4.00E-04	0.00E+00	0.00E+00
Br-85		NA	0.00E+00	NA
	Kr-85	NA	0.00E+00	NA
Rb-88		4.00E-04	0.00E+00	0.00E+00
Rb-89		9.00E-04	0.00E+00	0.00E+00
	Sr-89	8.00E-06	3.86E-05	4.82E+00
Sr-90		5.00E-07	3.26E-05	6.51E+01
	Y-90	7.00E-06	3.26E-05	4.65E+00
Sr-91		2.00E-05	1.57E-159	7.87E-155
	Y-91m	2.00E-03	9.96E-160	4.98E-157
	Y-91	8.00E-06	8.22E-09	1.03E-03
Sr-92		4.00E-05	0.00E+00	0.00E+00
	Y-92	4.00E-05	0.00E+00	0.00E+00
Y-93		2.00E-05	8.18E-152	4.09E-147
Zr-95		2.00E-05	1.02E-05	5.08E-01
	Nb-95m	3.00E-05	7.54E-08	2.51E-03
	Nb-95	3.00E-05	1.48E-09	4.93E-05
Mo-99		2.00E-05	4.03E-24	2.02E-19
	Tc-99m	1.00E-03	3.89E-24	3.89E-21
Ru-103		3.00E-05	2.09E-06	6.96E-02
	Rh-103m	6.00E-03	2.08E-06	3.47E-04
Ru-106		3.00E-06	1.84E-05	6.12E+00
	Rh-106	NA	1.84E-05	NA
Ag-110m		6.00E-06	1.13E-07	1.89E-02
	Ag-110	NA	1.51E-09	NA
Te-127m		9.00E-06	1.19E-04	1.33E+01
	Te-127	1.00E-04	1.17E-04	1.17E+00
I-129		2.00E-07	4.60E-08	2.30E-01
I-130		2.00E-05	3.22E-122	1.61E-117
Te-129m		7.00E-06	2.20E-05	3.14E+00
	Te-129	4.00E-04	1.43E-05	3.58E-02
Te-131m		8.00E-06	1.43E-52	1.79E-47
	Te-131	8.00E-05	3.23E-53	4.03E-49

Table 2.4-59— {Transport Analysis Considering Advection and Radioactive Decay - Results}
(Page 2 of 2)

Parent Radionuclide	Progeny in Chain	Effluent Concentration Limit (µCi/cm^3)	Maximum Predicted Ground-Water Concentration Near Walker Run (µCi/cm^3)	Maximum Predicted Ground-Water Concentration / ECL
	I-131	1.00E-06	1.57E-08	1.57E-02
Te-132		9.00E-06	4.46E-21	4.96E-16
	I-132	1.00E-04	4.59E-21	4.59E-17
I-133		7.00E-06	9.52E-72	1.36E-66
	Xe-133m	NA	1.49E-30	NA
	Xe-133	NA	0.00E+00	NA
Te-134		3.00E-04	0.00E+00	0.00E+00
	I-134	4.00E-04	0.00E+00	0.00E+00
I-135		3.00E-05	3.48E-225	1.16E-220
	Xe-135m	NA	5.57E-226	NA
	Xe-135	NA	4.33E-166	NA
Cs-134		9.00E-07	1.41E-01	1.56E+05
Cs-136		6.00E-06	1.03E-06	1.72E-01
Cs-137		1.00E-06	1.09E-01	1.09E+05
	Ba-137m	NA	1.03E-01	NA
Cs-138		4.00E-04	0.00E+00	0.00E+00
Ba-140		8.00E-06	8.54E-09	1.07E-03
	La-140	9.00E-06	9.84E-09	1.09E-03
Ce-141		3.00E-05	1.13E-06	3.77E-02
Ce-143		2.00E-05	1.54E-49	7.70E-45
	Pr-143	2.00E-05	2.73E-09	1.36E-04
Ce-144		3.00E-06	4.18E-05	1.39E+01
	Pr-144m	NA	7.45E-07	NA
	Pr-144	6.00E-04	0.00E+00	0.00E+00
W-187		3.00E-05	1.95E-65	6.50E-61
Np-239		2.00E-05	5.82E-30	2.91E-25
	Pu-239	2.00E-08	2.33E-10	1.17E-02

Notes:
NA = Maximum Effluent Concentration Limit (ECL) is not available.
Bolded cell entry means ratio is greater than 1% of ECL

Table 2.4-60— {BBNPP Site-Specific Radionuclide Adsorption (K_d) Values}

Soil	Sample Depth(ft bgs)	Mn		Co		Zn		Sr		Cs		Ce		Fe		Ru	
		Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
MW301A	7 - 11	59.1	0.7	341	31	745	283	36.5	6.0	15,400	6,800	995	99	375	4	141	85
MW302A1	5 - 9	54.6	9.2	856	274	1,010	840	27.5	1.5	11,500	900	2,260	20	3,860	890	156	117
MW305A1	5 - 9	78.4	12.9	85	5	149	32	72.9	1.2	40,900	6,600	1,460	140	3,910	50	234	188
MW306A	5 - 9	447	42	3,090	1,970	2,980	1,010	75.9	1.4	8,700	50	987	90	3,300	550	820	599
MW308A	5 - 9	71.7	8.7	375	31	1,020	820	29.1	1.1	7,560	1,300	1,810	130	3,000	760	97	61
MinimumValue		54.6		85		149		27.5		7,560		987		375		97	
Note: Units of K_d are L/kg. or ml/cm^3																	

Table 2.4-61— {Distribution Coefficients and Retardation Factors Used in Advection-Decay-Retardation Analysis}

Parent Radionuclide	Progeny in Chain	Distribution Coefficient (L/kg)	Retardation Factor[(1)]
H-3		0	1
Cr-51		850	4621
Mn-54		54.6	298
Fe-55		375	2039
Fe-59		375	2039
Co-58		85	463
Co-60		85	463
Zn-65		149	811
Rb-89		0	1
	Sr-89	27.5	150
Sr-90		27.5	150
Sr-91		27.5	150
	Y-91m	15.08	83
	Y-91	15.08	83
Zr-95		3,000	16305
	Nb-95m	380	2066
	Nb-95	380	2066
Ru-103		97	528
Ru-106		97	528
Ag-110m		8.3	46
	Ag-110	8.3	46
Te-127m		38	208
	Te-127	38	208
I-129		0	1
Te-129m		38	208
	Te-129	38	208
Te-131m		38	208
	Te-131	38	208
	I-131	0	1
Cs-134		7,560	41088
Cs-136		7,560	41088
Cs-137		7,560	41088
Ce-141		987	5365
Ce-144		987	5365
Np-239		0.96	6
	Pu-239	84.59	953

Notes:
(1) Retardation Factor calculated using K_d values listed in this table, a dry bulk density (kg/L) of 1.75 (Table 2.4-34), and an effective porosity of 0.322 (Table 2.4-54).

Table 2.4-62— {Transport Analysis Considering Advection, Radioactive Decay, and Retardation}

Parent Radionuclide	Progeny in Chain	ECL ($\mu Ci/cm^3$)	Initial Concentration ($\mu Ci/cm^3$)	Distribution Coefficient (K_d) (L/kg)	Retardation Factor (Rf)	Maximum Predicted Groundwater Concentration Near Walker Run ($\mu Ci/cm^3$)	Maximum Predicted Groundwater Concentration / ECL
H-3		1.00E-03	1.00E+00	0	1	9.69E-01	9.69E+02
Cr-51		5.00E-04	2.00E-03	850	4621	0.00E+00	0.00E+00
Mn-54		3.00E-05	1.00E-03	54.6	298	2.62E-62	8.72E-58
Fe-55		1.00E-04	7.60E-04	375	2039	1.82E-131	1.82E-127
Fe-59		1.00E-05	1.90E-04	375	2039	0.00E+00	0.00E+00
Co-58		2.00E-05	2.90E-03	85	463	0.00E+00	0.00E+00
Co-60		3.00E-06	3.40E-04	85	463	5.43E-19	1.81E-13
Zn-65		5.00E-06	3.20E-04	149	811	3.18E-209	6.35E-204
Rb-89		9.00E-04	4.70E-02	0	1	0.00E+00	0.00E+00
	Sr-89	8.00E-06	6.30E-04	27.5	150	0.00E+00	0.00E+00
Sr-90		5.00E-07	3.30E-05	27.5	150	4.39E-06	**8.78E+00**
	Y-90	7.00E-06	7.70E-06	15.08	83	3.22E-05	**4.60E+00**
Zr-95		2.00E-05	9.30E-05	3000	16305	0.00E+00	0.00E+00
Ru-103		3.00E-05	7.70E-05	97	528	0.00E+00	0.00E+00
Ru-106		3.00E-06	2.70E-05	97	528	1.06E-93	3.55E-88
Ag-110m		6.00E-06	2.00E-07	8.3	46	8.51E-19	1.42E-13
Te-127m		9.00E-06	4.40E-04	38	208	1.37E-121	1.53E-116
	Te-127	1.00E-04	0.00E+00	38	208	0.00E+00	0.00E+00
I-129		2.00E-07	4.60E-08	0	1	4.60E-08	**2.30E-01**
Te-129m		7.00E-06	1.50E-03	38	208	0.00E+00	0.00E+00
	Te-129	4.00E-04	2.40E-03	38	208	0.00E+00	0.00E+00
Cs-134		9.00E-07	1.70E-01	7560	41088	0.00E+00	0.00E+00
Cs-136		6.00E-06	5.30E-02	7560	41088	0.00E+00	0.00E+00
Cs-137		1.00E-06	1.10E-01	7560	41088	3.82E-232	3.82E-226
Ce-141		3.00E-05	8.90E-05	987	5365	0.00E+00	0.00E+00
Ce-144		3.00E-06	6.90E-05	987	5365	0.00E+00	0.00E+00
Np-239		2.00E-05	8.70E-04	0.96	6	1.58E-166	7.92E-162
	Pu-239	2.00E-08	0.00E+00	84.59	461	0.00E+00	0.00E+00

Notes:
Bolded cell entry means ratio is greater than 1 percent of ECL

Table 2.4-63— {Transport Analysis Considering Advection, Radioactive Decay, Retardation, and Dilution}

Tank-Plume Characteristics		
Tank volume	4061 ft^3	115 m^3
Spill volume	3249 ft^3	92.0 m^3
Effective porosity	0.322	0.322
Plume volume	10,090 ft^3	286 m^3
Assumed plume thickness	10 ft	3.3 m
Plume plan-view area	1,009 ft^2	93.5 m^2

Table 2.4-64— {Transport Analysis Considering Advection, Radioactive Decay, Retardation, and Dilution - continued}

Dilution Factor - Walker Run		
Plume cross-sectional area	100 ft^2	9.27 m^2
Darcy velocity	5.84 ft/day	1.78 m/day
Groundwater discharge rate	6.76E-03 ft^3/s	1.92E-04 m^3/s
Surface water flow rate	3.2 ft^3/s	0.091 m^3/s
Dilution factor	0.0021	0.0021

Table 2.4-65— {Transport Analysis Considering Advection, Radioactive Decay, Retardation, and Dilution - continued}

Radionuclide	ECL[1] (µCi/cm³)	Predicted GroundwaterConcentration near Walker Run [2] (µCi/cm³)	Predicted Surface WaterConcentration in Walker Run [3] (µCi/cm³)	Predicted Surface WaterConcentration,Walker Run / ECL [4]
H-3	1.00E-03	OK	2.3E-03	2.03E+00
Sr-90	5.00E-07	4.39E-06	9.22E-09	1.84E-02
Y-90	7.0E-06	3.22E-05	6.77E-08	9.66E-03
I-129	2.0E-07	4.60E-08	9.66E-11	0.00

Notes:
1 Values from 10 CFR Part 20, Appendix B, Table 2, Column 2
2 Values from Table 2.4-62
3 Surface water concentration = groundwater concentration * dilution factor (0.0021).
4 Shaded value means that ratio is greater than 1 percent of the ECL

Table 2.4-66— {Compliance with 10 CFR Part 20, Appendix B, Table 2}

(Page 1 of 2)

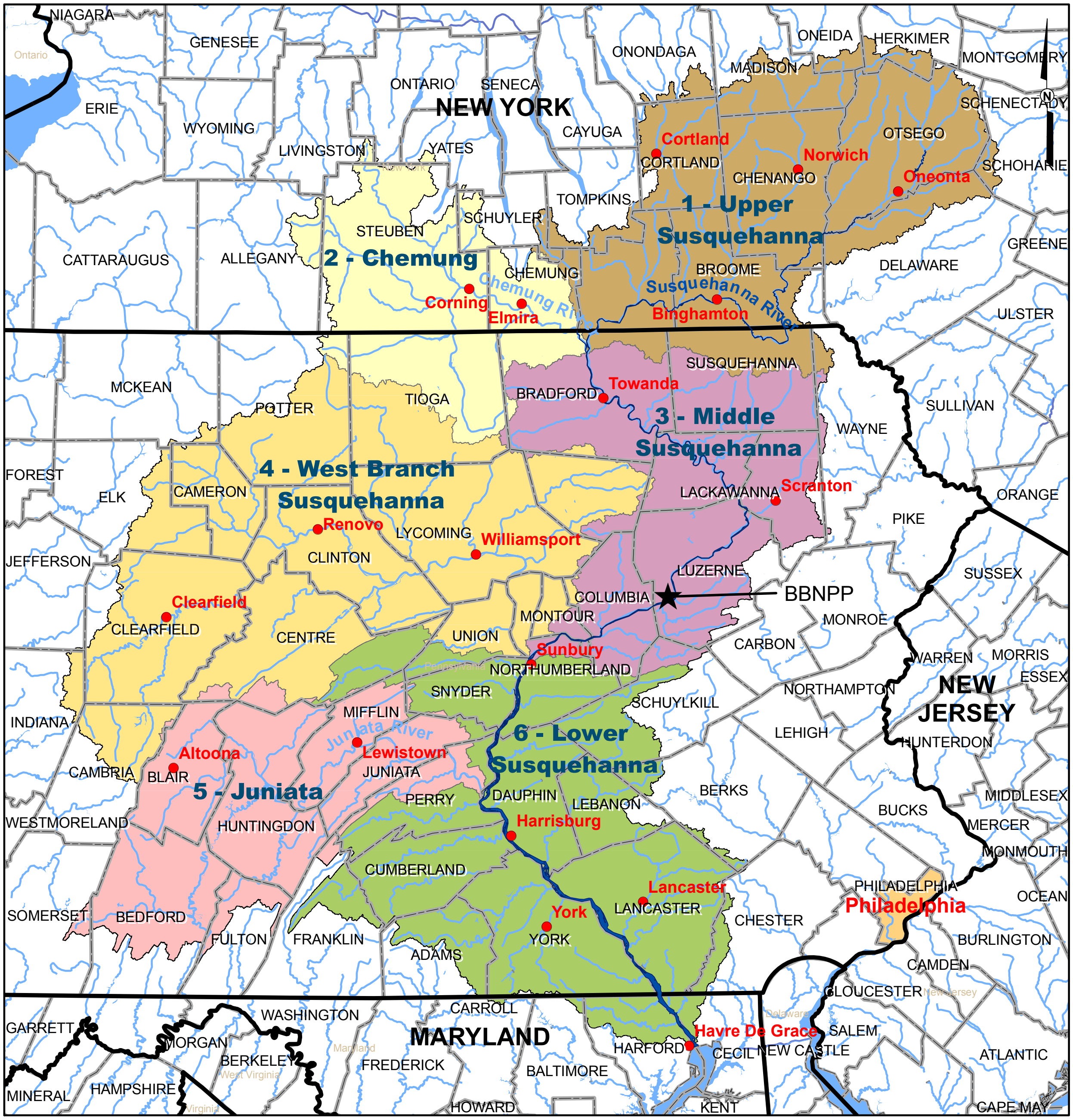
Parent Radionuclide	Progeny in Chain	Advection + Decay)/ECL	(Advection + Decay + Retardation)/ECL	(Advection + Decay + Retardation + Dilution)/ECL	Minimum Values
H-3		9.69E+02	9.69E+02	2.03E+01	1.45E+01
Na-24		1.14E-96			1.14E-96
Cr-51		2.50E-02	0.00E+00		0.00E+00
Mn-54		2.33E+01	9.59E-58		9.59E-58
Fe-55		7.01E+00	1.94E-127		1.94E-127
Fe-59		8.17E-01	0.00E+00		0.00E+00
Co-58		2.08E+01	0.00E+00		0.00E+00
Co-60		1.11E+02	1.92E-13		1.92E-13
Zn-65		3.80E+01	6.75E-204		6.75E-204
Br-83		0.00E+00			0.00E+00
	Kr-83m	NA			0.00E+00
Br-84		0.00E+00			0.00E+00
Br-85		NA			0.00E+00
	Kr-85	NA			0.00E+00
Rb-88		0.00E+00			0.00E+00
Rb-89		0.00E+00	0.00E+00		0.00E+00
	Sr-89	5.05E+00	2.56E-182		2.56E-182
Sr-90		9.08E+01	1.22E+01	1.84E-02	1.84E-01
	Y-90	1.12E-23		9.66E-03	1.12E-23
Sr-91		8.65E-155	0.00E+00		0.00E+00
	Y-91m	0.00E+00	0.00E+00		0.00E+00
	Y-91	9.57E-01	7.60E-87		7.60E-87
Sr-92		0.00E+00			0.00E+00
	Y-92	0.00E+00			0.00E+00
Y-93		4.22E-147			4.22E-147
Zr-95		5.41E-01	0.00E+00		0.00E+00
	Nb-95m	0.00E+00	0.00E+00		0.00E+00
	Nb-95	5.82E-02	0.00E+00		0.00E+00
Mo-99		2.38E-19			2.38E-19
	Tc-99m	1.08E-244			1.08E-244
Ru-103		9.94E-02	0.00E+00		0.00E+00
	Rh-103m	0.00E+00			0.00E+00
Ru-106		1.41E+01	8.15E-88		8.15E-88
	Rh-106	NA			0.00E+00
Ag-110m		9.45E-02	7.09E-13		7.09E-13
	Ag-110	NA			0.00E+00
Te-127m		1.99E+01	2.29E-116		2.29E-116
	Te-127	0.00E+00			0.00E+00
I-129		2.30E-01	2.30E-01	3.45E-03	3.45E-03
I-130		1.61E-117			1.61E-117
Te-129m		3.98E+00	0.00E+00		0.00E+00
	Te-129	0.00E+00			0.00E+00
Te-131m		2.23E-47	0.00E+00		0.00E+00
	Te-131	0.00E+00	0.00E+00		0.00E+00
	I-131	1.57E-02	1.57E-02	2.36E-04	2.36E-04

Table 2.4-66— {Compliance with 10 CFR Part 20, Appendix B, Table 2}
(Page 2 of 2)

Parent Radionuclide	Progeny in Chain	Advection + Decay)/ECL	(Advection + Decay + Retardation)/ECL	(Advection + Decay + Retardation + Dilution)/ECL	Minimum Values
Te-132		6.04E-16			6.04E-16
	I-132	0.00E+00			0.00E+00
I-133		1.36E-66			1.36E-66
	Xe-133m	NA			0.00E+00
	Xe-133	NA			0.00E+00
Te-134		0.00E+00			0.00E+00
	I-134	0.00E+00			0.00E+00
I-135		1.16E-220			1.16E-220
	Xe-135m	NA			0.00E+00
	Xe-135	NA			0.00E+00
Cs-134		4.05E+05	0.00E+00		0.00E+00
Cs-136		3.58E-01	0.00E+00		0.00E+00
Cs-137		1.68E+05	5.91E-226		5.91E-226
	Ba-137m	NA			0.00E+00
Cs-138		0.00E+00			0.00E+00
Ba-140		1.22E-03			1.22E-03
	La-140	3.59E-36			3.59E-36
Ce-141		4.10E-02	0.00E+00		0.00E+00
Ce-143		8.41E-45			8.41E-45
	Pr-143	1.37E-04			1.37E-04
Ce-144		1.48E+01	0.00E+00		0.00E+00
	Pr-144m	NA			0.00E+00
	Pr-144	0.00E+00			0.00E+00
W-187		6.86E-61			6.86E-61
Np-239		5.01E-25	0.00E+00		0.00E+00
	Pu-239	0.00E+00	0.00E+00		0.00E+00
	Sum =	5.74E+05	9.81E+02	1.47E+01	2.06E+00

Notes:
NA = Maximum Effluent Concentration Limit (ECL) is not available.

Figure 2.4-1— {Susquehanna River Basin and Sub-basins}



LEGEND

★ Center Point of Proposed Bell Bend NPP (BBNPP)

Susquehanna River Subbasins

- Chemung
- Juniata
- Lower Susquehanna
- Middle Susquehanna
- Upper Susquehanna
- West Branch Susquehanna

- Waterbody
- County Boundary
- State Boundary

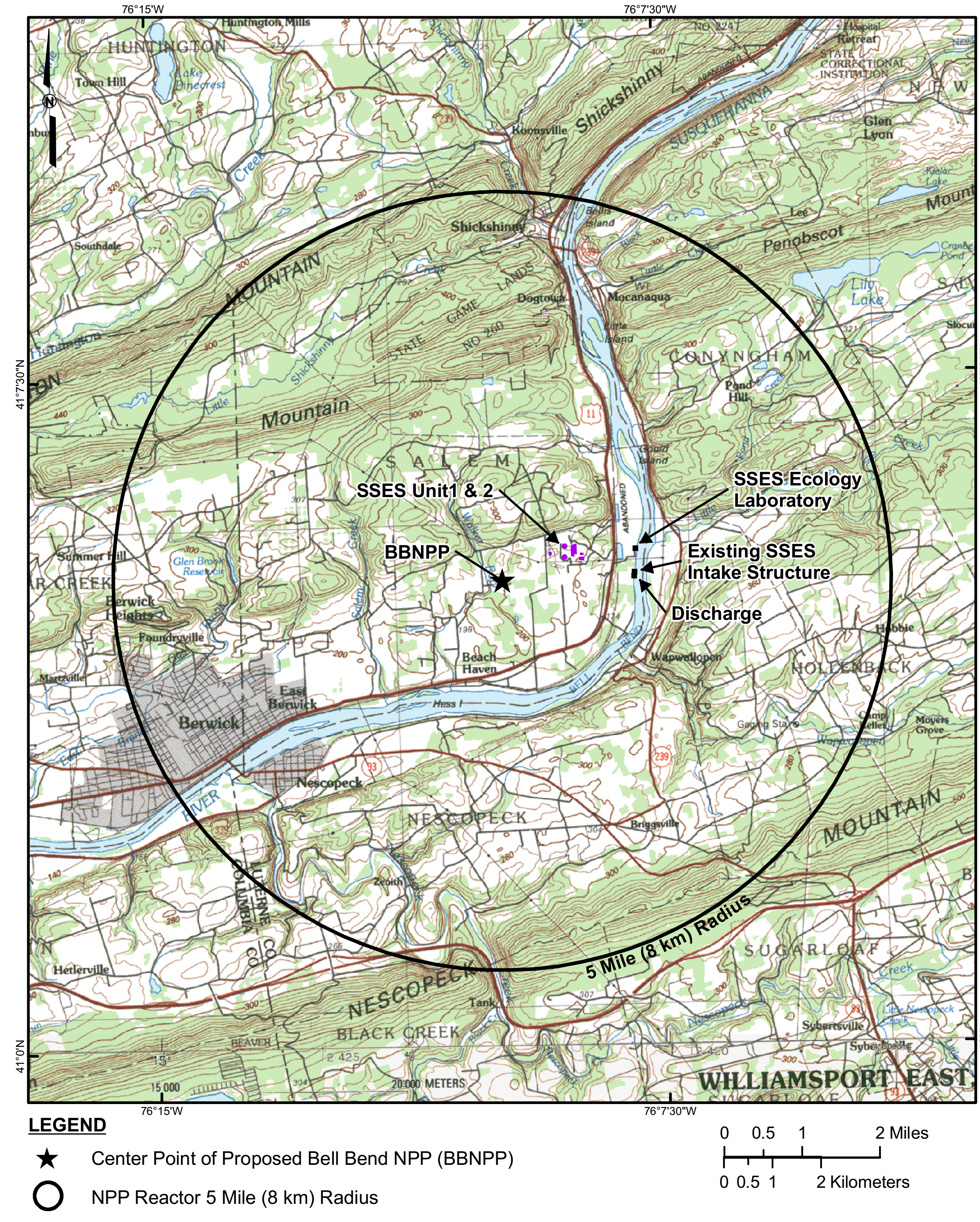
0 17.5 35 70 Miles

0 17.5 35 70 Kilometers

REFERENCES:

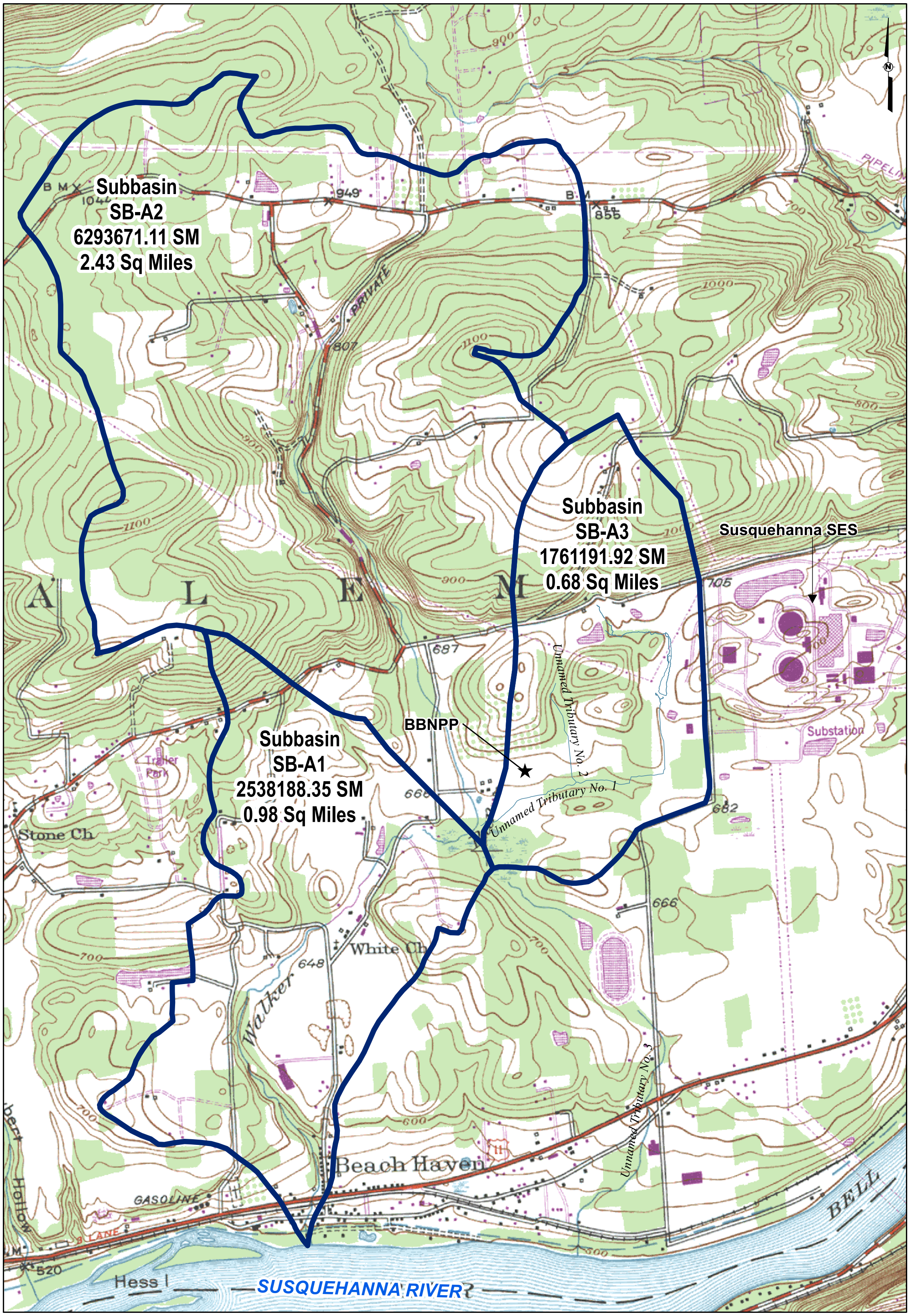
ESRI StreetMap Pro [CD-ROM], 2007, Waterbody, Roads, County, Boundary, and City.
Susquehanna River Basin Commission, 2006, Susquehanna River Basin Subbasins

Figure 2.4-2— {Site Area Topographic Map 5 Mile (8 km) Radius}



REFERENCE:
USGS 1:100K Topographic Maps:
Williamsport East and Sunbury.Maps edited 1984.

Figure 2.4-3— {Walker Run Watershed}



LEGEND

★ Center Point of Poposed Bell Bend NPP (BBNPP)

Subbasin Boundary

0 750 1,500 3,000 Feet

0 250 500 Meters

REFERENCE:
• USGS 7.5-minute Qaudrangles: Berwick and Sybertsville, 1955, Photorevised 1989.