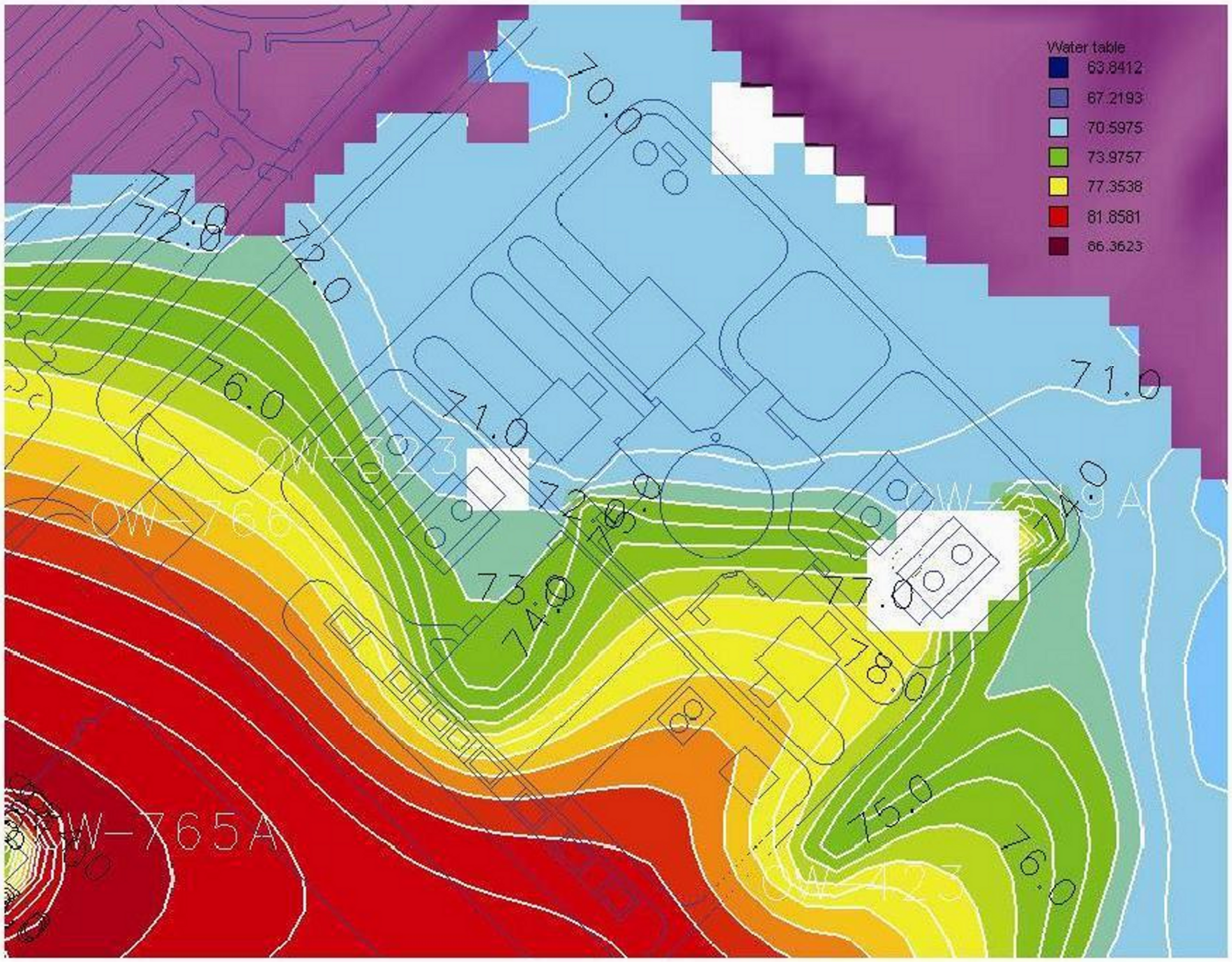

Notes:

1. Contours are in Feet msl
2. Water Table is below base of the Surficial Aquifer at cells shown in “white”

FIGURE 2.3.2-25 Rev. 0

MODELED POST–CONSTRUCTION ELEVATION OF THE SURFICIAL AQUIFER WATER TABLE AROUND POWER BLOCK 3

CCNPP UNIT 3 ER

2.3.3 WATER QUALITY

This section describes the site-specific surface water quality characteristics that could directly be affected by plant construction and operation or that could affect plant water use and effluent disposal within the vicinity of the **{**CCNPP**}** site. Site-specific water quality data was obtained through the **{**Chesapeake Bay Program (CBP) databases, CCNPP, U.S. Geological Survey (USGS), site water body sampling, and other available sources.

The data available and collected for this report is believed to be adequate to characterize the water bodies in terms of suitability for aquatic organisms and to serve as a baseline for assessing if plant construction or operations have impacted water quality. All liquid effluent discharges during plant operation will be monitored and regulated by a NPDES permit.

Most of the data available and collected was to characterize Chesapeake Bay, the most significant water body in the vicinity of the CCNPP site. The most important parameters in terms of evaluating the Chesapeake Bay water quality are salinity, dissolved oxygen, temperature, sediments and chemical contaminants, and nutrients. Because nutrient loading is widely regarded as Chesapeake Bay's most critical water quality problem, this section examines trends in macronutrient concentrations (total nitrogen, nitrates, ammonia, phosphorus, orthophosphate) in Chesapeake Bay in the CCNPP vicinity. Many of these parameters were also measured in samples collected from the onsite water bodies. Groundwater samples were collected to monitor water quality parameters in the Surficial and Aquia aquifers in the area of the proposed project.

As described in Section 4.2.1.7, Best Management Practices will be used during plant construction to prevent pollutant discharges to the onsite water bodies or groundwater aquifers. The most probable pollutant expected during construction would be sediment or dust entering the air, streams, or groundwater. These particulates could also contain possible contaminants such as heavy metals. Steps will be taken to mitigate the generation and transport of these particulate materials. Sediment samples were collected and analyzed to establish a baseline indication of the pollution that is present in the bay floor sediments in the area near the CCNPP Unit 3 discharge structure.**}**

2.3.3.1 Surface Water

{The CCNPP site is located in Calvert County, Maryland on the western shore of the Chesapeake Bay, approximately 10 mi (16 km) to the north of the Patuxent River mouth. The CCNPP site lies within the Lower Maryland Western Shore watershed, which is characterized by freshwater flow from the Patuxent River, Fishing Creek, Parkers Creek, Plum Point Creek, Grays Creek and Grover Creek (CBP, 2006a). At the CCNPP site, the Chesapeake Bay is about 6 mi (10 km) wide. The bottom of the Chesapeake Bay slopes gradually to a depth of about 50 to 55 ft (15 to 117m) until it reaches the approximate center of Chesapeake Bay where the depth increases sharply to approximately 110 ft (34 m) (NOAA, 2007).

At the site, surface water within approximately 1,000 ft (300 m) of the Chesapeake Bay drains directly to the Bay. The portion of the site which will be used during the construction period, drains through Johns Creek watershed into the St. Leonard Creek, which then drains into the Patuxent River approximately 4 mi (7 km) from the plant (NRC, 1999a). The rest of the site drains into Goldstein Branch via unnamed drainage channels that also eventually discharge to the Patuxent River. The Patuxent River drains into the Chesapeake Bay at its mouth located approximately 10 mi (16 km) south of the plant (NRC, 1999a). Previous expansion and construction disturbed 220 acres (89 hectares) of the CCNPP site. Baltimore Gas and Electric

Company concluded in its Environmental Report for license renewal of CCNPP Units 1 and 2 that surface water impacts remain small (BGE, 1998).

While no major impacts to surface water quality have been reported to date due to the construction and/or operation of CCNPP Units 1 and 2, these on-site surface water bodies, including the surface water channels, four on-site ponds, the Patuxent River, and the Chesapeake Bay, could potentially be impacted by the construction and operation of the new CCNPP Unit 3.**}**

2.3.3.1.1 {Freshwater Bodies

Surface water channels, including Johns Creek and Goldstein Branch, and four perennial ponds (Lake Conoy, Lake Davies and Ponds 1 and 2) are present within the boundary of CCNPP. Water quality data for the on-site surface water bodies was collected in October 2006 as part of a biological study. A summary of the water quality data collected during this study is presented in Table 2.3.3-1. Based upon these data, the in situ water quality measurements are representative of a healthy aquatic environment in the streams and Lake Conoy. Dissolved oxygen greater than 5 ppm and a neutral pH were recorded at Johns Creek, Goldstein Branch, and Lake Conoy (EA, 2006). Low dissolved oxygen concentrations were detected in Lake Davies and the two ponds; and total organic carbon, alkalinity, and total dissolved solids are notably higher at Lake Davies than the other site waters. Despite the low dissolved oxygen concentration at Lake Davies and the two ponds, and the elevated nutrients at Lake Davies, the general water quality of these systems does not indicate that any significant adverse conditions are the result of current operations at the CCNPP site (EA, 2006).**}**

2.3.3.1.2 {Chesapeake Bay

The Chesapeake Bay is the largest estuary in the U.S., with over 64,000 square miles of watershed that spans six states (Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia) and the District of Columbia. The Susquehanna River provides about 50% of fresh water entering the Bay while other important tributaries include the Patapsco, Patuxent, Potomac, James, and Choptank. The Chesapeake Bay is nearly 200 mi (320 km) long and its width varies from 3.4 mi (5.5 km) near Aberdeen, Maryland, to 35 mi (56 km) across near the mouth of the Potomac River. The majority of the Chesapeake Bay is relatively shallow with an average water depth of approximately 21 ft (6 m); however, several deep trenches are found within the Chesapeake Bay with depths of over 100 ft (30 m).

The Chesapeake Bay estuary is a mixing zone of freshwater influx from rivers and streams and salt water from the Atlantic Ocean. Circulation of Bay waters transports sediment, dissolved oxygen, nutrients, chemical contaminants, and planktonic aquatic biota. Freshwater influx flows seaward, above the denser seawater intrusion, forming two wedges moving in opposite directions. The opposing movement of these two wedges, combined with seasonal weather patterns and tidal forces, drives the circulation of nutrients and sediments throughout the Chesapeake Bay.

CCNPP Units 1 and 2 use water from the Chesapeake Bay for condenser cooling, drawing bottom water through a 45 ft (15 m) deep, dredged channel that extends approximately 4,500 ft (1,400 m) offshore (NRC, 1999a). Water passes through the plant in approximately 4 minutes and is discharged from an outfall north of the plant that is approximately 850 ft (260 m) offshore in 10 ft (3 m) of water. A curtain wall that extends to a depth of 30 ft (9 m) across the intake channel limits the cooling water withdrawal to mostly bottom water, although there is evidence that mixing of surface and lower depth water occurs before entrance to the plant (NRC, 1999a). Proposed CCNPP Unit 3 will withdraw makeup water from the Chesapeake Bay through a new intake structure located immediately south of the existing intake structure, as discussed in Section 3.4. All cooling system discharges from the new unit, including the cooling tower blowdown, will be discharged to the Chesapeake Bay via a new discharge structure to be built south of the existing structure.

In the area of the CCNPP site, predominant physical characteristics of the Chesapeake Bay include silt and clay sediments, mesohaline salt concentrations (i.e., concentrations ranging from 5 to 18 parts per thousand), seasonal stratification, current patterns influenced by wind and tides, high levels of localized particulates, and moderate sedimentation and resuspension rates. The local aquatic ecosystem is driven by high spring nutrient influx, turbidity, high primary production and phytoplankton density with an intermediate benthic abundance, and a relatively low biological diversity. Throughout the Bay, contaminant distribution is largely influenced by physical processes, with the movement of water and sediment providing the principal mechanism for transport. Winds, waves, currents, tidal actions and episodic events, such as storms and hurricanes, can cause major resuspension of bottom sediments and associated contaminants, and the frequency and intensity of these physical events will have a fundamental effect on residence time of contaminants in any given area. Likewise, stratification and subsequent mixing will determine vertical, as well as horizontal, movement of contaminants, an important factor in a two-layered estuary like the Chesapeake Bay (MDSG, 2006).

The overall health of the Chesapeake Bay is considered degraded by nutrient, air, sediment, and chemical pollution (CBP, 2006c). High levels of nutrients, such as phosphorus and nitrogen, enter the bay system via stormwater, industrial/utility effluent, and atmospheric deposition. Sediments are washed into the Bay by natural processes including stream and shoreline erosion and stormwater runoff. The mass influx of nutrients and sediments decreases water clarity and stimulates algal production (which can reduce dissolved oxygen in the water column). Low freshwater flows lead to increased salinity and mixing between surface fresh water (higher oxygen levels) and the more saline water (where nutrients become available) below (CBP, 2007).

The Chesapeake Bay Program (CBP), formed in 1983 by the first Chesapeake Bay agreement, is a regional partnership that monitors the water quality and effective restoration of the Bay and its tributaries. Members of the program include the State of Maryland, Commonwealths of Pennsylvania and Virginia, the District of Columbia, the Chesapeake Bay Commission (a tri-state legislative body), the U.S. Environmental Protection Agency (EPA), and participating citizen advisory groups. The program was established to restore and protect the Chesapeake Bay from natural and anthropogenic pollutants that have been widely distributed throughout the area impacting the Chesapeake Bay's overall water quality.

The following water quality databases, maintained by state agencies, federal agencies, and non-profit groups, were accessed to locate available and applicable water quality data relevant to the Chesapeake Bay water in the area of the CCNPP site:

- CBP Water Quality Database (1984 to present)
- Chesapeake Bay Institute (CBI) Water Quality Database (1949 to 1982)
- CBP Toxics Database
- Alliance Citizen Monitoring Database
- USGS River Input Monitoring Database
- USGS Monthly Stream Flow Data
- Susquehanna River Basin Commission (SRBC) Nutrient Assessment Program

- National Estuarine Research Reserve System (NERRS)
- CBP Nutrient Point Source Database

After examining these databases, the most available data was found within the CBP Water Quality Database (1984 to present). Using this database, the CBP manages water quality data recorded at monitoring stations throughout the Bay and its tributaries, including stations in the area of the CCNPP site. Data from three mainstem monitoring stations (identified on Figure 2.3.3-1) north of the CCNPP site (CB4.3W, CB4.3C, and CB4.3E) and three mainstem monitoring stations south of the CCNPP site (CB4.4, CB5.1, and CB5.1W) were used to characterize seasonal water quality trends for the Bay waters within the vicinity of the power plant. Water quality data presented in this report were obtained from these monitoring stations using the CBP database, unless otherwise noted.

Data reviewed for this environmental report was based on water year (WY) 2005 (i.e., the natural, annual water cycle from October 2004 through September 2005). Availability of water quality data varies by parameter and not all data were collected at the same collection events. However, where possible, trends in the available data sets were evaluated for discussion herein. Quality assurance/ quality control methodologies utilized can be found at the CBP website. Values with quality assurance/quality control issues noted by CBP were not included.

Freshwater Flow

Water quality of the Chesapeake Bay is directly influenced by the quantity and quality of freshwater inflow. The CCNPP site lies within the Lower Maryland Western Shore watershed, characterized by freshwater inflow from the Patuxent River, Fishing Creek, Parkers Creek, Plum Point Creek, Grays Creek, and Grover Creek (CBP, 2006a). The topography at the site is gently rolling with steeper slopes along stream courses. Local relief ranges up to about 130 ft (40 m). The site is well drained by short, intermittent streams. A drainage divide, which is generally parallel to the coastline, extends across the site as shown on Figure 2.2.1-3. The area to the east of the divide comprises about 20% of the site and includes CCNPP Units 1 and 2. This area drains to the Chesapeake Bay. The area west of the divide, which includes the CCNPP Unit 3 location, is drained by tributaries of Johns Creek and Woodland Branch, which flow into St. Leonard Creek and subsequently into the Patuxent River. Grading during construction of the current operating units and support facilities did not substantially alter the drainage system (CCNPP, 2005). As shown in Figure 2.3.1-2, Johns Creek would drain the majority of the proposed project area. As described in Section 2.2.1.1.1.3, and shown on Figure 2.3.1-7, the CCNPP Unit 3 site is located further northeast of the predicted 100 year flood extent boundary for Johns Creek. Flooding for the 100 year and 500 year events could occur along portions of the CCNPP property that directly borders the Chesapeake Bay (FEMA, 1998).

The USGS calculates streamflow entering the Chesapeake Bay at five index stations including one, Segment B, located downstream of the Patuxent River mouth and north of the Potomac River mouth as described in Figure 2.3.3-2. Between 1937 and 2005, the monthly mean inflow between Segment A (at the mouth of the Susquehanna river) and Segment B was reported at 45,700 ft^3/s (1,294,000 L/s), and the average flow is 16% of the total flow to the Chesapeake Bay (USGS, 2007).

CCNPP is required by permit to monitor effluent discharge on an annual basis. Information on the average flow during periods of effluent discharge was reported in the Effluent and Waste Disposal 2005 Annual Report (CE, 2006), prepared by Constellation Energy. The 2005 flow data provided is as follows:

- 1.86×10^6 gals (7.05×10^6 L) of liquid waste were processed through the radwaste system (volume prior to dilution)
- 5.27×10^7 gals (2.00×10^8 L) of low activity liquid waste were processed through the secondary system (volume prior to dilution)
- 1.22×10^{12} gals (4.61×10^{12} L) of dilution water were discharged

The liquid effluent currently discharged from CCNPP Units 1 and 2 has relatively minimal impacts to the Chesapeake Bay (NRC, 1999a). Potential impacts include the distribution of water at higher or lower temperatures than the ambient waters and the discharge of toxic and/or radioactive materials to the receiving water body.

Pycnocline

Freshwater flow is less dense than the cooler, saline waters entering the Bay from the Atlantic Ocean creating vertical stratification of the water column and a zone (pycnocline) where the density changes rapidly due to temperature and salinity differences. The pycnocline plays an important role in determining seasonal changes in photosynthesis and nutrient distribution. Stratification and subsequent mixing will determine vertical, as well as horizontal, movement of contaminants, an important factor in a two-layered estuary such as the Chesapeake Bay. In some systems, stratification can represent a physical barrier to the mixing of the water column, thus minimizing the exchange of nutrients and oxygen through the pycnocline.

Sampling is conducted within the Chesapeake Bay to characterize the separate upper and lower water masses. Pycnocline data was obtained through the CBP to identify the depth and thickness of the pycnocline in the area of the CCNPP site. Four monitoring stations (CB4.3C, CB4.3E, CB4.4, and CB5.1) in the CCNPP site vicinity were found to have pycnocline data. A summary of the pycnocline data are provided in Table 2.3.3-2.

Based upon WY 2005 data, a pycnocline is established within the vicinity of the CCNPP site throughout the year; however, its depth and thickness fluctuate spatially throughout the seasons. The pycnocline fluctuated in thickness between < 3 ft (1 m) during the spring (at monitoring station CB4.3E) and 57.4 ft (17.5 m), observed during the winter (at monitoring station CB4.3C). In WY 2005, the pycnocline had the most variable thickness at monitoring station CB5.1, which was also the location of the greatest thickness.

Water Temperature

Seasonal variations in the thermal stratification of the Chesapeake Bay are observed with generally well-mixed conditions during winter and strong stratification during summer. During the winter, stratification is generally limited to ambient temperature and weather patterns that impact surface water temperature. WY 2005 water temperature data are provided in Table 2.3.3-3.

Water temperature affects chemical and biochemical reaction rates as well as physical processes such as current patterns and contaminant movement. With as little as an 18°F (10°C) water temperature increase, the speed of many chemical and physical reactions can double. Within the Bay, water temperature fluctuates throughout the year, ranging from 34 to 84°F (1 to 29°C) (CBP, 2006d).

Based upon the WY 2005 temperature data, presented above, the water temperature dropped quickly in the winter months, with the minimum temperature of 34.9°F (1.6°C) at monitoring station CB4.3C and average temperatures ranging from 42.7 to 43.2°F (6.0 to 6.2°C). The greatest variability in temperature was observed during the fall months with a maximum temperature of 80.6°F (27.0°C) and a minimum temperature of 53.2°F (11.8°C) recorded at monitoring stations CB4.4 and CB5.1W. Temperatures during the winter showed the lowest variation with a maximum high temperature of 54.5°F (12.5°C) at monitoring stations CB4.3C, CB4.4, and CB5.1, and a low temperature of 34.9°F (1.6°C) at monitoring station CB4.3C.

Evaluation of the water temperature data compared to the pycnocline data showed unusually high variations in stratification across the Chesapeake Bay. The surface water (above pycnocline) was found to have higher temperatures during the early spring through summer months that coincides with the establishment of the pycnocline. However, as the surface water temperatures dropped during late fall and winter the pycnocline began to decline, becoming less prominent within the water column.

<u>Dissolved Oxygen</u>

Dissolved oxygen (DO) concentrations in Chesapeake Bay waters fluctuate throughout the year in response to natural biological and physical processes. During the winter months, DO is relatively high throughout the water column in response to the increased solubility of DO in cooler water, reduced biologic activity and DO uptake, and a homogenizing of the water column produced by vertical mixing during turbulent seasonal weather (wind, storms). In the summer months, solubility decreases, biologic uptake increases, mixing becomes reduced, and the water column becomes stratified with the lowest DO concentrations typically observed below the pycnocline. Bacterial activity in organic material accumulating on the bay floor can produce DO-poor bottom water over large areas and the pycnocline can act as a barrier for bottom water exchange with DO-richer surface waters (CBP, 2006e).

A summary of WY 2005 DO data is provided as Table 2.3.3-4. The data indicate that annual DO concentrations decrease with depth. The greatest variation in DO concentrations was observed in the middle of the water column, or within the area of the pycnocline. DO concentrations within the upper portion of the water column, or above the pycnocline, remained the most constant over the year.

The lowest recorded DO concentration during the winter, at any depth, was 5.5 mg/L. Water below the pycnocline (benthic) fell into severe hypoxic and anoxic conditions during the summer months. During the summer, low concentrations of 0.1 mg/L occurred at four of the six monitoring stations, and a low concentration of 0.2 mg/L occurred at a fifth. According to the CBP, water quality data gathered between 2003 and 2005 also indicate that only about 29% of the Chesapeake Bay's waters met DO standards during the summer months.

State water quality standards have been developed to meet the DO needs of the Chesapeake Bay's aquatic life, and the standards vary with depth, season, and duration of exposure. The standards generally require 5.0 mg/l of DO for ideal aquatic conditions (CBP, 2006f). If the water column contains DO concentrations below 2.0 mg/L, the water is considered "severely hypoxic," and DO concentrations below 0.2 mg/l are considered "anoxic." Evidence suggests there has been an increase in the intensity and frequency of hypoxia and anoxia in the Chesapeake Bay waters over the past 100 to 150 years, most notably since the 1960s (USEPA, 2003).

Availability of DO is an important factor for biological and chemical processes within the Chesapeake Bay waters. Oxygen-rich shallow waters are most essential in the spring for spawning of aquatic species, and mortality rates for most aquatic species typically increase as DO concentrations decrease. DO additionally drives chemical processes such as the rate of flocculation, adsorption, and/or desorption of dissolved compounds (to organic or inorganic surfaces) within the Chesapeake Bay. Experiments have shown that the metals most strongly influenced by anoxia are manganese, zinc, nickel, and lead (MDSG, 2006). Dissolved oxygen levels can drive the release of metals from sediments within the Chesapeake Bay due to oxidative/reductive processes. Elevated DO concentrations cause the release of such metals as copper and zinc, therefore causing greater contaminant exposure to organisms in the water column (MDSG, 2006). On the other hand, decreased levels of oxygen (hypoxia or anoxia) cause metals to be bound in sediments, thus increasing exposure to bottom-dwelling organisms.

Salinity

Salinity levels are graduated vertically and horizontally within the Chesapeake Bay due to freshwater flows, and are generally higher along the Bay's eastern shore (CBP, 2006d). A summary of the WY 2005 seasonal salinity statistics is presented in Table 2.3.3-5.

Based upon the WY 2005 CBP monitoring data as described in Table 2.3.3-5, salinity concentrations ranged between 4.06 parts per thousand (ppt) in spring and 22.18 ppt in summer. Salinity concentrations showed the least uniformity in spring, likely due to the high freshwater inflow caused by seasonal rainfall and snow melt; winter and fall showed the most uniform salinities.

Salinity is a key factor in an estuarine ecosystem that affects distribution of living resources, circulation, and an integral fate and transport mechanism of chemical contaminants within the Chesapeake Bay. Aquatic species have varying degrees of tolerance for salinity. Since salinity affects various physiological mechanisms in an organism, such as movement across cell membranes, it can affect an organism's biological functioning; thus influencing how the organism may respond to the presence of contaminants (MDSG, 2006). Most aquatic organisms therefore move to areas within the Chesapeake Bay with suitable habitat conditions. Salinity affects movement of waters by influencing stratification in the water column and determines what form chemical contaminants are likely to take, making them less available for uptake by Chesapeake Bay organisms (MDSG, 2006).

Nutrients and Chemical Contaminants

Runoff within the Lower Maryland Western Shore watershed carries pollutants, such as nutrients and sediments, to rivers and streams that drain into the Chesapeake Bay. The entire watershed includes a land area of 83 mi^2 (215 km^2), with agricultural land uses comprising the second largest land use category at 14%; forested land made up 53% of the watershed area (CBP, 2006a). Fertilizers containing nitrogen and phosphorus that are applied to agricultural lands are predominant sources of nutrient pollutants in storm water.

Most of the Chesapeake Bay mainstem, all of the tidal tributaries, and numerous segments of non-tidal rivers and streams are listed as Federal Water Pollution Control Act (USC, 2006) Section 303(d) “impaired waters” largely because of low DO levels and other problems related to nutrient pollution (MDE, 2006a). The CCNPP site lies within the Lower Maryland Western Shore watershed, characterized by inflow from the Patuxent River, Fishing Creek, Parkers Creek, Plum Point Creek, Grays Creek and Grover Creek. According to the Maryland Department of Environment (MDE) listing of Section 303(d) waters, the Patuxent River is the only contributing water body within the watershed with Section 303(d) status. The discussion of Section 303(d) waters is limited to those in the watershed in the area of the CCNPP site. Although NUREG-1555 (NRC, 1999b) requests “State 303(d) lists of impaired waters”, there are significant portions of state waters, including waters outside of Chesapeake Bay, that are well removed from the CCNPP site and could not possibly be affected by discharges from the CCNPP site.

The Patuxent River Lower Basin was identified on the 1996 Section 303(d) list submitted to U.S. EPA by the MDE as impaired by nutrients and sediments, with listings of bacteria for several specified tidal shellfish waters added in 1998, and listings of toxics, metals and evidence of biological impairments added in 2002 (USEPA, 2005). The Section 303(d) segments within the Patuxent River have been identified as having low priority (MDE, 2004). Only waters that may require the development of Total Maximum Daily Loads (TMDLs) or that require future monitoring need have a priority designation (MDE, 2004). Two approved TMDLs are already established within Calvert County, including TMDL of fecal coliform for restricted shellfish harvesting areas and a TMDL for mercury in Lake Lariat. While the current Section 303(d) list identifies the lower Patuxent River and greater Chesapeake Bay as low priority for TMDL development, it does not reflect the high level of effort underway to identify and document pollution loadings in the watersheds.

Pursuant to the Federal Water Pollution Control Act (USC, 2006), the water quality of effluent discharges to the Chesapeake Bay and its tributaries is regulated through the National Pollutant Discharge Elimination System (NPDES). CCNPP Units 1 and 2 maintain a current NPDES permit, State Discharge Permit 92-DP-0187; NPDES MD0002399. When the permit required renewal in June 1999, the MDE was unaware of any major issue that would prevent the permit renewal, and it was granted at that time. At the time, the MDE noted that any new regulations promulgated by U.S. EPA or the MDE would be included in future permits and those may include development and implementation of TMDLs (NRC, 1999a). NPDES data collected in 2005 was reviewed to determine the nature of effluent discharges from the CCNPP site. Discharge parameters including biologic oxygen demand, chlorine (total residual), chlorine (total residual, bromine), cyanuric acid, fecal coliform, oil and grease, pH, temperature, and total suspended solids, were reported. Based upon the data reviewed, all discharges were within the acceptable range and no discharge violations were reported (USEPA, 2006).

Water quality data on the parameters cited in NUREG-1555 (NRC, 1999b) was researched for evaluation and inclusion in this report. As noted previously, not all the parameters were available. A summary of the water quality data parameters obtained from the CBP database is provided in Table 2.3.3-6.

Based upon the data, the following water quality trends were evident.

- Seasonal fluctuations in ammonia concentrations were observed throughout the year; however the highest variability was observed during the summer months. A minimum concentration of 0.003 mg/L was recorded at nearly all six monitoring stations during all seasons, while a maximum concentration of 0.344 mg/L was recorded during the summer. The annual average concentration of ammonia was 0.074 mg/L.
- Nitrite concentrations reached their peaks in the fall at all six monitoring stations; the greatest absolute fluctuation was at monitoring station CB4.3C, also during the fall. The annual average concentration was 0.0134 mg/L. Nitrate concentrations fluctuated seasonally throughout the year, with peak concentrations reached in the spring at all six monitoring stations. The highest concentration was 0.971 mg/L at CB4.3W. The annual average concentration was 0.2014 mg/L.
- Concentrations of total organic nitrogen fluctuated, but did not show a defined seasonal trend. A minimum concentration, 0.2698 mg/L, was recorded at monitoring station CB4.4 during the summer, while a maximum concentration of total organic nitrogen, 1.2507 mg/L, was recorded at monitoring station CB4.3W, also during the summer. The annual average concentration of total organic nitrogen was 0.5066 mg/L.

- Orthophosphate and total phosphorus concentrations remained relatively stable throughout the year, with no notable spatial or temporal variations. The highest concentrations for both parameters was reached at CB4.3W during the summer, with concentrations of 0.0932 mg/L and 0.1223 mg/L for orthophosphate and total phosphorus, respectively. The annual average concentration of orthophosphate was 0.0103 mg/L. The annual average concentration of total phosphorus was 0.392 mg/L.
- Concentrations of Chlorophyll A varied substantially at five of the six monitoring stations during nearly all seasonal periods. Peak concentrations were generally reached in spring or summer. Monitoring station CB5.1W had the lowest peak concentrations and the lowest variability. A minimum concentration of 0.449 µg/L was observed at monitoring station CB4.4 in the fall; while a maximum concentration 53.827 µg/L was recorded at CB4.3W during the summer. This high concentration corresponds to a rise in total available organic nitrogen and orthophosphates within the surface waters. The annual mean concentration was 9.764 µg/L.
- Total suspended solids concentrations fluctuated widely throughout the year, reaching peak concentrations at four of the six monitoring stations during the spring. Minimum concentrations of 2.4 mg/L were recorded at several monitoring stations. The maximum concentration of 53.827 mg/L was recorded during the summer at monitoring station CB4.3W. The lowest annual mean total suspended solids was 6.57 mg/L at Station CB5.1W. The average total suspended solids at Station CB4.4, nearest to CCNPP, range from 7.71 mg/L in the fall to 30.40 mg/L in the winter. The annual mean concentration for the six monitoring stations was 9.06 mg/L.
- Surface water pH fluctuated throughout the year from 7.0 to 8.6, averaging 7.764 standard units, with the lowest values generally reached during spring and summer. The average low pH across the stations was 7.7 standard units; the average maximum was 8.4 standard units. No spatial variations are noted.

In response to concerns about nutrient pollution in 2003, the U.S. EPA developed Chesapeake Bay-specific water quality criteria for dissolved oxygen, water clarity, and Chlorophyll A. Chlorophyll A is an indicator parameter used to measure the abundance and variety of microscopic plants or algae that form the base of the food chain in the Chesapeake Bay (USEPA, 2003). Excessive nutrients can stimulate algae blooms, resulting in reduced water clarity, reduced amount of good quality food, and depleted oxygen levels in deeper water. Chlorophyll A is, therefore, used to evaluate attainment of various water quality criteria including DO and water clarity (USEPA, 2003). Based on the WY 2005 water quality data, as shown in Table 2.3.3-4, mesotrophic to eutrophic water conditions may have been present in the vicinity of CCNPP site during the spring and summer months, and indicated that water quality criteria for DO would not be attained for the spring months.

Radioactive effluent discharge data reported in the 2005 Effluent and Waste Disposal Report (CE, 2006) was additionally reviewed. The parameters measured included tritium, gross alpha, gamma emitting radionuclides, iron-55, nickel-63, strontium-89, and strontium-90. The effluent data presented was compared to the site's maximum permissible concentrations used for radioactive materials released in liquid effluents. Table 2.3.3-7 provides a summary of the 2005 liquid effluent data reported in the CCNPP Annual Report (CE, 2006). The reported releases were found to be within permissible limits; and no abnormal releases were reported during the year.

Beginning in February 2007, six water samples were collected at the CCNPP Units 1 and 2 cooling water intake structure. During each sampling event, water samples were collected towards the end of the incoming (flood) and the outgoing (ebb) tides. Sample results and analytical parameters are shown in Table 2.3.3-8. Because of differences in analytical suites, not all results are directly comparable to the water quality samples collected by the CBP as shown in Table 2.3.3-6. In general, the intake analyte concentrations and measurements are similar to the values measured in CBP water samples collected at the stations closest to the CCNPP (locations CB4.3W, CB4.3C, CB4.3E, and CB4.4) indicating that there are no significant pollutants in the influent cooling water for Units 1 and 2.

Water withdrawn from Chesapeake Bay for CCNPP Unit 3 and desalination plant operation could contain pollutants that might interact with the plant. However, any pollutants, unless from a large, local, or continuous source, probably would be dilute due to mixing by tides and currents in the large volume of Chesapeake Bay water. As shown on Figure 2.3.2-1 and listed in Table 2.3.2-3, the closest, large permitted, discharge sources to the proposed project intake structure are CCNPP Units 1 and 2, the Cove Point LNG plant 4 mi (6.4 km) south, and the Naval Research Laboratory; Chesapeake Bay detachment, 18.5 mi (30 km) to the north.

The largest discharges originate from CCNPP Unit 1 and 2 with an average volume of 3.2E+9 gallons per day (1.2E+7 cubic meters per day). This discharge consists mainly of warm water from the once-through cooling system and minor amounts of treated effluent from other waste streams. All CCNPP Unit 1 and 2 liquids are discharged to Chesapeake Bay through the submerged outfall located approximately 850 ft (260 m) offshore, northeast of the plant. The quantity and quality of the water discharged are regulated and permitted by the State of Maryland (NRC, 1999a). Given the approximate 1,500 ft (460 m) distance from CCNPP Units 1 and 2 outfall to the CCNPP Unit 3 plant intake, and the Chesapeake Bay current patterns, any possible pollutants in the entrained bay water would be greatly diluted before reaching the new plant intake structure.

The most likely pollutants that might be present in effluent discharged from CCNPP Units 1 and 2 operations would be treatment chemicals used to prevent scaling and rusting in the cooling system piping, those used in the waste water treatment plant operations, and diluted radioactive liquid waste. The volume of those effluents would be very minor compared to the total volume discharged.

Since the other surface water bodies on site are not used for any plant operations, no impact would be expected from any pollutants that might be present in them.

<u>Sediments</u>

The lands surrounding the Chesapeake Bay are mostly comprised of Pleistocene era deposits. Erosion of these deposits along the shoreline releases sediment that flows southward as littoral drift. The general flow of nearshore sediment transport is from north of Long Beach to a location just north of CCNPP (MDNR, 2003). The CCNPP site as shown on Figure 2.3.3-3 is situated in an area of net loss of sediment as the result of a circulating eddy in the Flag Pond area. The eddy influences the transport and deposition of sediments along the shoreline, most evidently to the south of the CCNPP site in the area of Cove Point. Cove Point is a littoral promontory that is slowly moving in a southerly direction, due to the transport and deposition of shoreline erosion sediments from beaches two to three miles to the north. A 2001 Maryland Department of Natural Resources orthophotograph as shown on Figure 2.3.1-12, which includes Long Beach to Cove Point, shows the progression of beach movement in the area from 1848 through 1993 (MDNR, 2001).

Turbulent weather conditions, prevailing wind patterns, currents, and tidal forces influence the spatial distribution of chemical contaminants in the Chesapeake Bay by driving resuspension of benthic sediments (MDSG, 2006). Resuspension rates are generally higher in well-mixed areas, while sediments become buried faster and incorporated into the bottom in less vigorously mixed environments. Stratification in the water column due to temperature or salinity gradients can additionally limit the height to which eroded sediments can be resuspended, keeping them low in the water column. Within the Chesapeake Bay, burial rates of heavy metals and movement of chemical pollutants out of sediments is moderate due to sedimentation and resuspension rates and low benthic cycling (CBP, 2006f). Based upon the localized flow rates and pycnocline data, presented in this section, resuspended bottom sediments are likely to settle rapidly within area of the CCNPP site.

The bottom of Chesapeake Bay in the CCNPP site area is characterized as having a hard substrate composed of compacted sand, mud, and calcareous shell fragments, overlain in some areas by scattered stones of various sizes. Sediment grabs were collected in September 2006 to assess the sediments and benthic biota. The samples were taken in the vicinity of the CCNPP Unit 3 discharge point (sample CCNPP-1) and at two locations within 500 ft (152 m) of this point (as shown in Figure 2.3.3-4) and were analyzed for the following physical/chemical parameters (EA, 2006):

- percent solids
- ammonia nitrogen
- total Kjeldahl nitrogen (TKN)
- total phosphorous
- metals (Cd, Cr, Cu, Hg, Pb, Zn, As)
- pesticides
- Polychlorinated Biphenyl (PCB) congeners
- volatile organic compounds (VOCs)
- semivolatile organic compounds (SVOCs) (including polyaromatic hydrocarbons)
- grain size
- total organic carbon
- specific gravity

A summary of sediment quality data is presented in Table 2.3.3-9. Concentrations of TKN, total organic carbon, total phosphorus, arsenic, chromium, lead, zinc, and PCB-18, were detected at levels that were above their respective method detection limits: however, based upon the relatively low concentrations of these analytes in samples, there is no evidence of sediment contamination (EA, 2006).

Chesapeake Bay Restoration Act

The Chesapeake Bay is considered Maryland's greatest economic and environmental treasure (MDE, 2006b). Over the past 100 years, the water quality of the Chesapeake Bay has become increasingly degraded due to over enrichment of unwanted nutrients such as phosphorus and nitrogen.

In 2004, the Chesapeake Bay Restoration Fund was proposed and signed into Maryland law to address Bay restoration. Administered by MDE, the law creates a dedicated fund for upgrading 66 of the largest wastewater treatment facilities to Enhanced Nutrient Reduction (ENR) standards. The ENR standards are stringent, and by enacting the legislation, the MDE expects results faster than many other nutrient programs. Once these plants are operating at ENR standards, conservatively 7.5×10^6 lb (3.4×10^6 kg) of nitrogen and 260,000 lb (118,000 kg) of phosphorus will stop going into the Chesapeake Bay each year, which represents over one-third of Maryland's commitment under the 2000 Chesapeake Bay Agreement (MDE, 2006b). In addition to effluent and non-point source pollutants, nearly one-third of the nitrogen delivered to the Chesapeake Bay comes from atmospheric deposition. Maryland's Clean Power Rule should have a significant benefit on public health, air quality and the health of the Chesapeake Bay by reducing air deposition of nitrogen by 900,000 lb (408,000 kg) a year to the Bay (MDE, 2006b).**}**

2.3.3.1.3 Wastewater Treatment

{The CCNPP Unit 3 Waste Water Treatment Plant (WWTP) will collect sewage and waste water generated from the portions of the plant outside the radiological control areas of the power block and will treat them using an extensive mechanical, chemical, and biological treatment processes. The treated effluent will be combined with the discharge stream from the onsite waste water retention basin and discharged to Chesapeake Bay. The discharge will be in accordance with local and state safety codes. The dewatered sludge will be hauled offsite for disposal at municipal facilities.

The CCNPP Unit 3 WWTP operation will be similar to the CCNPP Unit 1 and 2 treatment plant operation and will follow standard practices and use processes that are identical to wastewater treatment plants throughout the U.S. The CCNPP Unit 3 system will consist of a holding/debris tank, macerating pumps, oil/water separator, clarifiers, aeration blowers, diffusers, pre-treatment tanks, sludge holding tanks, and the associated piping, instrumentation, and controls necessary for proper operation. All of the WWTP piping, tanks, venting, and valving arrangements will be separated from all other plant chemical or radiological processes, and treatments by appropriate isolation devices.

The final stage of treatment will be disinfection of the wastewater to substantially reduce the number of microorganisms before discharge. Disinfection will either involve Ultraviolet (UV) or chlorination methods. If UV disinfection is used, discharge could be directly into the effluent stream from the retention basin. If chlorination disinfection is used, a de-chlorination step will be necessary before discharge in order to reduce the chlorine level below what is harmful to marine organisms.

The plant will be sized to have sufficient capacity to hold, process sewage or treated effluent under peak anticipated demand or operational transitional conditions. The treated wastewater will meet all applicable health standards, regulations, and total daily maximum loads (TMDLs) set by the Maryland Department of the Environment and the U.S. EPA.**}**

2.3.3.2 Groundwater

{Five groundwater production wells provide the process and domestic water for the operation of CCNPP Units 1 and 2. During the site characterization for CCNPP Unit 3, 145 borings were drilled and 40 observation wells were installed, primarily to monitor groundwater elevations. In May 2007, production Well No.5 and observation wells OW 752-A, OW 319-A and OW 319-B were sampled to collected groundwater quality data for the surficial and Aquia aquifers as shown in Figure 2.3.3-5. The well completion data for the wells sampled is presented in Table 2.3.3-10. The groundwater sample analytical results are presented in Table 2.3.3-11.

As shown in Table 2.3.3-11, there are differences in the Surficial aquifer groundwater across the site and between the Surficial aquifer and the deeper groundwater sampled beneath the site. For the Surficial aquifer samples, the metals concentrations are generally twice as high, the water is more alkaline and has elevated chloride, nitrate, phosphorus, pH, and total suspended solids concentrations in the groundwater sample from the eastern part of the site (well OW 319-

A) than in the western sample (OW 752-A). Alkalinity, hardness, calcium, magnesium, and silicon are higher in the sample from the Upper Chesapeake Unit (well OW 319-B) than in samples from the other aquifers. The sample from the Aquia Aquifer (Well No. 5) has the highest sodium and potassium concentrations and most of the other parameters are intermediate in concentration between the Surficial and Upper Chesapeake Unit samples. The detections of bacteria in the samples is believed to be the result of contamination during sampling rather than contamination in the aquifer from a septic system source, especially since fecal colliforms were not detected.

While the groundwater wells provide the source of water for the site's domestic, plant service, and de-mineralized makeup water requirements, the Chesapeake Bay is the sole source of water for the once-through cooling system utilized at CCNPP Units 1 and 2. All CCNPP Units 1 and 2 liquid effluents are combined before being discharged to the Chesapeake Bay through a submerged outfall. Both the quantity of the water pumped (from the groundwater wells and the Chesapeake Bay) and quality of the water discharged to the Bay are regulated and permitted by the State of Maryland (NRC, 1999a).

In keeping with the requirements of 10 CFR 50.75(g) (CFR, 2006), CCNPP Units 1 and 2 reported detection of low-level tritium within a piezometer tube located within the CCNPP site (CE, 2006). According to the Calvert Cliffs Nuclear Power Plant Effluent and Waste Disposal 2005 Annual Report (CE, 2006), the detection was identified during routine annual samples collected in December 2005 from piezometers that were installed to access the shallow groundwater beneath the CCNPP site. Tritium was detected within the water from one piezometer at an activity of approximately 1,800 pCi/L (72 Bq/L), but no gamma activity was detected (CE, 2006). Tritium was not detected at the remaining three piezometers. Since the December 2005 detection, tritium has not been detected within any of the four piezometers.**}**

2.3.3.3 References

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Table 2.3.3-1 Summary of Water Quality Analytical Data and In-situ Measurements for CCNPP Streams and Ponds (Page 1 of 2)

Water Body	Units	Johns Creek		Goldstein Branch	Lake Conoy[a]				Pond 1[a]	Pond 2[a]	Lake Davies		
Parameter		JCUS-01	JCDS-01	GB-01	LC-01	LC-02	LC-02 DUP	LC-03	P-01	P-02	LD-01	LD-02	LD-03
Temperature[b]	°F (°C)	64 (18)	59 (15.5)	62 (16.9)	76 (24.9)	70 (21.3)	NA	70 (21.7)	65 (18.4)	63 (17.3)	68 (20)	70 (20.5)	71 (20.7)
Dissolved Oxygen[b]	ppm	6.4	6	6.7	7.6	6.1	NA	6.16	3.21	0.99	3.4	3.4	4
pH[b]	SU	6.4	7.63	7.4	7.8	7.72	NA	7.3	6.7	6.39	7.5	7.7	7.7
Conductivity[b]	µmhos/cm	50	484	737	66	63	NA	62	109	135	1566	1592	1591
Alkalinity	mg/L	3.5	76	100	14	8.5	4.5	4.5	30	56	330	280	270
Biological Oxygen Demand (BOD)	mg/L	<2.0	3.2	5.9	6.3	6.9	<2.0	4.5	18	14	9.8	7.2	9.1
Ammonia	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrate plus Nitrite-N	mg/L	<0.05	<0.05	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus Dissolved-P	mg/L	0.021	0.018	0.011	<0.01	0.021	<0.01	0.011	0.011	<0.01	0.22	0.19	0.21
Phosphorus Total-P	mg/L	0.029	0.032	0.079	0.17	0.038	0.067	0.035	0.18	0.095	0.36	0.31	0.29
Total Dissolved Solids	mg/L	30	280	440	35	67	20	48	41	51	980	950	980
Total Kjeldahl Nitrogen	mg/L	2	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	3.1	1.4	2.2	1.8	1.7
Total Organic Carbon	mg/L	5.5	4	3.9	6.1	5.8	5.6	5.7	6.3	6.4	15	16	16
Total Suspended Solids	mg/L	4	5	62 (16.9)	27	<5.0	<5.0	150	56	11	6	6.5	8

See footnotes at end of table.

[a]Lake Conoy is also known as the Camp Conoy Fishing Pond. Pond 1 and Pond 2 are the first and second impoundments downstream of the Camp Conoy Fishing Pond.

[b]Insitu measurements for Temperature, Dissolved Oxygen, pH, and Conductivity are for surface readings. Additional data collected at various depths in the two lakes are provided in Table 2.3.3-1 (Page 2 of 2).

Table 2.3.3-1 Summary of Water Quality Analytical Data and In-situ Measurements for CCNPP Streams and Ponds (Page 2 of 2)

Water Body	Units	Lake Conoy			Lake Davies		
		LC-01	**LC-02**	**LC-03**	**LD-01**	**LD-02**	**LD-03**
Parameter - Surface							
Temperature	°F (°C)	76 (24.9)	70 (21.3)	70 (21.7)	68 (20)	70 (20.5)	71 (20.7)
Dissolved Oxygen	ppm	7.6	6.1	6.16	3.4	3.4	4
pH	SU	7.8	7.72	7.3	7.5	7.7	7.7
Conductivity	µmhos/cm	66	63	62	1566	1592	1591
Parameter – Mid-Depth							
Temperature	°F (°C)	NA	NA	70.6 (21.2)	68 (20)	68.4 (20.2)	68.5 (20.3)
Dissolved Oxygen	ppm	NA	NA	5.68	3.1	2.5	2.5
pH	SU	NA	NA	7.06	7.6	7.6	7.7
Conductivity	µmhos/cm	NA	NA	63	1581	1612	1581
Parameter - Bottom							
Temperature	°F (°C)	77.5 (25.3)	70.4 (21.34)	70.2 (21.2)	67.8 (19.9)	68.4 (20.2)	67.8 (19.9)
Dissolved Oxygen	ppm	6.7	5.88	5.06	2.2	2.6	2.2
pH	SU	7.5	7.44	6.77	7.5	7.6	7.7
Conductivity	µmhos/cm	65	62	62	1563	1608	1576

mg/L = Milligrams per liter
NA = Not applicable. There is no duplicate sampling for in-situ measurements.
µmhos/cm =Microsiemens per centimeter
ppm = Parts per million
SU = Standard Units (pH)

Table 2.3.3-2 Summary of Pycnocline Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005

Station ID	Fall		Winter		Spring		Summer		Yearly Average
	Max	Min	Max	Min	Max	Min	Max	Min	
Depth to Pycnocline in feet (meters)									
CB4.3C	37.7 (11.5)	27.9 (8.5)	57.4 (17.5)	11.5 (3.5)	41 (12.5)	11.5 (3.5)	41 (12.5)	14.8 (4.5)	29.2 (8.9)
CB4.3E	34.4 (10.5)	11.5 (3.5)	--	--	44.3 (13.5)	14.8 (4.5)	27.9 (8.5)	14.8 (4.5)	25.7 (7.8)
CB4.4	44.3 (13.5)	18 (5.5)	44.3 (13.5)	27.9 (8.5)	34.4 (10.5)	8.2 (2.5)	41 (12.5)	27.9 (8.5)	31.4 (9.6)
CB5.1	47.6 (14.5)	8.2 (2.5)	54.1 (16.5)	18 (5.5)	41 (12.5)	11.5 (3.5)	37.7 (11.5)	14.8 (4.5)	27.9 (8.5)
Thickness of Pycnocline in feet (meters)									
CB4.3C	16.4 (5)	9.8 (3)	29.5 (9)	3.3 (1)	29.5 (9)	9.8 (3)	23 (7)	3.3 (1)	16.2 (4.9)
CB4.3E	19.7 (6)	16.4 (5)	--	--	6.6 (2)	<3 (<1)	26.2 (8)	9.8 (3)	13.1 (4)
CB4.4	49.2 (15)	9.8 (3)	19.7 (6)	9.8 (3)	32.8 (10)	19.7 (6)	23 (7)	6.6 (2)	19.9 (6.1)
CB5.1	52.5 (16)	6.6 (2)	32.8 (10)	9.8 (3)	49.2 (15)	23 (7)	49.2 (15)	9.8 (3)	23.6 (7.2)

Note:
-- = No data

{Table 2.3.3-3 Summary of Temperature Statistics (°F [°C]) for Selected Chesapeake Bay Monitoring Stations, Water Year 2005
(Page 1 of 1)

Seasonal Statistics	CB4.3W	CB4.3C	CB4.3E	CB4.4	CB5.1W	CB5.1
Fall – September, October, November						
Max	78.3 (25.7)	79.7 (26.5)	79.5 (26.4)	80.6 (27.0)	80.2 (26.8)	79.9 (26.6)
Min	66.6 (19.2)	56.7 (13.7)	66.4 (19.1)	58.1 (14.5)	53.2 (11.8)	58.3 (14.6)
Average	71.9 (22.2)	69.9 (21.1)	73.4 (23.0)	69.7 (21.0)	70.7 (21.5)	69.9 (21.1)
N	15	66	37	74	22	78
Winter – December, January, February						
Max	--	54.5 (12.5)	--	54.5 (12.5)	47.7 (8.7)	54.5 (12.5)
Min	--	34.9 (1.6)	--	35.1 (1.7)	35.6 (2.0)	35.1 (1.7)
Average	--	42.8 (6.0)	--	42.7 (6.0)	43.0 (6.1)	43.2 (6.2)
N	0	69	0	75	10	75
Spring – March, April, May						
Max	61.7 (16.5)	61.5 (16.4)	61.3 (16.3)	61.9 (16.6)	62.8 (17.1)	62.2 (16.8)
Min	38.7 (3.7)	38.3 (3.5)	38.1 (3.4)	38.1 (3.4)	36.9 (2.7)	38.1 (3.4)
Average	51.0 (10.6)	49.0 (9.4)	50.0 (10.0)	49.8 (9.9)	51.2 (10.7)	49.2 (9.6)
N	41	105	93	123	26	131
Summer – June, July, August						
Max	82.9 (28.3)	83.5 (28.6)	83.1 (28.4)	85.3 (29.6)	83.5 (28.6)	84.4 (29.1)
Min	71.6 (22.0)	60.6 (15.9)	60.8 (16.0)	60.6 (15.9)	61.0 (16.1)	61.0 (16.1)
Average	79.0 (26.1)	74.9 (23.9)	75.0 (23.9)	75.4 (24.1)	77.6 (25.3)	74.8 (23.8)
N	50	126	108	135	24	148

Notes:

N = Number of measurements
-- = No data

{**Table 2.3.3-4 Summary of Dissolved Oxygen Concentrations (mg/L) for Selected Chesapeake Bay Monitoring Stations, Water Year 2005**
(Page 1 of 1)

Seasonal Statistics	CB4.3W	CB4.3C	CB4.3E	CB4.4	CB5.1W	CB5.1
Fall – September, October, November						
Max	9.1	9.2	8.1	8.6	10.1	8.3
Min	4.6	0.2	0.2	0.2	5.1	0.2
Average	7.627	4.556	4.414	4.773	7.059	4.674
N	15	66	37	74	22	78
Winter – December, January, February						
Max	--	13.6	--	13.2	13.8	13.3
Min	--	5.5	--	5.7	10.6	5.8
Average	--	10.122	--	9.889	11.980	9.852
N	0	69	0	75	10	75
Spring – March, April, May						
Max	13.2	12.6	12.5	12.8	13	12.3
Min	3.1	1.2	1.4	1.3	7.9	0.9
Average	9.283	7.062	7.670	7.020	10.727	7.096
N	41	105	93	123	26	131
Summer – June, July, August						
Max	10.2	10.4	9.2	9.8	9.7	8.6
Min	0.2	0.1	0.1	0.1	3.0	0.1
Average	5.746	2.729	2.756	2.673	6.421	2.106
N	50	126	108	135	24	148

Notes:

N = Number of measurements
-- = No data

{Table 2.3.3-5 Summary of Salinity Statistics (parts per thousand) for Selected Chesapeake Bay Monitoring Stations, Water Year 2005 (Page 1 of 1)

Seasonal Statistics	CB4.3W	CB4.3C	CB4.3E	CB4.4	CB5.1W	CB5.1
Fall – September, October, November						
Max	14.87	20.78	20.29	21.55	15.41	21.83
Min	7.93	7.93	8.89	9.98	8.44	10.69
Average	11.13	15.59	14.50	16.03	12.60	16.60
N	15	66	37	74	22	78
Winter – December, January, February						
Max	--	18.83	--	19.87	10.24	20.08
Min	--	5.82	--	7.12	8.69	8.38
Average	--	13.17	--	14.73	9.66	15.32
N	0	69	0	75	10	75
Spring – March, April, May						
Max	11.8	19.11	18.14	19.52	10.69	20.01
Min	4.6	4.06	4.3	4.42	5.39	4.18
Average	8.37	12.42	11.78	13.30	8.78	14.15
N	41	105	93	123	25	131
Summer – June, July, August						
Max	15.07	21.48	20.64	22.18	15	21.9
Min	10.5	10.56	10.63	10.95	9.33	10.95
Average	11.98	15.83	15.45	16.38	12.46	17.38
N	50	126	108	135	24	148

Notes:

N = Number of measurements
-- = No data

{Table 2.3.3-6 Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005
(Page 1 of 5)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	µmhos/cm	µg/L	mg/L
CB4.3W	***Fall – September, October, November***										
	Max	0.014	0.0434	0.3727	0.5434	0.0117	0.063	8.3	24700	17.942	14.6
	Min	0.003	0.001	0.001	0.465	0.0027	0.034	7.7	14100	8.373	6.6
	Average	0.008	0.0219	0.1830	0.5180	0.0058	0.0439	8.127	18993	13.606	9.45
	N	4	4	4	5	4	4	15	15	4	4
	Winter – December, January, February										
	Max	--	--	--	--	--	--	--	--	--	--
	Min	--	--	--	--	--	--	--	--	--	--
	Average	--	--	--	--	--	--	--	--	--	--
	N	--	--	--	--	--	--	--	--	--	--
	Spring – March, April, May										
	Max	0.277	0.0197	0.971	0.679	0.0139	0.0792	8.4	20100	42.165	31.7
	Min	0.003	0.0058	0.376	0.398	0.002	0.0214	7.1	8700	3.289	3.3
	Average	0.086	0.0104	0.5766	0.5070	0.0042	0.0365	7.868	14744	16.293	11.26
	N	10	10	10	12	10	10	41	41	10	9
	Summer – June, July, August										
	Max	0.302	0.0091	0.1769	1.2507	0.0932	0.1223	8.5	25000	53.827	16.8
	Min	0.003	0.0002	0.0008	0.3551	0.0023	0.0257	7.2	18100	1.096	3.7
	Average	0.059	0.0025	0.0329	0.7025	0.0139	0.0597	8.018	20356	17.367	9.29
	N	12	12	13	17	12	12	50	50	12	12
CB4.3C	***Fall – September, October, November***										
	Max	0.185	0.2045	0.374	0.5364	0.067	0.085	8.2	33300	17.942	11.2
	Min	0.003	0.0192	0.0033	0.3418	0.0016	0.023	7.4	14100	0.897	2.8
	Average	0.036	0.0478	0.1679	0.4389	0.0163	0.0396	7.791	25676	6.205	6.31
	N	15	13	13	15	15	15	66	66	14	12
	Winter – December, January, February										

{Table 2.3.3-6 Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005 (Page 2 of 5)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	µmhos/cm	µg/L	mg/L
	Max	0.129	0.0196	0.7785	1.104	0.0107	0.062	8.3	30500	26.615	28.2
	Min	0.003	0.0041	0.0532	0.348	0.002	0.0172	7.6	10700	2.563	2.4
	Average	0.048	0.0105	0.3375	0.5908	0.0053	0.0322	7.893	22084	11.758	9.43
	N	15	15	15	16	15	15	69	69	15	12
	Spring – March, April, May										
	Max	0.281	0.0143	0.7953	0.817	0.0061	0.0475	8.5	30900	42.464	15.5
	Min	0.003	0.0058	0.0895	0.27	0.002	0.0195	7.1	7800	2.243	2.9
	Average	0.091	0.0095	0.4111	0.5362	0.0034	0.0312	7.639	20932	16.689	7.76
	N	25	25	25	28	25	25	105	105	25	23
	Summer – June, July, August										
	Max	0.326	0.0107	0.1977	0.664	0.0697	0.1008	8.6	34300	14.952	31.2
	Min	0.003	0.0002	0.0011	0.2938	0.0016	0.0208	7.1	18200	0.498	2.4
	Average	0.119	0.0029	0.0282	0.4795	0.0172	0.0467	7.630	26066	6.065	6.34
	N	30	29	32	35	30	29	126	126	30	24
CB4.3E	***Fall – September, October, November***										
	Max	0.094	0.0792	0.3495	0.558	0.0647	0.0961	8.2	32600	14.204	9.8
	Min	0.003	0.0002	0.0008	0.3609	0.0016	0.0207	7.4	15600	1.196	3.4
	Average	0.025	0.0277	0.1264	0.4470	0.0213	0.0484	7.746	24092	5.490	6.32
	N	8	8	9	10	8	8	37	37	8	5
	Winter – December, January, February										
	Max	--	--	--	--	--	--	--	--	--	--
	Min	--	--	--	--	--	--	--	--	--	--
	Average	--	--	--	--	--	--	--	--	--	--
	N	--	--	--	--	--	--	--	--	--	--
	Spring – March, April, May										
	Max	0.278	0.0145	0.77	0.793	0.008	0.0826	8.4	29500	41.866	51

{Table 2.3.3-6 Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005 (Page 3 of 5)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	µmhos/cm	µg/L	mg/L
	Min	0.003	0.0053	0.0975	0.389	0.0018	0.0173	7.1	8200	3.551	2.8
	Average	0.104	0.0090	0.3713	0.5088	0.0034	0.0338	7.714	19981	15.564	14.02
	N	20	20	20	21	20	19	93	93	20	14
	Summer – June, July, August										
	Max	0.344	0.0157	0.1648	0.6342	0.0725	0.1002	8.5	33100	17.045	15.9
	Min	0.003	0.0002	0.0006	0.2864	0.0019	0.0267	7	18300	0.797	2.4
	Average	0.143	0.0039	0.0220	0.4560	0.0221	0.0521	7.609	25519	6.509	6.58
	N	24	24	31	28	24	24	108	108	24	19
CB4.4	***Fall – September, October, November***										
	Max	0.167	0.1775	0.2951	0.597	0.0567	0.0752	8.2	34400	19.139	14.6
	Min	0.003	0.0003	0.0022	0.3156	0.0019	0.0236	7.4	17300	0.449	2.6
	Average	0.045	0.0596	0.0969	0.4291	0.0190	0.0430	7.839	26350	4.604	7.71
	N	15	14	14	17	15	15	74	74	15	10
	Winter – December, January, February										
	Max	0.12	0.0219	0.6152	1.0337	0.0149	0.1171	8.4	32000	34.39	98.3
	Min	0.003	0.0035	0.0386	0.3288	0.0006	0.0131	7.7	12800	2.392	4
	Average	0.043	0.0096	0.2136	0.5667	0.0050	0.0448	7.972	24407	14.113	30.40
	N	15	15	15	16	15	15	75	75	15	11
	Spring – March, April, May										
	Max	0.259	0.0203	0.8034	0.8573	0.0072	0.0694	8.6	31500	34.39	40.5
	Min	0.003	0.0045	0.0479	0.341	0.0015	0.0156	7.2	8400	5.607	2.6
	Average	0.106	0.0089	0.3094	0.5117	0.0034	0.0328	7.698	22265	16.387	11.09
	N	25	25	25	27	25	24	123	123	25	22
	Summer – June, July, August										
	Max	0.291	0.0131	0.1799	0.6933	0.0719	0.0986	8.5	35300	26.316	30.6
	Min	0.003	0.0002	0.001	0.2698	0.0017	0.0254	7	18800	0.748	2.4
	Average	0.145	0.0032	0.0225	0.4409	0.0225	0.0509	7.632	26868	5.239	8.78

{Table 2.3.3-6 Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005 (Page 4 of 5)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	µmhos/cm	µg/L	mg/L
	N	30	28	32	30	30	30	135	135	30	25
CB5.1	*Fall – September, October, November*										
	Max	0.145	0.1775	0.263	0.462	0.0545	0.0778	8.2	34800	11.214	28.8
	Min	0.003	0.0002	0.0012	0.3379	0.0028	0.0249	7.5	18400	0.897	3.2
	Average	0.041	0.0524	0.0856	0.4115	0.0150	0.0404	7.849	27200	5.177	7.46
	N	12	12	13	15	12	12	78	78	12	9
	Winter – December, January, February										
	Max	0.122	0.0196	0.4916	0.6394	0.0162	0.0579	8.4	32300	22.054	34.3
	Min	0.003	0.0032	0.0334	0.341	0.0006	0.0139	7.7	14800	2.35	3.1
	Average	0.034	0.0088	0.2247	0.4416	0.0043	0.0290	7.999	25295	10.527	8.55
	N	12	12	12	13	12	12	75	75	12	12
	Spring – March, April, May										
	Max	0.249	0.0152	0.8126	0.808	0.0067	0.0792	8.4	32200	27.412	59
	Min	0.003	0.0042	0.0464	0.316	0.0014	0.013	7.2	8000	5.981	2.4
	Average	0.084	0.0079	0.3169	0.4958	0.0033	0.0318	7.777	23550	15.697	10.91
	N	20	19	19	22	20	20	131	131	20	18
	Summer – June, July, August										
	Max	0.29	0.011	0.1768	0.6651	0.0689	0.1038	8.5	34900	16.148	23
	Min	0.003	0.0002	0.001	0.3094	0.0019	0.0229	7.1	18800	0.498	2.4
	Average	0.110	0.0025	0.0215	0.4504	0.0178	0.0464	7.593	28340	5.419	6.23
	N	24	23	28	28	24	24	148	148	24	18
CB5.1W	*Fall – September, October, November*										
	Max	0.055	0.1032	0.4085	0.9713	0.0159	0.0551	8.2	25500	8.22	12.4
	Min	0.003	0.0023	0.0021	0.357	0.0033	0.0239	7.6	14900	2.06	2.9
	Average	0.017	0.0349	0.1762	0.5540	0.0080	0.0358	7.968	21259	5.618	5.50
	N	25	25	25	32	25	25	22	22	25	24

{Table 2.3.3-6 Summary of Water Quality Data for Selected Chesapeake Bay Monitoring Stations, Water Year 2005 (Page 5 of 5)

Monitoring Station ID	Seasonal Statistics	Water Quality Parameters									
		Ammonia (Filtered)	Filtered Nitrite	Filtered Nitrate	Total Organic Nitrogen	Ortho-phosphate	Total Phosphorus	pH	Specific Conductivity	Chlorophyll A	Total Suspended Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	µmhos/cm	µg/L	mg/L
	Winter – December, January, February										
	Max	0.024	0.0103	0.5711	0.583	0.0072	0.0314	8	17700	9.42	7.5
	Min	0.003	0.007	0.3857	0.35	0.0014	0.0134	7.9	15300	3.44	2.4
	Average	0.012	0.0091	0.4790	0.4710	0.0036	0.0228	7.990	16810	6.413	5.27
	N	10	10	10	13	10	10	10	10	9	7
	Spring – March, April, May										
	Max	0.107	0.0259	0.8964	0.684	0.0057	0.0639	8.4	18400	14.52	34.3
	Min	0.006	0.0063	0.3081	0.2881	0.0009	0.0121	7.7	10000	3.44	2.4
	Average	0.032	0.0100	0.5475	0.4773	0.0028	0.0229	8.042	15412	8.509	8.03
	N	30	30	30	30	30	30	26	25	30	24
	Summer – June, July, August										
	Max	0.209	0.0088	0.3435	0.9183	0.014	0.0637	8.5	24900	16.02	25.8
	Min	0.003	0.0002	0.0007	0.428	0.0023	0.0215	7.3	16300	3.29	5.2
	Average	0.031	0.0031	0.0644	0.6508	0.0047	0.0406	8.121	21075	8.606	9.37
	N	30	29	30	31	30	30	24	24	28	20
All Stations	***Annual***										
	Max	0.344	0.2045	0.971	1.2507	0.0932	0.1223	8.6	35300	53.827	98.3
	Min	0.003	0.0002	0.0006	0.2698	0.0006	0.0121	7	7800	0.449	2.4
	Average	0.074	0.0162	0.2014	0.5066	0.0103	0.0392	7.764	23978	9.764	9.06
	N	411	402	425	461	411	408	1631	1630	407	334

Notes:
µg/L = micrograms/liter
µmhos/cm = micromhos per centimeter
mg/L = milligrams/liter
N = Number of measurements
SU = Standard units (pH)
-- = No data

{Table 2.3.3-7 Summary of 2005 Radiological Liquid Effluent Calvert Cliffs Nuclear Power Plant Units 1 and 2 (Page 1 of 3)

Nuclide Reported	Continuous Mode		Batch Mode		Continuous Mode		Batch Mode	
	1st QTR	2nd QTR	1st QTR Ci (Bq)	2nd QTR Ci (Bq)	3rd QTR	4th QTR	1st QTR Ci (Bq)	2nd QTR Ci (Bq)
Beryllium - 7	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Sodium - 24	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Chromium - 51	(1)	(1)	1.22E-04 (4.51E+06)	2.67E-04 (9.88E+06)	(1)	(1)	(1)	(1)
Manganese - 54	(1)	(1)	1.14E-05 (4.22E+05)	2.01E-05 (7.44E+05)	(1)	(1)	5.39E-06 (1.99E+05)	4.22E-06 (1.56E+05)
Iron - 55	(2)	(2)	7.88E-04 (2.92E+07)	6.51E-02 (2.41E+09)	(2)	(2)	1.81E-02 (6.70E+08)	2.71E-03 (1.00E+08)
Cobalt - 57	(1)	(1)	(1)	1.39E-06 (5.14E+04)	(1)	(1)	(1)	(1)
Cobalt - 58	(1)	(1)	1.23E-03 (4.55E+07)	1.00E-03 (3.70E+07)	(1)	(1)	1.21E-04 (4.48E+06)	3.97E-05 (1.47E+06)
Iron - 59	(1)	(1)	4.08E-06 (1.51E+05)	1.25E-05 (4.63E+05)	(1)	(1)	(1)	(1)
Cobalt - 60	(1)	(1)	2.57E-04 (9.51E+06)	1.21E-04 (4.48E+06)	(1)	(1)	1.99E-04 (7.36E+06)	1.67E-05 (6.18E+06)
Nickel - 63	(1)	(1)	3.17E-04 (1.17E+07)	4.92E-03 (1.82E+08)	(1)	(1)	7.82E-04 (2.89E+07)	1.40E-04 (5.18E+06)
Zinc - 65	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Strontium - 89	(1)	(1)	2.75E-04 (1.02E+07)	7.54E-05 (2.79E+06)	(1)	(1)	3.25E-05 (1.20E+06)	(1)
Strontium - 90	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Strontium - 92	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Niobium - 95	(1)	(1)	2.81E-05 (1.04E+06)	1.24E-04 (4.59E+06)	(1)	(1)	4.41E-06 (1.63E+05)	3.88E-06 (1.44E+05)
Zirconium - 95	(1)	(1)	2.30E-05 (8.51E+05)	8.81E-05 (3.26E+06)	(1)	(1)	4.38E-06 (1.62E+05)	1.95E-06 (7.22E+04)
Niobium - 97	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Zirconium - 97	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Molybdenum - 99	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)

{Table 2.3.3-7 Summary of 2005 Radiological Liquid Effluent Calvert Cliffs Nuclear Power Plant Units 1 and 2 (Page 2 of 3)

Nuclide Reported	Continuous Mode		Batch Mode		Continuous Mode		Batch Mode	
	1st QTR	2nd QTR	1st QTR Ci (Bq)	2nd QTR Ci (Bq)	3rd QTR	4th QTR	1st QTR Ci (Bq)	2nd QTR Ci (Bq)
Technetium - 99m	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Ruthenium - 103	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Rhodium - 105	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Ruthenium - 105	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Silver - 110m	(1)	(1)	(1)	(1)	(1)	(1)	9.78E-06 (3.62E+05)	(1)
Tin - 113	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Tin - 117m	(1)	(1)	6.10E-05 (2.26E+06)	6.72E-05 (2.49E+06)	(1)	(1)	(1)	(1)
Antimony - 122	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Antimony - 124	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Antimony - 125	(1)	(1)	8.57E-06 (3.17E+05)	(1)	(1)	(1)	(1)	(1)
Tellurium - 125m	(1)	(1)	5.68E-03 (2.10+08)	7.02E-03 (2.60E+08)	(1)	(1)	(1)	(1)
Tellurium - 132	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Iodine - 131	(1)	(1)	1.45E-04 (5.37E+06)	2.59E-06 (9.58E+04)	(1)	(1)	4.39E-06 (1.62E+05)	6.35E-06 (2.35E+05)
Iodine - 132	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Iodine - 133	(1)	(1)	2.32E-06 (8.58E+04)	4.38E-06 (1.62E+05)	(1)	(1)	4.91E-06 (1.82E+05)	4.24E-06 (1.57E+05)
Iodine - 135	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Cesium - 134	(1)	(1)	2.25E-05 (8.33E+05)	3.02E-05 (1.12E+06)	(1)	(1)	1.48E-05 (5.48E+05)	8.03E-06 (2.97E+05)
Cesium - 136	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Cesium - 137	(1)	(1)	4.58E-05 (1.69E+06)	3.49E-05 (1.29E+06)	(1)	(1)	1.97E-05 (7.29E+05)	3.17E-05 (1.17E+06)
Barium - 140	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)

{Table 2.3.3-7 Summary of 2005 Radiological Liquid Effluent Calvert Cliffs Nuclear Power Plant Units 1 and 2 (Page 3 of 3)

Nuclide Reported	Continuous Mode		Batch Mode		Continuous Mode		Batch Mode	
	1st QTR	2nd QTR	1st QTR Ci (Bq)	2nd QTR Ci (Bq)	3rd QTR	4th QTR	1st QTR Ci (Bq)	2nd QTR Ci (Bq)
Lanthanum - 140	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Cerium - 144	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Europium - 154	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Europium - 155	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Tungsten - 187	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Total for Period	(1)	(1)	9.02E-03 (3.34E+08)	7.89E-02 (2.92E+09)	(1)	(1)	1.93E-02 (7.14E+08)	2.97E-03 (1.10E+08)
Krypton - 85	(1)	(1)	(1)	(1)	(1)	(1)	(1)	6.42E-03 (2.38E+08)
Xenon - 131m	(1)	(1)	1.92E-03 (7.10E+07)	(1)	(1)	(1)	(1)	(1)
Xenon - 133	(1)	(1)	1.13E-01 (4.18E+09)	2.03E-03 (7.51E+07)	(1)	(1)	2.63E-03 (9.73E+07)	1.52E-02 (5.62E+08)
Xenon - 133m	(1)	(1)	6.99E-04 (2.59E+07)	(1)	(1)	(1)	(1)	(1)
Xenon - 135	(1)	(1)	5.28E-05 (1.95E+06)	(1)	(1)	(1)	(1)	(1)
Total for Period	(1)	(1)	1.15E-01 (4.26E+09)	2.03E-03 (7.51E+07)	(1)	(1)	2.63E-03 (9.73E+07)	2.17E-02 (8.03E+08)

From: Calvert Cliffs Nuclear Power Plant – Effluent and Waste Disposal, Annual Report, July 13, 2006.
(1) = Less than minimal detectable activity which meets the LLD requirement of ODCM Surveillance Requirement 4.11.1.1.1.
(2) = Continuous mode effluents are not analyzed for Iron-55.
Bq = Becquerel; 1 Bq = 3.7E+10 Curies
Ci = Curies
M = Metastable isotope.

Table 2.3.3-8 Summary of Analytical Results for Chesapeake Bay Water Samples Collected during Ebb and Flood Tides at the Unit 1 and 2 Intake Structure, February – May 2007 (Page 1 of 2)

Parameter	EPA Test Method	Method Detection Limit	Ebb Tide 2/19/07	Flood Tide 2/20/07	Ebb Tide 3/05/07	Flood Tide 3/06/07	Ebb Tide 3/20/07	Flood Tide 3/20/07	Ebb Tide 4/17/07	Flood Tide 4/17/07	Ebb Tide 5/22/07	Flood Tide 5/22/07
Metals												
Aluminum	200.7	0.1 mg/L	0.26	0.19	ND (0.5)	ND (0.5)	ND (0.10)	0.12	0.4	0.33	ND (0.1)	ND (0.1)
Arsenic	200.8	0.0004 mg/L	0.035	0.041	0.03	0.028	0.02	0.022	0.02	0.02	ND (0.002)	ND (0.002)
Barium	200.8	0.001 mg/L	0.03	0.033	0.024	0.023	0.029	0.029	0.03	0.03	0.027	0.027
Calcium	200.7	0.5 mg/L	160	170	180	170	180	170	130	130	170	160
Copper	200.8	0.0004 mg/L	0.025	0.024	0.026	0.026	0.019	0.021	0.026	0.027	0.029	0.031
Iron, dissolved	200.7	0.01 mg/L	ND (0.01)	ND (0.01)	ND (0.05)	ND (0.05)	ND (0.10)	ND (0.10)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)
Iron, total	200.7	0.01 mg/L	0.22	0.12	2.7	0.36	0.042	0.082	0.55	0.46	0.041	0.1
Lead	200.8	0.0004 mg/L	0.0017	0.0018	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)
Manganese, dissolved	200.7	0.01 mg/L	ND (0.01)	ND (0.10)	ND (0.05)	ND (0.05)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)
Manganese, total	200.7	0.01 mg/L	ND (0.01)	ND (0.10)	ND (0.05)	ND (0.05)	ND (0.01)	ND (0.01)	0.021	0.015	0.069	0.064
Magnesium	200.7	0.1 mg/L	460	490	490	480	480	500	360	360	450	430
Potassium	200.7	0.1 mg/L	160	170	150	150	150	150	120	120	140	130
Sodium	200.7	1 mg/L	3,700	3,800	4,000	3,900	3,600	3,800	3,000	3,100	3,600	3,400
Strontium	200.7	0.005 mg/L	2.8	2.9	2.9	2.8	2.6	2.7	2	2.1	2.5	2.4
Vanadium	200.7	0.01 mg/L	ND (0.01)	ND (0.01)	ND (0.05)	ND (0.05)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)
Zinc	200.7	0.02 mg/L	ND (0.02)	ND (0.020)	ND (0.10)	ND (0.10)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	ND (0.02)	0.09
Non-Metals												
M alkalinity, as $CaCO_3$	310.1	1 mg/L	72	75	69	72	74	40	60	60	70	70
Ammonia as NH_3	350.2	1 mg/L	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1.0)	ND (1.0)
Biological Oxygen Demand (BOD_5)	405.1	2 mg/L	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (3)	3.7	ND (2.0)	ND (2.0)
Bromides	320.1_R3_83	1 mg/L	17	15	11	11	15	16	8.8	8.9	NR	NR
Chlorides	325.3	1 mg/L	6,500	6,700	7,200	6,500	6,600	7,000	4,900	5,000	6,600	6,500
Color (Color Units)	110.2	5 Color Units	10	5	15	10	5	5	ND (5)	ND (5)	15	10
Conductivity, (µmho/cm)	120.1	NA	28,000	29,000	20,000	20,000	19,000	20,000	15,000	15,000	21,000	23,000
Fluorides	340.2	0.1 mg/L	0.37	0.36	0.42	0.43	0.42	0.43	0.44	0.48	0.41	0.41
Hardness as $CaCO_3$	130.2	1 mg/L	3,400	4,000	3,600	3,200	4,500	3,300	2,400	2,200	4,300	3,100
Nitrates, as NO_3	353.2	0.05 mg/L	0.3	0.29	0.22	0.22	0.26	0.25	0.51	0.51	0.19	0.19
Nitrites, as NO_2	SM 4500	0.005 mg/L	0.0063	0.006	ND (0.005)	ND (0.005)	0.05	ND (0.005)	ND (0.005)	0.0057	0.011	0.012

Table 2.3.3-8 Summary of Analytical Results for Chesapeake Bay Water Samples Collected during Ebb and Flood Tides at the Unit 1 and 2 Intake Structure, February – May 2007 (Page 2 of 2)

Parameter	EPA Test Method	Method Detection Limit	Ebb Tide 2/19/07	Flood Tide 2/20/07	Ebb Tide 3/05/07	Flood Tide 3/06/07	Ebb Tide 3/20/07	Flood Tide 3/20/07	Ebb Tide 4/17/07	Flood Tide 4/17/07	Ebb Tide 5/22/07	Flood Tide 5/22/07
Oil & grease (O&G)	1664	5 mg/L	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
pH (standard units)	150.1	1	7.7	7.8	7.8	7.8	7.5	7.2	7.6	7.2	8.5	8.4
Phosphorus, Total as P	SM 4500	0.01 mg/L	0.04	0.043	0.052	0.061	0.036	0.056	0.054	0.057	0.04	0.043
PO_4	SM 4500PE	0.01 mg/L	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	0.023	ND (0.01)	ND (0.01)
Silica, dissolved	200.7	0.5 mg/L	1.1	0.99	ND (2.5)	ND (2.5)	0.62	0.58	0.82	0.85	ND (0.5)	ND (0.5)
Silica, total	200.7	0.5 mg/L	2	1.8	ND (2.5)	ND (2.5)	1.1	1.2	2	1.8	0.61	0.69
Sulfates	375.4	1 mg/L	1,000	940	950	980	980	1,100	580	1,100	1,000	1,100
Total Organic Carbon (TOC)	415.1	1 mg/L	2.6	2.1	1.2	1.2	2.7	4.3	2.6	3.6	NR	NR
Total Dissolved Solids (TDS)	160.1	1 mg/L	12,000	12,000	14,000	11,000	12,000	11,000	15,000	14,000	18,000	13,000
Total Suspended Solids (TSS)	160.2	1 mg/L	12	11	21	23	17	18	28	25	7	8.5
Turbidity (NTU)	180.1	0.1 NTU	ND (0.1)	ND (0.1)	4	5.5	3.7	5.1	8.5	7.7	4.7	3.3

BOD_5 = Biological Oxygen Demand, corrected for dilution
M Alkalinity = Total alkalinity expressed as $CaCo_3$
NA = Not analyzed
ND ( ) = Not detected at the concentration reported inside the parentheses
NR = Not Reported as of June 14, 2007
NTU = Nephelometric Turbidity Unit
SM = Standard Method

{Table 2.3.3-9 Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006
(Page 1 of 7)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
General Chemistry Parameters							
Ammonia	--	--	mg/kg	7.0	**6.1 J**	**6.8 J**	**4.9 J**
Total Kjeldahl Nitrogen	--	--	mg/kg	210	**186 J**	**316**	ND
Total Organic Carbon	--	--	mg/kg	752	**23600**	**30700**	**24100**
Total Phosphorus	--	--	mg/kg	140	**1080**	**1110**	**615**
Metals							
Arsenic	7.240	41.600	mg/kg	0.98	**1.2**	**1.1**	**0.95 J**
Cadmium	0.676	4.210	mg/kg	0.49	**0.17 J**	**0.20 J**	**0.18 J**
Chromium	52.300	160.400	mg/kg	0.49	**3.7**	**4.3**	**3.4**
Copper	18.700	108.200	mg/kg	2.40	**1.2 J**	**1.2 J**	**1.3J**
Lead	30.240	112.180	mg/kg	0.29	**1.1**	**1.4**	**1.2**
Mercury	0.130	0.696	mg/kg	0.33	ND	ND	ND
Zinc	124.000	271.000	mg/kg	2.00	**7.5**	**9.4**	**9.3**
Polyaromatic Hydrocarbons							
Acenaphthene	6.71	88.9	µg/kg	640	ND	ND	ND
Acenaphthylene	5.87	127.87	µg/kg	640	ND	ND	ND
Anthracene	46.85	245	µg/kg	640	ND	ND	ND
Benzo(a)anthracene	74.83	692.53	µg/kg	640	ND	ND	ND
Benzo(a)pyrene	88.81	763.22	µg/kg	640	ND	ND	ND
Benzo(b)fluoranthene	--	--	µg/kg	640	ND	ND	ND
Benzo(ghi)perylene	--	--	µg/kg	640	ND	ND	ND
Benzo(k)fluoranthene	--	--	µg/kg	640	ND	ND	ND
Chrysene	107.77	845.98	µg/kg	640	ND	ND	ND
Dibenzo(a,h)anthracene	6.22	134.61	µg/kg	640	ND	ND	ND

{Table 2.3.3-9 Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006
(Page 2 of 7)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
Fluoranthene	112.82	1493.54	µg/kg	640	ND	ND	ND
Fluorene	21.17	144.35	µg/kg	640	ND	ND	ND
Naphthalene	34.57	390.64	µg/kg	640	ND	ND	ND
Phenanthrene	86.68	543.53	µg/kg	640	ND	ND	ND
Pyrene	152.66	1397.6	µg/kg	640	ND	ND	ND
PCB Congeners *							
PCB 90	--	--	µg/kg	0.24	ND	ND	ND
PCB 8	--	--	µg/kg	0.24	ND	ND	ND
PCB 18	--	--	µg/kg	0.24	**0.18 J**	**0.2 J, PG**	**0.27, PG**
PCB 28	--	--	µg/kg	0.24	ND	ND	ND
PCB 44	--	--	µg/kg	0.24	ND	ND	ND
PCB 49	--	--	µg/kg	0.24	ND	ND	ND
PCB 52	--	--	µg/kg	0.24	ND	ND	ND
PCB 66	--	--	µg/kg	0.24	ND	ND	ND
PCB 77	--	--	µg/kg	0.24	ND	ND	ND
PCB 87	--	--	µg/kg	0.24	ND	ND	ND
PCB 101	--	--	µg/kg	0.24	ND	ND	**0.058 J, PG**
PCB 105	--	--	µg/kg	0.24	ND	ND	ND
PCB 118	--	--	µg/kg	0.24	ND	ND	ND
PCB 126	--	--	µg/kg	0.24	ND	ND	ND
PCB 128	--	--	µg/kg	0.24	ND	ND	ND
PCB 138	--	--	µg/kg	0.24	ND	ND	ND
PCB 153	--	--	µg/kg	0.24	ND	ND	ND
PCB 156	--	--	µg/kg	0.24	ND	ND	ND
PCB 169	--	--	µg/kg	0.24	ND	ND	ND
PCB 170	--	--	µg/kg	0.24	ND	ND	ND

{Table 2.3.3-9 Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006 (Page 3 of 7)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
PCB 180	--	--	µg/kg	0.24	ND	ND	ND
PCB 183	--	--	µg/kg	0.24	ND	ND	ND
PCB 184	--	--	µg/kg	0.24	ND	ND	ND
PCB 187	--	--	µg/kg	0.24	ND	ND	ND
PCB 195	--	--	µg/kg	0.24	ND	ND	ND
PCB 206	--	--	µg/kg	0.24	ND	ND	ND
PCB 209	--	--	µg/kg	0.24	ND	ND	ND
Chlorinated Pesticides							
4,4'-DDD	1.22	7.81	µg/kg	1.7	ND	ND	ND
4,4'-DDE	2.07	374.17	µg/kg	1.7	ND	ND	**0.18 J, PG**
4,4'-DDT	1.19	4.77	µg/kg	1.7	ND	ND	ND
Aldrin	--	--	µg/kg	1.7	**0.15 J, PG**	**0.17 J, PG**	**0.17 J, PG**
Alpha-BHC	--	--	µg/kg	1.7	ND	ND	ND
Alpha-Chlordane	--	--	µg/kg	1.7	ND	ND	ND
Beta-BHC	--	--	µg/kg	1.7	ND	ND	ND
Delta-BHC	--	--	µg/kg	1.7	ND	ND	ND
Dieldrin	0.715	4.3	µg/kg	1.7	ND	ND	ND
Endosulfan I	--	--	µg/kg	1.7	ND	ND	ND
Endosulfan II	--	--	µg/kg	1.7	ND	ND	ND
Endosulfan Sulfate	--	--	µg/kg	1.7	ND	ND	ND
Endrin	--	--	µg/kg	1.7	ND	ND	ND
Endrin Aldehyde	--	--	µg/kg	1.7	ND	**0.41 J, PG**	ND
Endrin Ketone	--	--	µg/kg	1.7	ND	ND	ND
Gamma-BHC (Lindane)	0.32	0.99	µg/kg	1.7	ND	ND	ND
Gamma-Chlordane	--	--	µg/kg	1.7	ND	ND	ND
Heptachlor	--	--	µg/kg	1.7	**0.29 J, PG**	**0.52 J**	**0.63 J**

{Table 2.3.3-9 Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006
(Page 4 of 7)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
Heptachlor Epoxide	0.6	2.74	µg/kg	1.7	ND	ND	ND
Methoxychlor	--	--	µg/kg	3.2	ND	ND	ND
Toxaphene	--	--	µg/kg	66	ND	ND	ND
Semi-Volatile Organic Compounds							
1,2,4-Trichlorobenzene	--	--	µg/kg	640	ND	ND	ND
1,2-Dichlorobenzene	--	--	µg/kg	640	ND	ND	ND
1,2-Diphenylhydrazine	--	--	µg/kg	640	ND	ND	ND
1,3-Dichlorobenzene	--	--	µg/kg	640	ND	ND	ND
1,4-Dichlorobenzene	--	--	µg/kg	640	ND	ND	ND
2,4,6-Trichlorophenol	--	--	µg/kg	640	ND	ND	ND
2,4-Dichlorophenol	--	--	µg/kg	640	ND	ND	ND
2,4-Dimethylphenol	--	--	µg/kg	640	ND	ND	ND
2,4-Dinitrophenol	--	--	µg/kg	3100	ND	ND	ND
2,4-Dinitrotoluene	--	--	µg/kg	640	ND	ND	ND
2,6-Dinitrotoluene	--	--	µg/kg	640	ND	ND	ND
2-Chloronaphthalene	--	--	µg/kg	640	ND	ND	ND
2-Chlorophenol	--	--	µg/kg	640	ND	ND	ND
2-Methyl-4,6-Dinitrophenol	--	--	µg/kg	3100	ND	ND	ND
2-Nitrophenol	--	--	µg/kg	640	ND	ND	ND
3,3'-Dichlorobenzidine	--	--	µg/kg	3100	ND	ND	ND
4-Bromophenyl phenyl ether	--	--	µg/kg	640	ND	ND	ND
4-Chloro-3-methylphenol	--	--	µg/kg	640	ND	ND	ND
4-Chlorophenyl phenyl ether	--	--	µg/kg	640	ND	ND	ND
4-Nitrophenol	--	--	µg/kg	3100	ND	ND	ND
Benzidine	--	--	µg/kg	640	ND	ND	ND
Bis(2-Chloroethoxy)methane	--	--	µg/kg	640	ND	ND	ND

{Table 2.3.3-9 Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006 (Page 5 of 7)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
Bis(2-Chloroethyl) ether	--	--	µg/kg	640	ND	ND	ND
Bis(2-Chloroisopropyl) ether	--	--	µg/kg	640	ND	ND	ND
Bis(2-Ethylhexyl) phthalate	--	--	µg/kg	640	ND	ND	ND
Butyl benzyl phthalate	--	--	µg/kg	640	ND	ND	ND
Diethyl phthalate	--	--	µg/kg	640	ND	ND	ND
Dimethyl phthalate	--	--	µg/kg	640	ND	ND	ND
Di-n-butyl phthalate	--	--	µg/kg	640	ND	ND	ND
Di-n-octyl phthalate	--	--	µg/kg	640	ND	ND	ND
Hexachlorobenzene	--	--	µg/kg	640	ND	ND	ND
Hexachlorobutadiene	--	--	µg/kg	640	ND	ND	ND
Hexachlorocyclopentadiene	--	--	µg/kg	3100	ND	ND	ND
Hexachloroethane	--	--	µg/kg	640	ND	ND	ND
Indeno(1,2,3-cd)pyrene	--	--	µg/kg	640	ND	ND	ND
Isophorone	--	--	µg/kg	640	ND	ND	ND
Nitrobenzene	--	--	µg/kg	640	ND	ND	ND
N-Nitrosodimethylamine	--	--	µg/kg	640	ND	ND	ND
N-Nitrosodi-n-propylamine	--	--	µg/kg	640	ND	ND	ND
N-Nitrosodiphenylamine	--	--	µg/kg	640	ND	ND	ND
Pentachlorophenol	--	--	µg/kg	3100	ND	ND	ND
Phenol	--	--	µg/kg	640	ND	ND	ND
Volatile Organic Compounds							
1,1,1-Trichloroethane	--	--	µg/kg	7	ND	ND	ND
1,1,2,2-Tetrachloroethane	--	--	µg/kg	7	ND	ND	ND
1,1,2-Trichloroethane	--	--	µg/kg	7	ND	ND	ND
1,1-Dichloroethane	--	--	µg/kg	7	ND	ND	ND
1,1-Dichloroethene	--	--	µg/kg	7	ND	ND	ND

{Table 2.3.3-9 Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006 (Page 6 of 7)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
1,2-Dichloroethane	--	--	µg/kg	7	ND	ND	ND
1,2-Dichloropropane	--	--	µg/kg	7	ND	ND	ND
2-Chloroethyl vinyl ether	--	--	µg/kg	14	ND	ND	ND
Acrolein	--	--	µg/kg	140	ND	ND	ND
Acrylonitrile	--	--	µg/kg	140	ND	ND	ND
Benzene	--	--	µg/kg	7	ND	ND	ND
Bromodichloromethane	--	--	µg/kg	7	ND	ND	ND
Bromoform	--	--	µg/kg	7	ND	ND	ND
Bromomethane	--	--	µg/kg	7	ND	ND	ND
Carbon Tetrachloride	--	--	µg/kg	7	ND	ND	ND
Chlorobenzene	--	--	µg/kg	7	ND	ND	ND
Chloroethane	--	--	µg/kg	7	ND	ND	ND
Chloroform	--	--	µg/kg	7	ND	ND	ND
Chloromethane	--	--	µg/kg	7	ND	ND	ND
cis-1,3-Dichloropropene	--	--	µg/kg	7	ND	ND	ND
Dibromochloromethane	--	--	µg/kg	7	ND	ND	ND
Ethylbenzene	--	--	µg/kg	7	ND	ND	ND
Methylene Chloride	--	--	µg/kg	7	**4.5 J**	**5.0 J**	**4.5 J**
Tetrachloroethene	--	--	µg/kg	7	ND	ND	ND
Toluene	--	--	µg/kg	7	ND	ND	ND
Trans-1,2-Dichloroethene	--	--	µg/kg	7	ND	ND	ND
Trans-1,3-Dichloropropene	--	--	µg/kg	7	ND	ND	ND
Trichloroethene	--	--	µg/kg	7	ND	ND	ND
Vinyl Chloride	--	--	µg/kg	7	ND	ND	ND
Physical Properties							
Clay Percent	--	--	%	--	2.7	2.1	2.3

{Table 2.3.3-9 Summary of Analytical Results for Sediment Samples Collected in Chesapeake Bay Near the CCNPP Barge Slip - September 2006 (Page 7 of 7)

Analyte	Theshold Effects Level	Probable Effects Level	Units	Average Reporting Limit	CCNPP Unit 1	CCNPP Unit 2	CCNPP Unit 3
Gravel Percent	--	--	%	--	5.1	4.6	1.5
Sand Percent	--	--	%	--	93.9	93.5	96
Silt Percent	--	--	%	--	–	–	0.2
Specific Gravity	--	--	%	--	2.681	2.667	2.679
Percent Solids	--	--	%	--	**71.6**	**67.3**	**73.4**

Notes:

Bolded values represent detected concentrations.

* PCB congeners used for Total PCB summation, as per Table 9-3 of the Inland Testing Manual (USEPA/USACE 1998)

J = compound was detected, but below the reporting limit (value is estimated)

ND = Not detected

PG = the percent difference between the original and confirmation second column analysis is greater than 40%}

– = <1%

Table 2.3.3-10 Well Construction Data for Wells Sampled at CCNPP May 31, 2007 (Page 1 of 1)

Well	Ground Surface Elevation ft (m)	Well Pad Elevation ft (m)	Top of Casing Elevation ft (m)	Boring Depth ft (m)	Well Depth ft (m)	Screen Interval Depth ft (m)		Screen Interval Elevation ft (m)		Filterpack Interval Depth ft (m)		CCNPP Hydrostratigraphic Unit
						Top ft (m)	Bottom ft (m)	Top ft (m)	Bottom ft (m)	Top ft (m)	Bottom ft (m)	
OW 319A	103.13 (31.4)	103.31 (31.5)	104.91 (32)	35.0 (10.7)	32.0 (9.8)	20.0 (6.1)	30.0 (9.1)	83.1 (25.3)	73.1 (22.3)	15.0 (4.6)	35.0 (10.7)	Surficial Aquifer
OW 319B	103.53 (31.6)	103.85 (31.6)	105.35 (32.1)	85.0 (25.9)	82.0 (25)	70.0 (21.3)	80.0 (24.4)	33.5 (10.2)	23.5 (7.2)	65.0 (19.8)	85.0 (25.9)	Upper Chesapeake Unit
OW 752A	95.3 (29.0)	95.73 (29.2)	97.0 (29.6)	37.0 (11.3)	37.0 (11.3)	25.0 (7.6)	35.0 (10.7)	70.3 (21.4)	60.3 (18.4)	19.0 (5.6)	37.0 (11.3)	Surficial Aquifer
CCNPP Well No. 5	Not Available	Not Available	Not Available	Not Available	621 (190)	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Aquia

All elevations are in feet (m) above the North American Vertical Datum of 1927 (NAVD 27).

Table 2.3.3-11 Summary of Analytical Results for Groundwater Well Sampling at CCNPP. May 31, 2007 (Page 1 of 2)

Parameter	Units	OW 752A Surficial Aquifer	OW 319A Surficial Aquifer	OW 319B Upper Chesapeake Unit	OW 319B Duplicate Upper Chesapeake Unit	CCNPP Well No. 5 Aquia Aquifer	Rinse Blank
Metals							
Arsenic	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Barium	mg/l	0.027	0.055	0.044	0.044	0.025	<0.010
Cadmium	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Calcium	mg/l	1.5	9.2	85	85	7.0	0.62
Chromium	mg/l	<0.0049	0.025	<0.0031	<0.0030	<0.0025	<0.0025
Iron	mg/l	1.8	23	8.0	8.0	3.2	<0.10
Lead	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Magnesium	mg/l	1.4	3.2	3.1	3.1	2.3	<0.10
Mercury	mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Potassium	mg/l	1.5	3.7	2.4	2.4	10.0	<0.10
Selenium	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Silicon	mg/l	6.3	13	16	16	5.3	2.3
Silver	mg/l	<0.012	<0.012	<0.001	<0.001	<0.012	<0.001
Sodium	mg/l	4.9	8.3	9.9	9.8	29	1.5
Non-metals							
Alkalinity, Bicarbonate	mg/l	<5	24.6	190	187	101	<5
Alkalinity, Total as $CaCO_3$	mg/l	<2.2	24.6	190	187	101	<2.2
Carbon Dioxide	mg/l	**	85.4	21.3	21	20	<5
Biologic Oxygen Demand	mg/l	<2	<3	<3	<3	<2	<2
Chemical Oxygen Demand	mg/l	21	24	26	28	26	<10
Chloride (Titrimetric, Mercuric Nitrate)	mg/l	4	10	10	12	2	<1
Color, True	color units	5	10	5	5	<5	<5
Enterococci	MPN/100ml	<1	410.6	2	<1	387.3	<1
Total Coliform	MPN/100ml	<1	17.1	<1	<1	1,299.70	<1
Fecal Coliform	MPN/100ml	<1	<1	<1	<1	<1	<1

Table 2.3.3-11 Summary of Analytical Results for Groundwater Well Sampling at CCNPP. May 31, 2007 (Page 2 of 2)

Parameter	Units	OW 752A Surficial Aquifer	OW 319A Surficial Aquifer	OW 319B Upper Chesapeake Unit	OW 319B Duplicate Upper Chesapeake Unit	CCNPP Well No. 5 Aquia Aquifer	Rinse Blank
Hardness, Total	mg/L	29	190	300	300	120	9
Nitrogen, Ammonia	mg/L	<1	<1	<1	<1	<1	<1
Nitrogen, Organic	mg/L	<1	<1	<1	<1	<1	<1
Nitrogen, Total Kjeldahl	mg/L	<1	<1	<1	<1	<1	<1
Nitrogen, Nitrite	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrogen, Nitrate	mg/L	<0.050	2.9	<0.050	<0.050	<0.050	<0.050
Odor, Threshold	TON	<1	16	8	16	<1	<1
Ph*	SU	3.93	5.76	7.25	7.25	7.01	7.4
Phosphorus, Ortho	mg/L	<0.010	<0.010	<0.010	<0.010	0.010	<0.010
Phosphorus, Total	mg/L	0.031	0.064	0.081	0.034	0.041	<0.010
Total Dissolved Solids (TDS)	mg/L	92	110	230	310	210	<10
Total Suspended Solids (TSS)	mg/L	21	210	50	43	12	<2
Sulfate	mg/L	22	20	20	22	7.5	<1
Temperature	ºF (ºC)	65.2 (18.4)	69.3 (20.7)	63.2 (17.3)	63.2 (17.3)	68.0 (20.0)	69.1 (20.6)
Turbidity	NTU	7	60	49	37	4.1	<0.10

Notes:

SU = Standard Units (pH)
mg/L = Milligrams per liter
TON = Threshold odor number
MPN = Most probable number per 100
NTU = Nephelometric turbidity unit
* = Field Measurement
** = Carbon Dioxide could not be determined due to nondetected alkalinity and low pH

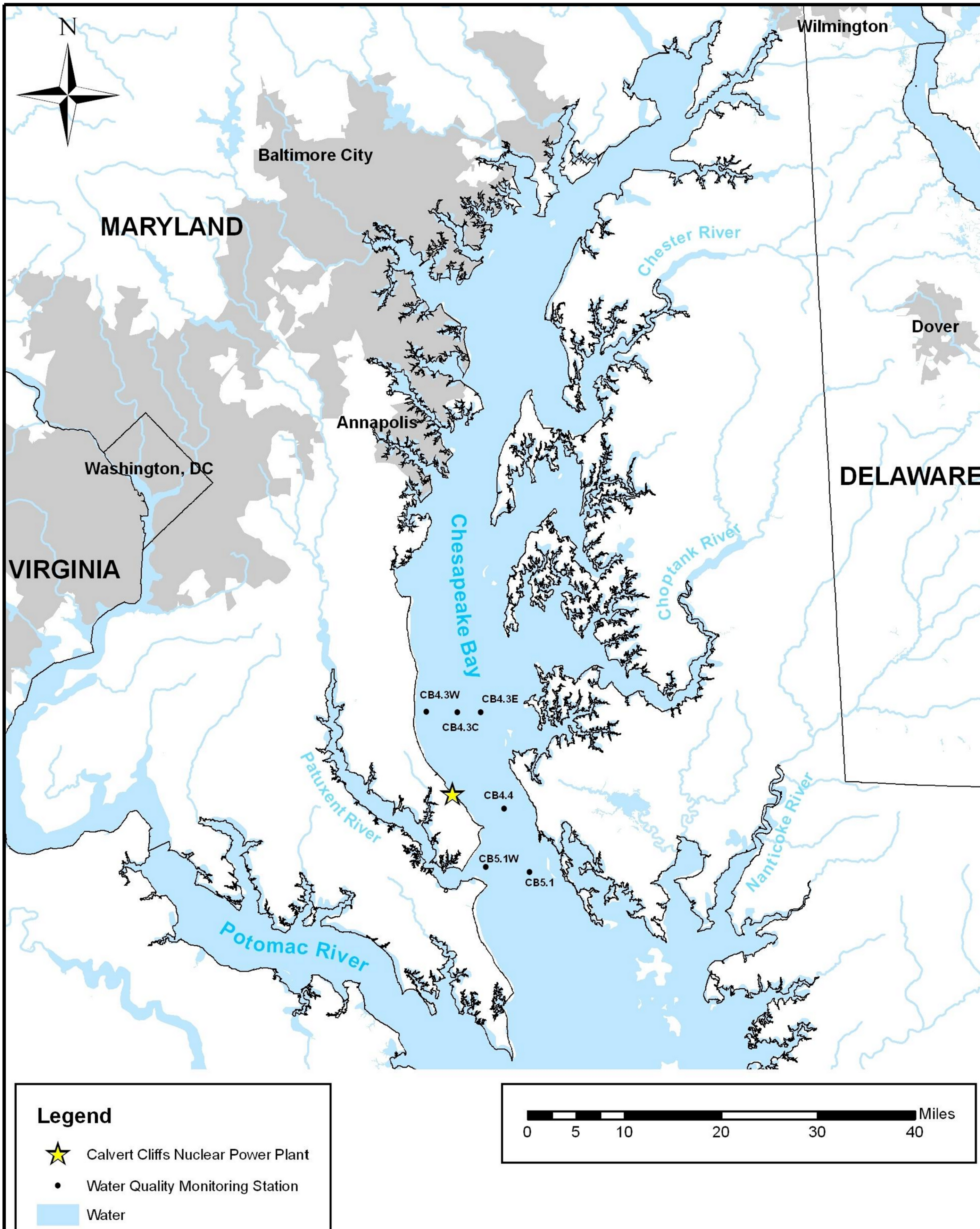

FIGURE 2.3.3-1 Rev. 0

CHESAPEAKE BAY
WQ MONITORING STATIONS

CCNPP UNIT 3 ER

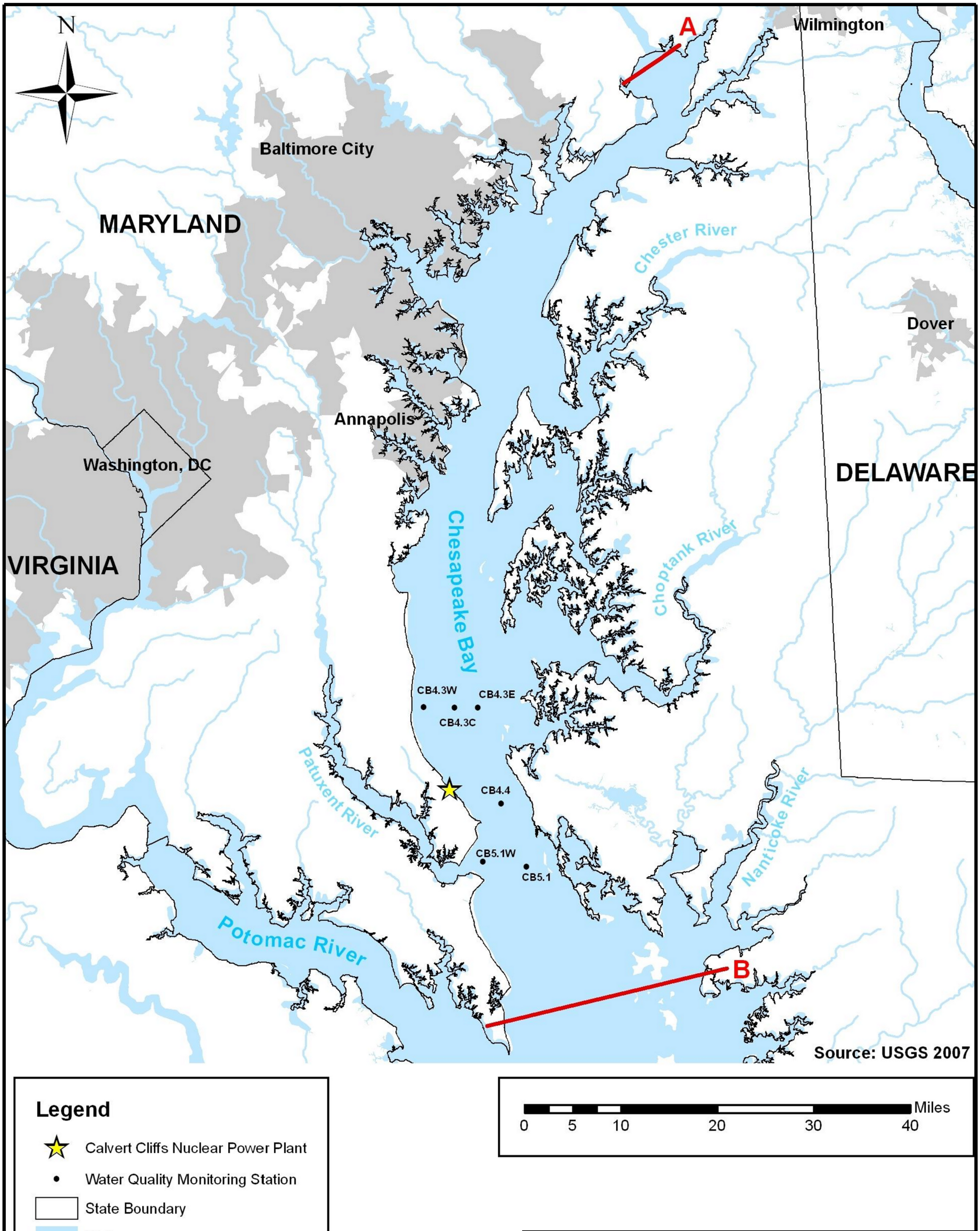

FIGURE 2.3.3-2 Rev. 0

LOCATION OF SEGMENTS USED FOR CALCULATION OF INFLOW TO CHESAPEAKE BAY

CCNPP UNIT 3 ER

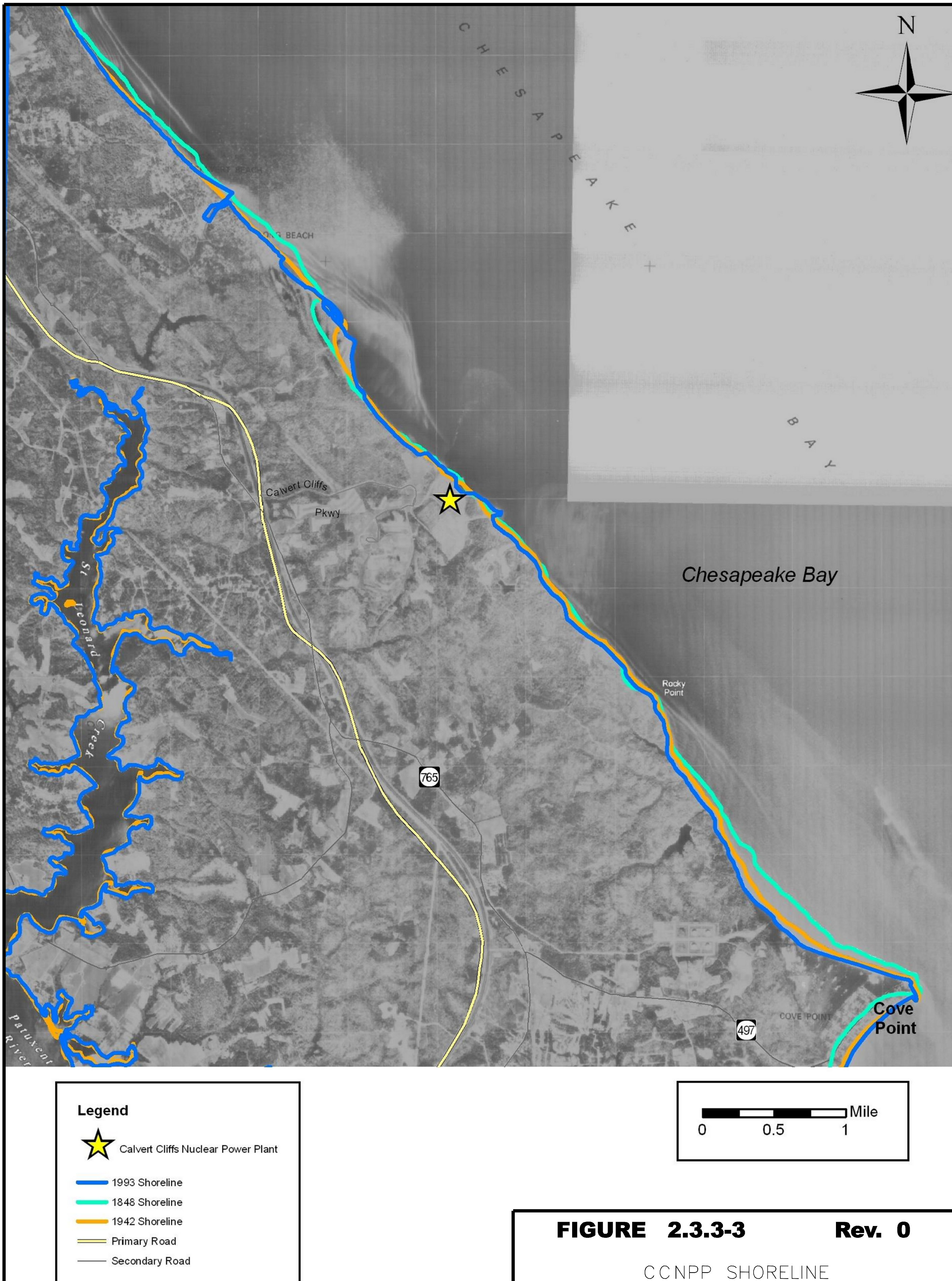

FIGURE 2.3.3-3 Rev. 0

CCNPP SHORELINE

CCNPP UNIT 3 ER

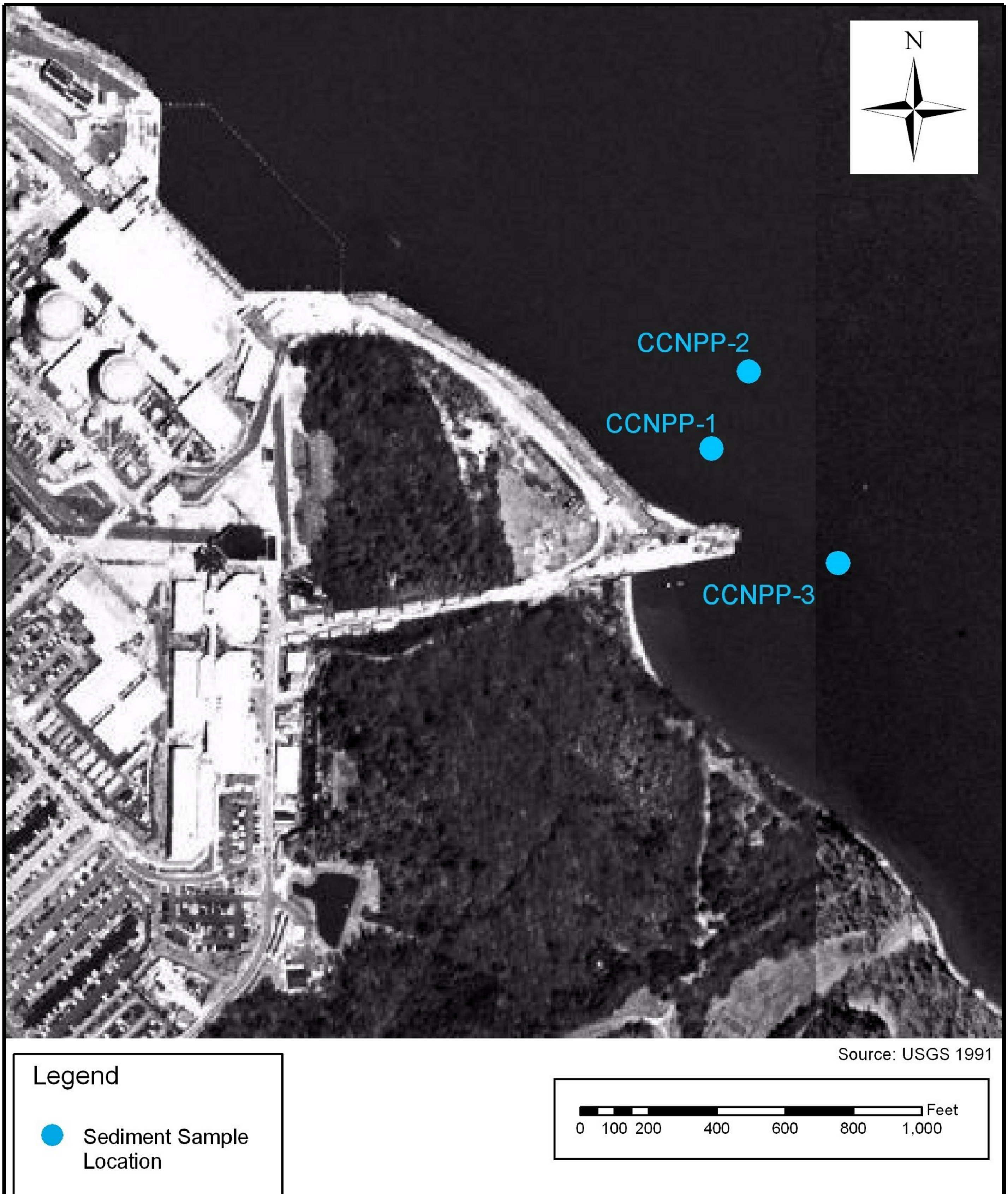

FIGURE 2.3.3-4 Rev. 0

SEDIMENT SAMPLING LOCATIONS IN THE CHESAPEAKE BAY NEAR THE CCNPP BARGE SLIP, SEPTEMBER 2006

CCNPP UNIT 3 ER

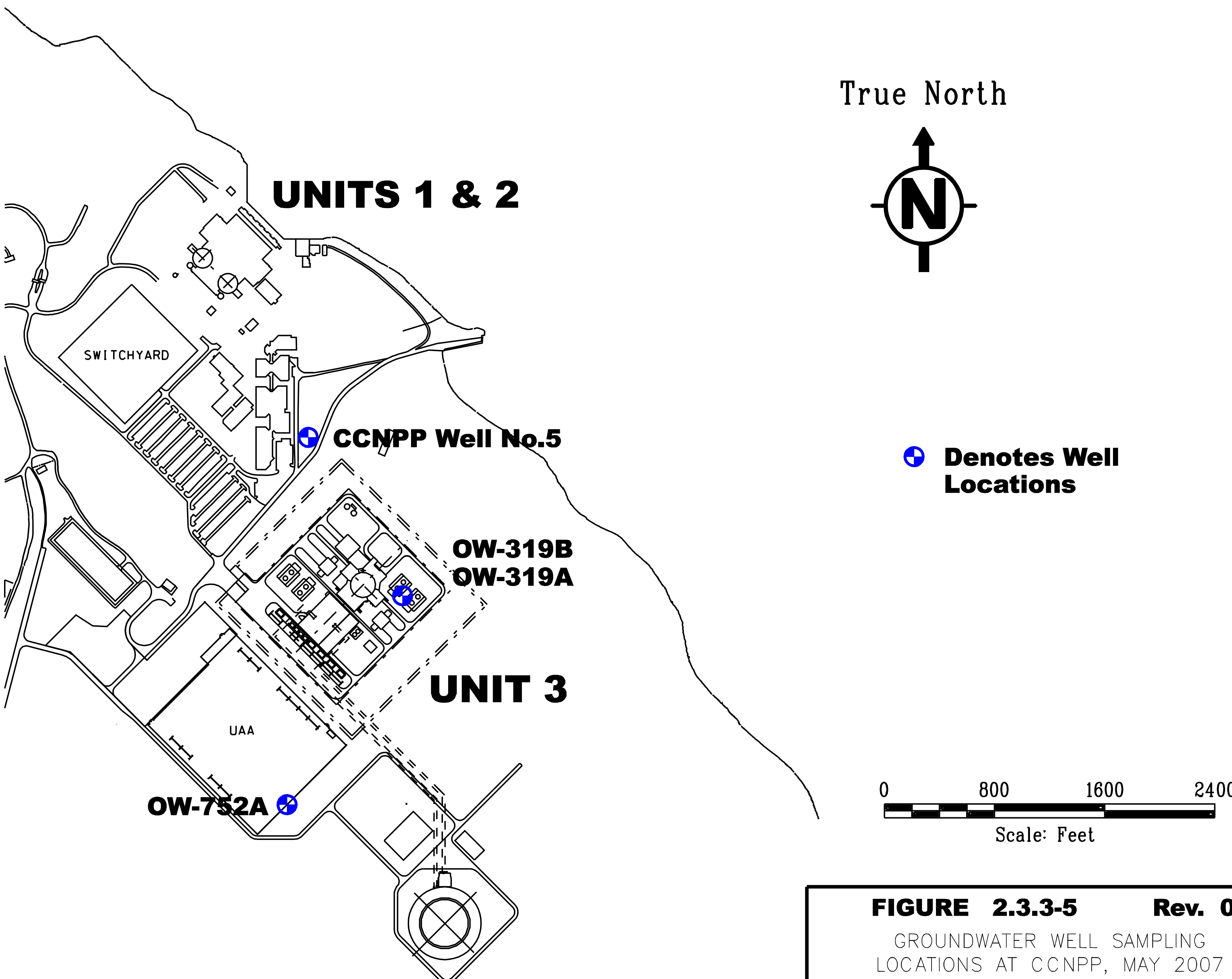

FIGURE 2.3.3-5 Rev. 0

GROUNDWATER WELL SAMPLING LOCATIONS AT CCNPP, MAY 2007

CCNPP UNIT 3 ER

2.4 <u>ECOLOGY</u>

2.4.1 TERRESTRIAL ECOLOGY

The terrestrial ecology of the **{**Calvert Cliffs Nuclear Power Plant (CCNNP) site, including the CCNPP Unit 3 construction area, was characterized in a series of field studies conducted over a one year period extending from May 2006 to April 2007**}**. The field studies include **{**a flora survey, a faunal survey, rare tiger beetles, rare plants, and wetlands delineation**}**. The subsections below summarize relevant information from each of these studies and provide other data on existing terrestrial ecology in accordance with the guidance in NUREG-1555 (NRC, 1999a).

A topographic map of the site is provided as Figure 2.3.1-2.

2.4.1.1 Terrestrial Habitats

The flora survey covers each plant community type (terrestrial habitat type) observed on the **{**CCNPP site in 2006 and 2007**}**. A map of the plant community types is presented in Figure 2.4.1-1, and each plant community type is briefly discussed below.

{<u>Lawns and Developed Areas</u> (Gray in Figure 2.4-1) - Lawns and developed areas occur over a broad area in the east-central part of the CCNPP site (surrounding the two existing CCNPP reactor units) and in Camp Conoy. Camp Conoy includes several athletic fields and other lawn areas surrounding recreational facilities. Other than scattered trees and shrubs planted as ornamental landscaping, the lawns on the CCNPP site consist only of a groundcover stratum. Most of the lawns consist of cool season grasses (grasses that typically seed during spring and fall) such as tall fescue (*Festuca arundinacea*), bluegrass (*Poa pratensis*), large crabgrass (*Digitaria sanguinalis*), and Bermuda grass (*Cynodon dactylon*). Common broadleaf weeds typical of lawns are also present, such as white clover (*Trifolium repens*), broadleaf plantain (*Plantago major*), dandelion (*Taraxicum officinale*), and yellow hawkweed (*Hieracium pretense*).**}**

{Old Field (Yellow and Light Brown in Figure 2.4-1) - The largest area of old field vegetation in the CCNPP site is on the dredge spoils deposited since the early 1970s on lands extending west from CCNPP Units 1 and 2 (Yellow in Figure 2.4-1). The dredge spoils are covered by a dense stand of phragmites (Phragmites australis). Phragmites is a perennial grass that can grow to more than 10 ft (3 m) tall and typically infests brackish and fresh tidal and non-tidal marshes. Its presence on the dredge spoil piles is likely a result of propagules (seeds and rhizome fragments) carried with dredge spoils excavated from the shoreline. Other plants typical of old fields, such as common blackberry (Rubus allegheniensis) and tall fescue (Festuca arundinacea), are also present on the dredge spoils but are not as prevalent as phragmites.

Old field vegetation is also located in some small fields in the northwestern part of the CCNPP Unit 3 construction area, in scattered forest clearings around the perimeter of the dredge spoils, and in other developed areas on the CCNPP site, as well as along roadsides (Light Brown in Figure 2.4-1). Many such areas were disturbed during construction of CCNPP Units 1 and 2 and various support facilities, such as the Independent Spent Fuel Storage Installation (ISFSI). Vegetation in these areas is dominated by tall fescue, sericea lespedeza (*Lespedeza cuneata*), common blackberry, Canada goldenrod (*Solidago canadensis*), and asters (*Aster sp.*).**}**

{<u>Mixed Deciduous Forest</u> (Light Green in Figure 2.4-1) - Most forested uplands on the CCNPP site, as well as the southern and western parts of the CCNPP Unit 3 construction area, support deciduous forest dominated by tulip poplar (*Liriodendron tulifera*); chestnut oak (*Quercus prinus*); white oak (*Quercus alba*); red oaks such as black oak (*Quercus velutina*), southern red oak (*Quercus falcata*), and scarlet oak (*Quercus coccinia*); American beech (*Fagus grandifolia*); and Virginia pine (*Pinus virginiana*). Other canopy trees include hickories such as pignut hickory (*Carya glabra*) and bitternut hickory (*Carya cordiformis*), red maple (*Acer rubrum*), sweet gum (Liquidambar styraciflua), swamp chestnut oak (*Quercus michauxii*), and black gum (*Nyssa sylvatica*). The forest understory consists of dense patches of mountain laurel (*Kalmia latifolia*), pawpaw (*Asimina trilobata*), and American holly (*Ilex opaca*), with scattered but frequent saplings of canopy species. Ground cover is sparse except where recently fallen trees have left gaps in the tree canopy. Scattered patches of the following species are present in the groundcover: partridgeberry (*Mitchella repens*), Christmas fern (*Polystichum acrostichoides*), common violet (*Viola papilionacea*), and large whorled pogonia (*Isotria verticillata*).**}**

{Mixed Deciduous Regeneration Forest (Dark Green in Figure 2.4-1) - Several areas of relatively level highlands that formerly supported mixed deciduous forest have been subjected to timber harvest activities within the past 20 years. These areas presently support dense thickets of deciduous trees and Virginia pines. The deciduous trees consist of tulip poplar, oaks, sweet gum, and red maple. Virginia pine is generally more frequent in the regenerating forest than in adjoining areas of mature mixed deciduous forest. The regenerating forest lacks a distinct understory but does contain scattered mountain laurel and American holly. Little groundcover is present other than along fire roads or in other small openings.**}**

{Well-Drained Bottomland Deciduous Forest (Light Red in Figure 2.4-1) - Areas of well-drained soils in lowlands adjoining Johns Creek, Goldstein Branch, their headwaters, and other streams on the CCNPP site support bottomland deciduous forest dominated by tulip poplar, American beech, sweet gum, black gum, and red maple. This vegetation represents an ecotone (transition) between the mixed deciduous forest on the adjoining upland slopes and the bottomland hardwood forest in wetter areas closer to the stream channel. The understory is generally sparse, although some mountain laurel and American holly are present. While groundcover is generally sparse, dense patches of New York fern (*Thelypteris noveboracensis*) are frequent. (Note: Bottomland deciduous forest outside of the area addressed by the wetland delineation is mapped as a single unit (purple) rather than separated into well-drained and poorly drained components.)**}**

{Poorly Drained Bottomland Deciduous Forest (Dark Red in Figure 2.4-1) - Areas of poorly-drained, seasonally saturated soils in lowlands adjoining Johns Creek, Goldstein Branch, their headwaters, and other streams on the CCNPP site support bottomland hardwood forest dominated by red maple, sweet gum, and black gum. The shrub layer is generally sparse. The groundcover is generally dense, dominated by ferns such as New York fern, sensitive fern (*Onoclea sensibilis*), and royal fern (*Osmunda regalis*); sedges and rushes such as tussock sedge (*Carex stricta*), eastern bur-reed (*Sparangium americanum*), and soft rush (*Juncus effusus*); and forbs such as lizard tail (*Saururus cernuus*) and skunk cabbage (*Symplocarpus foetidus*). (Note: Bottomland deciduous forest outside of the area addressed by the wetland delineation is mapped as a single unit (purple) rather than separated into well-drained and poorly drained components.)**}**

{Herbaceous Marsh Vegetation (Light Blue in Figure 2.4-1) - Herbaceous marsh vegetation occurs throughout much of the broad bottomland areas adjoining Johns Creek in the western part of the CCNPP site as well as in localized gaps in the forest cover in the narrower bottomlands adjoining the headwaters of Johns Creek, Goldstein Branch, and other streams. It is dominated in many places by phragmites. Other areas are dominated by sedges, rushes, and bulrushes; lizard tail, which forms localized dense patches; and various other wetland forbs such as dotted smartweed (*Polygonum punctatum*), Pennsylvania smartweed (*Polygonum pensylvanicum*), jewelweed (*Impatiens capensis*), and halberd-leaved tearthumb (*Polygonum* *arifolium*). These areas include a marshy fringe surrounding the shore of Lake Conoy, two smaller impoundments on the stream carrying the outflow from Lake Conoy to the Chesapeake Bay, a constructed wetland in the northwestern part of the CCNPP site, and a marshy fringe surrounding a stormwater detention pond west of a dock on the Chesapeake Bay.**}**

{Successional Hardwood Forest (Dark Brown in Figure 2.4-1) - Small patches of forest on recently disturbed lands in the central part of the CCNPP site support forest cover dominated by fast-growing tree species that establish in sunny areas such as old fields. Dominant tree species include black locust (*Robinia pseudoacacia*), black cherry (*Prunus serotina*), and eastern redcedar (*Juniperus virginiania*). The understory generally consists of the same shrub, vine, and herbaceous species described for old field vegetation. Most of the canopy trees are less than 10 in (25.4 cm) diameter at breast height (DBH). The canopy trees cast only weak shade and allow dense undergrowth by old field species.

Most lands elsewhere on the CCNPP site support the habitats described above. Where the Chesapeake Bay shoreline has not been developed with the existing reactor units and barge dock, it consists of a narrow sandy beach at the base of steep, sandy cliffs. The beach is generally less than 20 ft (6 m) wide during normal low tides. There are no tidal marshes on the CCNPP site. However, small tidal marshes are present in the Flag Ponds Natural Area north of the CCNPP site and on the shoreline of tidal reaches of St. Leonard's Creek and its tributaries. Some forested areas close to the Chesapeake Bay or other tidal waters support forest dominated by loblolly pine (*Pinus taeda*), and some inland areas support forest dominated by Virginia pine. The latter consist primarily of recently abandoned farmlands or other lands recently disturbed and left to naturally regenerate.**}**

2.4.1.2 Important Terrestrial Species and habitats

NUREG-1555 (NRC, 1999a) defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.11 and 50 CFR 17.12 (CFR, 2007a), by the U.S. Fish and Wildlife Service, or the state in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structure and function of local terrestrial ecosystems; or 5) species that could serve as biological indicators of effects on local terrestrial ecosystems. Floral and faunal surveys that document observations made on the **{**CCNPP site between May 2006 through April 2007**}** are summarized herein.

Table 2.4.1-1 lists each species and habitat identified as important for the **{**CCNPP**}** site and surrounding area according to the criteria in NUREG-1555 (NRC, 1999a). Each species deemed an important species is discussed in more detail below.

2.4.1.2.1 Mammals

{The only mammal species meeting the NUREG-1555 criteria for important is the white-tail deer (*Odocoileus virginianus*). White-tail deer is a recreationally valuable species that is valued for hunting in most rural counties in Maryland, including Calvert County.

Population Abundance and Distribution

White-tail deer were observed in all habitats on the CCNPP site during the 2006 fauna survey. Although other mammal species were observed, none were as frequent or widespread over all habitats as white-tail deer.

Habitat Requirements

White-tail deer are large herbivorous (plant-eating) mammals favoring fragmented brushy woods interspersed with abandoned fields and thickets.

Life History

Rutting season extends from late September through February, with a peak in November. Gestation takes between 200 and 210 days. Does reproduce only once a year, in May or June, and usually produce one fawn the first year, but may produce twins or even triplets in the following years, if food is plentiful. Fawns remain in the den for the first couple of weeks, and are weaned between the ages of four and eight months, but begin to graze before this time. They lose their white spots in the fall. Males reach puberty at around 18 months, and begin growing their first rack in the spring following their birth. Deer are more social in winter and congregate in herds, and tend to disperse and become more solitary in spring.

Population Dynamics

Natural predators in Maryland were historically limited to large carnivores such as wolves and mountain lions. Elimination of these predators coupled with a recent increase in forest fragmentation has resulted in very high white-tail deer populations in Maryland and Virginia. Today, white-tail deer are a pest species that damage forest and landscape vegetation and cause numerous automobile collisions.**}**

2.4.1.2.2 Birds

{Two bird species have been identified as important according to NUREG-1555 (NRC, 1999a). They are the bald eagle (*Haliaeetus leucocephalus*) and the scarlet tanager (*Piranga olivacea*).

2.4.1.2.2.1 Bald Eagle

Population Abundance and Distribution

The bald eagle, a federal and state threatened species, is the only bird species observed during the 2006 to 2007 field surveys or anecdotally reported by site personnel to occur on the CCNPP site that is designated threatened or endangered on the federal or state level, or candidates for such listing. As of the end of 2006, three bald eagle nests were known to exist on the CCNPP Site as shown in Figure 2.4-2. All were outside of the Project Area. In April 2007, a new active bald eagle nest was observed in a Virginia pine tree close to Camp Conoy Road, near the southwestern corner of a baseball field. Parent bald eagles were observed circling the nest, suggesting that it was active and contained eggs or recently hatched chicks. However, one of the previously recognized nests (located near the shoreline north of the existing reactors) was reported by site personnel to be inactive in April 2007.

Habitat Requirements

Bald eagles prefer to nest in tall trees within sight of lakes, rivers, and other open waters. Bald eagles feed primarily on fish but also feed on waterfowl, seagulls, and small mammals. The optimal bald eagle nesting habitat on the CCNPP site is therefore the forested areas at the top of the cliffs overlooking the Chesapeake Bay. Two of the known nesting locations are in such areas, to the north and south of the project area. The Camp Conoy nest is more than 1,500 feet inland from the Chesapeake Bay but is within sight of the Camp Conoy Fishing Pond. The western nest is situated even farther inland but directly adjoins a large marshy area with pools of open water formed by beaver dams on Johns Creek. The mixture of forest cover and open water present throughout the CCNPP site and surrounding region therefore provides potentially suitable bald eagle habitat.

Life History

In Maryland and Virginia, bald eagles typically lay eggs in March or April. They typically hatch about 35 days later, and the young typically begin to fly about 12 weeks after hatching.

Population Dynamics

Bald eagle population levels have rebounded in the eastern U.S., including Maryland and Virginia, in recent years.

2.4.1.2.2.2 Scarlet Tanager

The scarlet tanager is included as an important species because it can serve as a biological indicator of effects related to forest fragmentation. Given the relatively high frequency of observance at the CCNPP site and its forest interior habitat preference, a rarity or absence of observations could indicate a degradation of forest interior habitat.

Population Abundance and Distribution

The scarlet tanager (*Piranga olivacea*) represents the most frequently observed forest interior bird (FIB) species observed in the CCNPP site area during the late spring and summer of 2006 (as expected, this migratory species was not observed during fall 2006 or winter or early spring 2007). All of the FIB species were observed in forested areas in the southern, southwestern, and western part of the project site area.

Habitat Requirements

FIB species are birds requiring large forested areas to breed successfully and maintain viable populations. Most FIB species have suffered noticeable population declines in Maryland and elsewhere in the eastern United States concurrent with increased fragmentation of forest cover by urban development in the last 50 years. The Chesapeake Bay Critical Area Commission has identified an objective of preserving habitat for FIBs in lands surrounding the Chesapeake Bay (CAC, 2000).

Life History

The scarlet tanager breeds in woodland areas, constructing open-cup nests in the mid-story/canopy. Eggs are laid in clutch sizes of 3 to 5, with an incubation period of 13 to 14 days. Nine to 11 days are needed to fledge.

Population Dynamics

The scarlet tanager is a neotropical migrant that breeds in Maryland but winters primarily in Central and South America. Most of the FIB species that have suffered the greatest population declines over the last 50 years are neotropical migrants. Neotropical migrant FIB species are sensitive not only to changes in their breeding habitats in eastern North America but also to changes to their wintering habitats in Central and South America. The scarlet tanager typically occupies its breeding grounds in Maryland between May 25 and August 10 (CAC, 2000).**}**

2.4.1.2.3 Insects

{The Puritan Tiger Beetle (*Cicindela puritana*) and the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) have been identified as important because they are Federally threatened beetle species known to occur on sandy cliffs and beaches in Calvert County.

2.4.1.2.3.1 Puritan Tiger Beetle

Population Abundance and Distribution

The Puritan Tiger Beetle (*Cicindela puritana*), is known to presently inhabit only three locations: the Chesapeake Bay shoreline in Calvert County, around the mouth of the Sassafras River in eastern Maryland, and along the Connecticut River in Connecticut and Massachusetts. The Calvert County population has fluctuated greatly from peak numbers of over 9,000 in 1998 and 1988 to less than 6,000 in the past three years. A population of the Puritan Tiger Beetle has been known to be present at the shoreline of the CCNPP site since 1997. This site, like all others, has exhibited dramatic fluctuations in population size since that time. Counts of adults at the CCNPP site have varied more than some other locations, with the following estimates of adult numbers (USFWS, 1993):

YEAR	COUNT
1997	119
1998	616
1999	49
2000	367
2002	80
2003	226
2004	121
2006	111

Habitat Requirements

The Puritan Tiger Beetle has very specific habitat requirements. In Maryland, the larvae live in deep burrows, which they dig in sandy deposits on non-vegetated portions of bluff faces. They may also burrow at the base of bluffs in sediment deposits that have eroded from bluff faces. Chesapeake Bay populations are most abundant where bluffs are long and high, with little or no vegetation, and composed at least in part of yellow or red sandy soil. Wave-producing storms and concomitant erosion of bluffs are necessary to maintain the bare-bluff faces required for larval habitat. Larvae will not utilize densely vegetated bluffs; no tiger beetle larvae or adults were found to occupy bluffs stabilized by kudzu at Calvert Beach, though individuals were numerous on adjacent natural bluffs.

Life History

Puritan Tiger Beetles typically undergo a two-year larval period before emergence. Larvae hatch in late July or August as first instars. This stage lasts 2 to 4 weeks; larvae then molt and become second instars. Larvae generally over-winter as second instars and become active again (as evidenced by open burrows) the following spring, when they molt to the third instar.

Population Dynamics

Population variations are caused by year-to-year variations in climatic and other factors that affect survival and reproduction. Variations in recorded populations may, to a lesser extent, depend on survey conditions.

2.4.1.2.3.2 Northeastern Beach Tiger Beetle

Population Abundance and Distribution

There are two extant populations of *C. dorsalis* in southeastern Massachusetts, and the beetle has been found in the Chesapeake Bay region at 55 sites in Virginia and 13 sites in Calvert County, Maryland. The Chesapeake Bay populations include 15 with more than 500 adults (USFWS, 1994).

This species does not have an established population within the boundaries of the CCNPP site, and consequently this site has not been one of the target sites that are annually surveyed for *C. dorsalis* in Calvert County. However, in some years small numbers of adults (<25 individuals) have been observed at the far north end of the CCNPP site. These adults were found to be confined to an approximate 328 ft (100 m) section bordering Flag Ponds Nature Park, having apparently moved south from that area where a breeding population exists. No larvae or other evidence of a breeding population of *C. dorsalis* has been known in this northern section of the CCNPP site. No adults were found on the CCNPP site in 2006, nor were there any in the bordering section of Flag Ponds Nature Park. At Flag Ponds Nature Park, most of the adults and all larvae of *C. dorsalis* are restricted to the northern half of this area, and only occasionally are small numbers of adults found in the southern end near the CCNPP site boundary.

Habitat Requirements

The beach ecosystem conducive to *C. dorsalis* survival is undisturbed by heavy human use, highly dynamic, and subject to natural erosion and accretion processes.

Life History

Larvae dig vertical burrows over a relatively narrow band of the upper intertidal to high drift zone, capturing small arthropod prey passing nearby. In the Chesapeake Bay region, adults emerge in mid-June, reach peak abundance by very early July, and begin to decline through August. The adults are active on warm, sunny days along the water's edge, where they are commonly seen feeding, mating, or basking. Mating and egg laying occur from late June through August. Egg laying occurs in burrows.

Population Dynamics

Populations are highly variable from year to year; the beetle is subject to local population extinctions and capable of dispersal and recolonization. The extirpation of *C. dorsalis* from most of its range has been attributed primarily to destruction and disturbance of natural beach habitat from shoreline developments, beach stabilization structures, and high recreational use.**}**

2.4.1.2.4 Plants

{Several plant species have been identified as important according to NUREG-1555 (NRC, 1999a). They are the showy goldenrod (*Solidago speciosa*), Shumard's oak (*Quercus shumardii*), spurred butterfly pea (*Centrosema virginianum*), tulip poplar (*Liriodendron tulipifera*), chestnut oak (*Quercus prinus*), mountain laurel (*Kalmia latifolia*), and New York fern (*Thelypteris noveboracensis*). The rare plant inspections were conducted in late July/early August 2006, October 2006, and April 2007 so as to coincide with the flowering period for each plant listed by the Maryland Department of Natural Resources as rare, threatened, or endangered for Calvert County, Maryland.

2.4.1.2.4.1 Showy Goldenrod

The showy goldenrod (*Solidago speciosa*) is listed as threatened by the State of Maryland. Showy goldenrod is a perennial forb with showy yellow flower heads that typically flowers in August and September in Maryland. The tops typically die in late October, and the roots over-winter underground and regenerate new tops in spring. Patches of showy goldenrod were observed in several locations around Camp Conoy in October 2006.

2.4.1.2.4.2 Shumard's Oak

The Shumard's oak (*Quercus shumardii*) is listed as threatened by the State of Maryland. Shumard's oak is a deciduous tree whose leaves and bark closely resemble the more common red oak (*Quercus rubra*). Trees appearing to be Shumard's oak were observed at multiple locations in the Johns Creek floodplain in 2006 and 2007.

2.4.1.2.4.3 Spurred Butterfly Pea

The spurred butterfly pea (*Centrosema virginianum*) is designated by Maryland as rare It is not Federally-listed or listed by the State of Maryland as threatened or endangered. The Maryland Natural Heritage Program has a record of occurrence of the spurred butterfly pea on the CCNPP site southwest of the CCNPP Unit 3 construction area (MDNR, 2006). The plant was observed at multiple locations in early August 2006 in Johns Creek floodplain but well west of the CCNPP Unit 3 construction area. It is a perennial, climbing, leguminous vine with light purple flowers with a wide tolerance of habitat conditions.

2.4.1.2.4.4 Tulip Poplar

Tulip poplar (*Liriodendron tulipifera*) is the most numerous and widespread tree in upland forests on the CCNPP site. It is a tall, fast-growing deciduous tree that favors upland habitats with mesic (deep, rich, and moist) soils. Many tulip poplars in the CCNPP Unit 3 construction area are over 20 inches (50 cm) DBH. It is a key contributor to the overall structure and ecological function of the plant communities and serves as an indicator of the overall ecological stability.

2.4.1.2.4.5 Chestnut Oak

Chestnut oak (*Quercus prinus*) is another common tree on the CCNPP site, dominating on dry, sloping lands adjoining forested stream valleys. Tulip poplar and chestnut oak together comprise the majority of the tree canopy in forested areas on and surrounding the CCNPP site.

The chestnut oak is a tall, slow-growing deciduous tree that occurs in primarily dry soils. Acorns from chestnut oaks on the CCNPP site provide a key food source for gray squirrels, blue jays, and many of the other observed wildlife species. Chestnut oak is the principal tree stabilizing many steep slopes adjoining the Johns Creek and Goldstein Branch floodplains. It is a key contributor to the overall structure and ecological function of the plant communities and serves as an indicator of the overall ecological stability.

2.4.1.2.4.6 Mountain Laurel

Mountain laurel (*Kalmia latifolia*) is the most widespread shrub on the CCNPP site. It forms dense shrub thickets in the understory of upland forests throughout the CCNPP site and the CCNPP Unit 3 construction area, including most of the steep slopes adjoining the Johns Creek and Goldstein Branch floodplains. Although primarily a shrub, many mountain laurels on the steep slopes near Johns Creek and south of Camp Conoy are exceptionally large, reaching heights of over 20 ft (6 m). It is a key contributor to the overall structure and ecological function of the plant communities and serves as an indicator of the overall ecological stability.

2.4.1.2.4.7 New York Fern

New York fern (*Thelypteris noveboracensis*) is the most widespread groundcover plant in the CCNPP Unit 3 construction area and elsewhere on the CCNPP site. It forms large, dense patches of groundcover throughout most of the forested floodplain lands, and many of the patches extend to adjoining slopes. Mountain laurel and New York fern together comprise the majority of the understory and groundcover vegetation in forested areas on and surrounding the CCNPP Unit 3 construction area. It is a key contributor to the overall structure and ecological function of the plant communities and serves as an indicator of the overall ecological stability.**}**

2.4.1.2.5 Habitats

{Three plant communities occurring on the CCNPP site are identified as important habitats: herbaceous marsh vegetation, poorly drained bottomland deciduous forest, and well-drained bottomland deciduous forest and are shown in Figure 2.4-1. Herbaceous marsh vegetation and poorly drained bottomland deciduous forest meet the definition of wetlands established in 33 CFR 328.3 for the Federal Clean Water Act (CFR, 2007b) and COMAR 26.23.01.01(B)(62) for the Maryland Nontidal Wetland Protection Act (COMAR, 2007). The exact boundaries of wetlands in the CCNPP site area were delineated between May 2006 and September 2006 using routine onsite procedures in the Corps of Engineers Wetlands Delineation Manual (USACE, 1987). The wetland boundaries were marked in the field using sequentially numbered flags. The coordinates for each flag were determined in the field as part of a land survey. Well-drained bottomland deciduous forest habitat in the CCNPP site area occurs in stream valley lands that are too well-drained to meet the regulatory definition of a wetland but still occur in floodplains.

Two areas outside of but close to the CCNPP site are also identified as important habitats. The first is the Flag Ponds Natural Area, situated immediately north of the CCNPP site. The second is Calvert Cliffs State Park, situated immediately north of the CCNPP site.**}**

2.4.1.3 Habitat Importance

{White-tail Deer: White-tail deer are habitat generalists but tend to favor areas at the edge of forests. Because of the ability of the white-tail deer to adapt to a variety of habitats, their populations are not generally sensitive to localized habitat changes.

Bald Eagle: Bald eagles tend to return and reuse nests from previous years. Any construction close to the active bald eagles nests on the CCNPP site as shown in Figure 2.4-2 could discourage use of those nests in the future. Trees on top of the cliffs adjoining the Chesapeake Bay along the eastern edge of the CCNPP site provide some of the best bald eagle habitat in Calvert County. Local populations of bald eagle would be sensitive to loss or degradation of forested habitats adjoining the cliffs.

Scarlet Tanager (and other Forest Interior Birds): Recent aerial photographs of southern Calvert County suggest that the forested areas in the northern, southern and southwestern parts of the CCNPP site, including areas within the Unit 3 construction area draining to Johns Creek, provide some of the largest remaining blocks of unfragmented forest habitat in the region. Most areas of Calvert County outside of the CCNPP site and adjoining state parks (Calvert Cliffs State Park and Flag Ponds Natural Area) have experienced fragmentation caused by agricultural land uses, road construction, and construction of rural residences and small residential subdivisions. Therefore, the forested areas on the CCNPP site, including those close to Johns Creek in the CCNPP Unit 3 construction area, are likely valuable in sustaining localized populations of the scarlet tanager and other forest interior birds.

Puritan and Northeastern Beach Tiger Beetles: The undeveloped cliffs and beaches on the CCNPP site provide some of the best remaining habitat, both locally and nationally, for these two insect species with very specific habitat requirements.

Plants: None of the plant species identified as important are highly dependent on the CCNPP Unit 3 construction area or CCNPP site for their survival. Loss of suitable habitats in the CCNPP Unit 3 construction area would cumulatively contribute to the risk for population declines for each species but not likely result in immediate declines in regional populations.**}**

2.4.1.4 Disease Vector and Pest Species

A disease vector is an organism (commonly an insect) that carries disease agents (commonly bacteria or fungi) to a receptor host, which can be man, domestic or wild animals, or crops or wild plants. **{**The only disease vector known to occur on the CCNPP site is the deer tick (*Ixodes scapularis*), which transmits Lyme Disease to humans. Lyme Disease is a non-fatal but debilitating disease whose victims can display fever and severe joint pain. The causal agent is a bacterium, *Borrelia burgdorferi*, which is transmitted by the deer tick from white-tail deer, squirrels, rodents, and other mammalian wildlife to humans.**}**

{No pest species are known to be widespread over the CCNPP site and surrounding areas. However, two non-native invasive plant species were found to be prevalent at several locations on the CCNPP site in 2006. The most widespread is phragmites, which forms dense stands over large areas of wetlands and dredge spoils in the CCNPP site. Phragmites is a perennial grass species with hollow culms (stems) that can grow to more than 10 ft (3 m) in height. Flowers develop by mid summer and are arranged in tawny spikelets with tufts of silky hair. Flowering and seed set occur between July and September. Germination occurs in spring on exposed moist soils. Vegetative spread by below-ground rhizomes (roots) can result in dense patches with up to 20 stems per square foot (200 stems per square meter). Phragmites is capable of vigorous vegetative reproduction and often forms dense, nearly monospecific stands. Although some phragmites stands are of genotypes native to North America, most large stands of phragmites in North America today are considered to be of non-native genotypes.

Another non-native invasive plant species, Japanese stiltgrass (*Microstegium vimineum*), forms scattered patches in the groundcover of some forested areas in the CCNPP site. It occurs mostly in areas with a history of soil disturbance, such as along the sides of roadways and trails. Where it occurs, it has likely precluded the development of other more ecologically valuable groundcover.**}**

2.4.1.5 Wildlife Travel Corridors

Wildlife tends to move across landscapes using distinct corridors of favorable habitat. **{**Movement of most forest wildlife across fragmented agricultural and suburban landscapes is enhanced by linear corridors of forest that can consist of forested hedgerows, forested stream valleys, or forested ridge tops. The minimum width for a forest corridor to benefit wildlife is not known but may vary among wildlife species depending on body size. Wildlife movement is also enhanced by strings of closely spaced patches of favorable habitat that form “stepping stones” across areas of unfavorable habitat. For forest wildlife, such stepping stones can consist of woodlots in agricultural landscapes or parks and other undeveloped forest tracts in suburban landscapes.

The landscape of southern Calvert County consists predominantly of forest land broken by small agricultural fields, small developed areas referred to as “town centers,” rural residences on lots of one to a few acres, and small subdivisions of single-family houses on small lots. The landscape is crossed by a network of forested stream valleys that consist of forested floodplains adjoined by steep forested slopes. These stream valleys form corridors that facilitate the movement of forest wildlife around farm fields and developed areas.

The central part of the CCNPP site consists mostly of open land surrounding the existing reactors. The remainder of the CCNPP site, the Calvert Cliffs State Park to the south, and the Flag Ponds Natural Area to the north include large blocks of forest land. The forested stream valley surrounding Goldstein Branch and its tributaries along the western perimeter of the project site forms a corridor that may facilitate the north-south movement of wildlife. The forested stream valley surrounding Johns Creek and its tributaries may facilitate east-west movement.**}**

2.4.1.6 Existing Natural and Man-Induced Ecological Effects

{While most of the CCNPP site area north and south of the CCNPP Unit 3 construction area consists of contiguous forest cover, forest cover in the central part of the CCNPP site, including the north-central and northwestern parts of the CCNP Unit 3 construction area, has been fragmented by development of facilities serving the existing reactors, by dredge material disposal, and by development of recreational facilities at Camp Conoy. This fragmentation has reduced the habitat value of some forested areas in the northern part of the CCNPP Unit 3 construction area and adjoining Camp Conoy for wildlife such as the forest interior bird species that require large blocks of forest to successfully live and nest. However, the observation of several forest interior bird species in forest lands south of Camp Conoy and along Johns Creek, indicates that forest cover in those areas have not become substantially fragmented.

Several areas of mixed deciduous forest on uplands west of Camp Conoy Road were clear cut for timber within the last 20 years but presently support robust stands of regenerated deciduous tree saplings. Some of the former clear cuts are on slopes near Johns Creek where forest interior bird species were observed in 2006. Although the clear cuts may have temporarily reduced habitat quality for forest interior bird species, the effects seem to have diminished with regeneration of tree cover. However, large canopy trees over 12 in (30 cm) DBH are limited to areas not recently clear cut, mostly on steep slopes and lands east of Camp Conoy Road. Prescribed burns are not conducted to manage vegetation anywhere on the CCNPP site, and there have not been any substantial wild fires in the past several decades.

Several upland areas in the northern part of the CCNPP Unit 3 construction area were used for farming until recently. These areas presently support old field vegetation. No areas on the CCNPP site are presently used for farming or grazing, although several large areas around the existing reactors, along paved roads, and in Camp Conoy are kept regularly mowed. Areas under several electric transmission lines in the CCNPP Unit 3 construction area and elsewhere on the CCNPP site are periodically mowed and treated with herbicides to prevent regeneration of trees under the conductors.

There is no evidence that the CCNPP Unit 3 construction area has been subjected to substantial recent environmental stresses such as insect or disease outbreaks or storm damage. Occasional fallen canopy trees were observed throughout forested areas of the CCNPP Unit 3 construction area, especially on the slopes adjoining Johns Creek and its headwaters. These trees may have been felled by the winds from Hurricane Isabel, which passed through Calvert County on September 19, 2005. Large areas of oak-dominated forests in central Maryland experienced multiple rounds of defoliation by gypsy moths in the late 1980s. However, large numbers of dead trees as might have resulted from a localized gypsy moth (*Lymantria dispar*) outbreak were not observed anywhere within the CCNPP Unit 3 construction area during the 2006 floral survey.**}**

2.4.1.7 Ongoing Ecological and Biological Studies

{The only ecological or biological investigations performed on the CCNPP site within the last 5 years were the surveys described herein. Those studies are now complete.**}**

2.4.1.8 Regulatory Consultation

{The Maryland Natural Heritage Program, operated by the Maryland Department of Natural Resources, was consulted for information on known occurrences of Federally-listed and State-listed threatened, endangered, or special status species and critical habitats (MDNR, 2006). Identification of the important species discussed above was based in part on information provided by that consultation.**}**

2.4.1.9 Offsite Transmission and Access Corridors

{There are no new offsite transmission or access corridors associated with the construction and operation of CCNPP Unit 3.**}**

2.4.2 AQUATIC ECOLOGY

2.4.2.1 Aquatic Habitats

2.4.2.1.1 Freshwater Bodies Onsite

{Freshwater bodies at the CCNPP site are described in Section 2.3.1. A topographic map is provided as Figure 2.3.1-4 which shows the aquatic habitats. In addition, a separate wetlands delineation study was conducted. It describes the area as a steeply rolling landscape dissected by a dendritic pattern of stream valleys with narrow floodplains adjoined by steep side slopes whose grade exceeds 25% in places. Large areas in the north-central part of the site have been graded to accommodate existing facilities and the dredge spoil disposal area. The eastern part of the site, including most lands east of Camp Conoy Road, drains directly into the Chesapeake Bay. Drainage enters a series of unnamed intermittent and first-order perennial streams that flow generally eastward. The streams become increasingly incised as they approach the cliffs and then cascade over the cliffs and across the narrow beach into the bay. All stream reaches on the site are non-tidal; the cliffs prevent tidal influence from extending west of the beach.

The western part of the site, west of Camp Conoy Road, drains toward the Patuxent River. Lands west of Camp Conoy Road drain into intermittent headwaters of Johns Creek, which flows west under Maryland Route 2/4 and ultimately to the Patuxent River. Most lands in the northwestern part of the CCNPP site flow into the headwaters of the Goldstein Branch. Goldstein Branch flows south, close to the western CCNPP site perimeter, entering Johns Creek just east of Maryland Route 2/4. A small area in the northern part of the CCNPP site drains to the north and east into small streams that flow to the Chesapeake Bay north of the CCNPP Units 1 and 2; these are shown as Branch 1 and Branch 2 on Figure 2.3.1-2. The dredge spoil disposal area drains to the man-made Lake Davies, which discharges into a tributary to Goldstein Branch. Three other ponds retain surface water onsite: Camp Conoy Fishing Pond, Pond 1 and Pond 2.

Surveys of the benthic macroinvertebrates and fish inhabiting selected onsite streams and ponds were conducted during September 2006. Benthic invertebrates were collected using techniques developed for low gradient, non-tidal streams (USEPA, 1999). Fish sampling followed the guidance provided in the Maryland Biological Stream Survey Sampling Manual (MDNR, 2001). At each sampling station, standard water quality field measurements were made, and water samples were collected for laboratory analysis of nutrients and other physicochemical parameters. At the same time, habitat quality was assessed using the survey sampling guidance (MDNR, 2001). The results of the surveys are summarized for each water body in the following sections.

2.4.2.1.1.1 **{**Johns Creek

Two locations in Johns Creek were sampled: one upstream and one downstream of a dewatered reach that had filled in with an invasive reed (*Phragmites*). Water quality at both locations indicated a healthy stream. Benthic invertebrate and fish assemblages at the downstream location were excellent, and the overall habitat assessment produced an optimal score. The upstream location, however, supported only one species of fish, the eastern mudminnow (*Umbra pygmaea*), which is a common stream species that is extremely tolerant of poor water quality.

Differences in the benthic community of the two reaches were also apparent. The upstream location was numerically dominated by oligochaetes and chironomids; the downstream location by amphipods. However, both locations supported at least two of the three groups of aquatic insects that are considered indicators of nondegraded streams (Ephemeroptera, Plecoptera, and Trichoptera). Although both locations scored in the “optimal” category on the habitat assessment, an evaluation of the subscores reveals that the upstream site has poor pool variability, marginal epifaunal substrate and cover, and suboptimal pool substrate, sediment deposition, and channel sinuosity. The difference in the overall scores of the two reaches is attributable to substrate, cover, and pool variability.

Results of the biological survey are presented in Table 2.4.2-1. Water quality data are in Table 2.3.3-1.**}**

2.4.2.1.1.2 **{**Goldstein Branch

One location in Goldstein Branch, upstream from its confluence with Johns Creek, was sampled. This location had similar dissolved oxygen and pH, but higher conductivity, alkalinity, and total dissolved solids (TDS), compared with Johns Creek. Despite water quality indicators of a healthy stream, only one species of fish, the American eel (*Anguilla rostrata*), was collected at Goldstein Branch. Benthic invertebrate diversity and abundance were lower than in Johns Creek, but within acceptable limits. The reach supported all three groups of aquatic insects that are considered indicators of nondegraded streams (Ephemeroptera, Plecoptera, and Trichoptera). The overall habitat assessment produced an optimal score; individual subscores were similar to the upstream location at Johns Creek.

Results of the biological survey are presented in Table 2.4.2-2. Water quality data are presented in Table 2.3.3-1.**}**

2.4.2.1.1.3 **{**Impoundments

The four ponded waterbodies are neither functionally related nor similar in water quality. They are discussed here together for purposes of conciseness only.

Water quality in Lake Conoy was representative of a healthy pond. Six species of fish were collected; the eastern mosquitofish (*Gambusia affinis*) and the bluegill (*Lepomis macrochirus*) were numerically dominant, which is typical of an impoundment of this nature. The benthic invertebrate assemblage was more diverse than in the other three impoundments. Two of the three taxa of aquatic insects that are sensitive to degraded aquatic conditions, mayflies and caddisflies, were present in Lake Conoy; the stoneflies (Plecoptera) were absent from all impoundments at the site.

Neither Lake Davies nor the ponds had adequate dissolved oxygen (greater than 5 ppm) to be considered a healthy habitat. In Lake Davies, the dissolved oxygen dropped as low as 2.2 ppm at the bottom. In Pond 2, dissolved oxygen was less than 1.0 ppm. Fish species in the ponds were the same as those collected in Lake Conoy, except for the absence of the larger gamefish (white crappie (*Pomoxis annularis*) and largemouth bass (*Micropterus salmoides*)). Benthic invertebrate assemblages were dominated by chironomids in the two lakes, and by oligochaetes in the two ponds. Neither caddisflies nor stoneflies occurred in any samples from Lake Davies or the ponds, although mayflies were present.

Results of the biological survey are presented in Table 2.4.2-3. Water quality data are in Table 2.3.3-1. Invertebrate and fish data represent the cumulative totals from all samples in each water body. No federal or state rare, threatened or endangered aquatic species was reported during site surveys. However, the American eel (*Anguilla rostrata*) was collected from every water body sampled, except Lake Davies.**}**

2.4.2.1.1.4 **{**Nontidal Wetlands

Nine assessment areas were described based on field surveys conducted in Fall, 2006. Wetland Assessment Areas are defined as contiguous wetland and aquatic areas with a high degree of hydrological interaction and biological similarity. Assessment Areas I, II, III, and VIII correspond to small unnamed watersheds that drain directly to the Chesapeake Bay (Assessment Areas III and VIII flow out of the proposed project plant and construction area before reaching the Chesapeake Bay). Assessment Areas IV, V, and VI form the Johns Creek watershed (upstream of Goldstein Branch). Assessment Area IV constitutes the up-gradient headwaters to Johns Creek and their adjoining wetlands, while Assessment Area V constitutes the main channel and adjoining wetlands of Johns Creek. Assessment Area VI comprises a sequence of man-made basins carrying runoff from the Lake Davies dredged material disposal area to Johns Creek. Assessment Area VII constitutes the headwaters, main channel, and associated wetlands of Goldstein Branch. Assessment Area IX comprises a series of seepages and headwaters that drain into a storm drain system under the existing developed portion of the CCNPP site. Wetland functions and values for the nine assessment areas at the site are provided in Table 2.4.2-4.

The greatest overall functions and values are provided by Assessment Area V, which consists of the main channel of Johns Creek and its adjoining wetlands. Within the CCNPP site, Johns Creek remains largely free of human disturbance. It flows through a stream valley bounded throughout on both sides by mature deciduous forest cover free of agricultural or urban development. The channel is generally diffuse and poorly defined, spreading its flow through dense wetland vegetation that is more than 100 ft (30.5 m) in width at many locations. The vegetation is capable of attenuating flow velocity, filtering out dissolved nutrients or contaminants in the water and causing suspended sediment to settle out before flowing downstream to the tidal waters of St. Leonard’s Creek.

Many of the same functions and values are provided by Assessment Area IV, which consists of the seepages, springs, and headwaters that flow into the upper end of Johns Creek. The reach of Johns Creek east of Maryland Route 2/4 constitutes one of the largest remaining systems of headwaters and stream whose watershed is still largely forested.

The Camp Conoy fishing pond (part of Assessment Area II) has a long history of enjoyment by Constellation employees and their families; recreation is therefore identified as a principal function for Assessment Area II.**}**

2.4.2.1.2 {Chesapeake Bay

2.4.2.1.2.1 Importance of the Bay as a Resource

The Chesapeake Bay is fed by freshwater flows from a 64,000 square mile (166,000 km^2) drainage basin that touches parts of 6 states, as well as the District of Columbia. This freshwater is mixed in almost equal proportions with saline water from the Atlantic Ocean, forming, the largest estuary in the U.S. In addition to its role as a center of commerce and shipping, the Bay is home to dozens of species of wildlife and produces millions of pounds of seafood for domestic and international markets. In recent years, government, industry, and the public have focused efforts on reversing the processes that have led to a decline in the quality of the bay for both wild species and the human population. Pollution, nutrient enrichment, and over-harvesting of estuarine species are among the key threats to the health of the bay.

2.4.2.1.2.2 Review of Key Data Sources

Key data sources of information on the Chesapeake Bay are found with the following Federal, State, and private organizations:

- The Chesapeake Bay Program (CBP) is a regional partnership responsible for developing and implementing restoration plans for the Chesapeake Bay. The CBP includes state and federal government resource managers as well as citizen advisory groups in the Chesapeake Bay area. In addition to annual reports on the overall condition of the Chesapeake Bay and progress of the restoration, the CBP provides data on the life history, distribution, abundance, and harvest of numerous estuarine and marine species in the Chesapeake Bay.
- The Maryland Department of Natural Resources (MDNR) provides commercial landings data for a variety of fish and shellfish species. Crab, oyster, and striped bass data are available for the Chesapeake Bay region; all other species are reported on a statewide basis. The MDNR data is used to describe trends in commercial harvest, and to support the designation of a species as “important.”
- The Atlantic States Marine Fisheries Commission coordinates the conservation and management of the near shore fishery resources shared among the 15 Atlantic states. The Atlantic States Marine Fisheries Commission provides data on the life history, distribution, abundance, and status of the marine finfish and shellfish that it manages.
- The NOAA Fisheries Office of Science and Technology provides commercial landing data for either statewide or a Maryland-specific portion of the Chesapeake Bay.
- The Chesapeake Bay Foundation is a not-for-profit organization devoted to improving the overall environment of the Chesapeake Bay area. The foundation produces an annual report summarizing the condition of key components of the Chesapeake Bay ecosystem and issues a “health index” for the Chesapeake Bay.

2.4.2.1.2.3 Overall Condition of Chesapeake Bay Ecosystem

Both government and non-government reports on the status of the Chesapeake Bay reach the same conclusion: the overall health of the ecosystem remains degraded. Much of the extensive restoration effort expended during the last 20 years has merely kept the Chesapeake Bay from becoming even more severely impacted by the growing human population in the area.

The Chesapeake Bay Foundation assigned the Chesapeake Bay an overall score of 29 (out of a possible 100) based on measures of pollution, habitat, and fisheries. Despite the failing grade, the score was 2 points higher than in the last three years, indicating a slight improvement.

The CBP annual health assessment reached the following conclusions:

- Water Quality – Most of the Chesapeake Bay's waters are degraded. Each summer, a large expanse of its waters does not hold enough oxygen to support striped bass, crabs and oysters. Algal blooms fed by nutrient pollution block sunlight from reaching the underwater bay grasses needed to support aquatic life. Sediment from urban development and agricultural lands is carried into the Chesapeake Bay, clouding its waters and covering critical oyster reef habitat. Currently, about one-third of the Chesapeake Bay water quality goals are being met.
- Habitats and Lower Food Web – The Chesapeake Bay's critical habitats and food webs are at risk. Nutrient and sediment runoff have harmed bay grasses and bottom habitat. Excessive algae growth has pushed the Chesapeake Bay food web out of balance. A large portion of the Chesapeake Bay's wetlands has been lost to development. Currently, the Chesapeake Bay's habitats and lower food web are at about a third of desired levels.
- Benthic Organisms - In 2005, about 41% of the Chesapeake Bay's benthic habitat was considered healthy as measured by the composite Benthic Index of Biotic Integrity. This decline is likely due to persistent low dissolved oxygen levels during the summer. Reduced amounts of nutrients, sediment and chemical contaminants flowing into the Chesapeake Bay will help these bottom dwelling communities improve.
- Phytoplankton – microscopic plants commonly called algae are an excellent indicator of the health of the Chesapeake Bay's surface waters, as they are especially sensitive to changes in nutrient pollution and water clarity. Phytoplankton form the base of the food web. While increased populations provide more food to organisms further up the food web, too much or the wrong type of algae can harm the overall health of the Chesapeake Bay. In some cases, harmful algal blooms can impact human health. Scientists assess microscopic algal community health with a Phytoplankton Index of Biotic Integrity. Data from Spring 2005 show that about 9% of the Chesapeake Bay's phytoplankton communities were considered healthy.
- Fish and Shellfish - Many of the Chesapeake Bay's fish and shellfish populations are below historic levels. The number of adult blue crabs is below the long term average for the seventh straight year and oyster populations are at or near historic lows. American Shad are recovering slowly, while other species like striped bass show mixed signals. Current striped bass populations exceed restoration goals, but approximately 60% to 70% are infected by a disease called mycobacteriosis. Researchers are currently working to understand the extent and severity of the disease and the extent to which environmental conditions in the Chesapeake Bay influence it.**}**

2.4.2.2 Identification of Important Estuarine Species

NUREG-1555 (NRC, 1999a) defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.11 and 50 CFR 17.12 (CFR, 2007a), by the U.S. Fish and Wildlife Service, or the state in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structure and function of local terrestrial ecosystems; or 5) species that could serve as biological indicators of effects on local terrestrial ecosystems.

A list of species considered important in the project area was compiled based on these criteria and summarized in Table 2.4.2-5. A single species may meet more than one of the five criteria.

A 6th criterion, status as a potential nuisance to plant operation, is not discussed, as no nuisance aquatic species are expected to occur in the vicinity of the project area.

- Species Under Special Protection - Threatened, Endangered, or Candidate Species: Any species that is known to occur or could occur in the **{**Chesapeake Bay or near the CCNPP**}** site that is afforded special protection under the federal Endangered Species Act, or under the equivalent State of **{**Maryland**}** law, is defined as an important species.
- Commercially Harvested Species: **{**Finfish and shellfish that rely on habitat in the vicinity of the CCNPP**}** site during any life stage, and are commercially harvested to a substantial degree, are considered important resources.
- Recreational Target Species: **{**Finfish and shellfish that rely on habitat in the vicinity of the CCNPP site**}** during any life stage, and are preferentially taken by recreational anglers or trappers to a substantial degree are considered important resources.
- Keystone Species: Any species that is essential to maintaining the structure and function of the estuarine ecosystem in the vicinity of the **{**CCNPP**}** site will be identified as important.
- Indicator Species: A species whose abundance, distribution, or condition is known or believed to be a reliable predictor of the status of another species of interest is considered an important species.

{In addition, Section 5.3.1.2 includes information regarding additional estuarine and marine species not discussed in this section, e.g., Weakfish (Cynoscion regalis), Summer Flounder (Paralicthys dentatus), Spotfin Killifish (Fundulus luciae), and the Soft Shell Clam (Mya arenaria). These estuarine and marine species were determined not to be important species as defined above, because they do not meet any of the six criteria.**}**

2.4.2.2.1 Description of Important Species

Each important species is described in terms of the following parameters, which provide a context within which site-related effects may be measured and interpreted:

- Critical life support (natural history) requirements, including spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes (including maps)
- Temporal and three-dimensional spatial distribution and abundance, especially in the discharge area and receiving water body (including maps)
- Seasonal catch data (location, volume, and value) for commercially and recreationally important species
- Existing stressors and adverse effects not related to the proposed project

2.4.2.2.2 Threatened or Endangered Species

{Two fish and two sea turtle species in the project area are afforded special protection under the Endangered Species Act: the Shortnose and Atlantic Sturgeon, and the Loggerhead and Kemp's Ridley Turtle.**}**

2.4.2.2.2.1 **{**Shortnose Sturgeon

The Shortnose Sturgeon (*Acipenser brevirostrum*) is an anadromous bony fish that has historically inhabited sluggish tidal rivers and nearshore marine waters of the western Atlantic coast, including Chesapeake Bay. The ancestral range of this species is believed to extend from the St. John River in New Brunswick, Canada, to the St. Johns River in Florida. It moves up river channels to spawn in fresh water. Although this fish once supported an enormous international export business, the stock plummeted during the 1900s due to overharvesting.

The Shortnose Sturgeon was listed as federally endangered in 1967, and is considered extremely rare under Commonwealth of Maryland law. Deteriorating water quality (especially low dissolved oxygen) and placement of dams that restrict its access to historical spawning grounds have likely inhibited the strong comeback that could have been expected once legal protections were put in place.

In 1979, Baltimore Gas and Electric researchers captured a Shortnose Sturgeon during trawl studies in the vicinity of the CCNPP site. Other isolated individuals may use the area intermittently; however, no Shortnose Sturgeon is known to have spawned in the Chesapeake in decades. In August, 2006, a female with eggs was captured as she swam up the Potomoc, supposedly to spawn. It is not known whether she spawned, but biologists consider it doubtful, since males are exceedingly rare in the area. Intensive efforts by biologists to document the presence of this species in the Chesapeake are ongoing.**}**

2.4.2.2.2.2 **{**Atlantic Sturgeon

A larger, longer-lived relative of the Shortnose Sturgeon, the Atlantic Sturgeon (*Acipenser oxyrhynchus*) once supported a robust fishery in the Chesapeake Bay. It is currently on the candidate species list maintained by NOAA Fisheries, because it is undergoing a status review under the Endangered Species Act**.** The decline of the Atlantic Sturgeon was not as sudden or steep as that of the Shortnose Sturgeon, but its populations are currently depleted. In late 1997, a moratorium on the harvest of wild Atlantic Sturgeon was implemented and remains in effect until there are at least 20 protected year classes in each spawning stock, which may take up to 40 or more years.

The sturgeon's dependence on both estuarine and freshwater habitat makes it susceptible to harm from habitat degradation due to pollution, physical barriers to spawning areas, channelization or elimination of backwater habitats, de-watering of streams, and physical destruction of spawning grounds.

The MDNR conducted a trial stocking experiment in 1996 to investigate the viability of juvenile hatchery fish that were released on the Eastern Shore. During the subsequent 5 years, 14% of the juveniles were recaptured, suggesting that habitat conditions were adequate to support growth and survival. Recent changes to the water quality goals in the Chesapeake Bay are expected to result in habitat improvements for both sturgeon species.**}**

2.4.2.2.2.3 **{**Atlantic Loggerhead Turtle

Loggerheads (*Caretta caretta*) occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. The Loggerhead is the most abundant species of sea turtle found in U.S. coastal waters, including the Chesapeake Bay. Approximately 2,000 to 10,000 young Loggerheads forage in the bay each summer for horseshoe crabs, jellyfish, and mollusks. They are most often seen near the mouths of rivers, in water greater than 13 ft (4 m) deep. Most sightings are in the Virginia portion of the bay, where salinity is higher. In addition to the well-known juveniles, it has been reported that up to 5% of the Loggerheads in Chesapeake Bay are adult females who are taking time off between nesting efforts.

The stock structure of the U.S. population of Loggerheads is poorly understood. Some evidence suggests that individuals nesting in Georgia represent a population distinct from the Florida nesters. If so, the northern population may be more severely threatened. NOAA Fisheries suggests that it may become necessary to consider listing them as endangered. Adult Loggerheads are known to make extensive migrations between foraging areas and nesting beaches. The Virginia Institute of Marine Science Sea Turtle Program actively tracks individuals that nest on Virginia beaches in an effort to determine the migration routes of these turtles. At present, the place of origin of an individual turtle cannot be determined. Turtles feeding in the Chesapeake Bay may represent a number of nesting populations worldwide.

At the global level, the primary threat to Loggerhead turtle populations is incidental capture in fishing gear, especially in longlines and gillnets, but also in trawls, traps and pots, and dredges. NOAA Fisheries is currently implementing a program to evaluate the incidence of bycatch of sea turtles in various types of gear, including pound nets in the Chesapeake Bay.**}**

2.4.2.2.2.4 **{**Kemp's Ridley Turtle

The Kemp's Ridley Turtle (*Lepidochelys kempii*) is one of the smallest of the sea turtles, with adults reaching about 2 ft (0.6 m) in length and weighing up to 100 lbs. The Kemp's Ridley Turtle has been on the endangered species list since 1970. Nesting occurs in spring on Mexican beaches. After leaving the nesting beach, hatchlings are believed to become entrained in eddies within the Gulf of Mexico, where they are dispersed within the Gulf and Atlantic by oceanic surface currents until they reach about 7.9 in (20 cm) in length, (or about two years of age) at which size they enter coastal shallow water habitats.

A sizeable group of the Kemp's Ridley Turtle spends the summers in the Chesapeake Bay, although most remain in the higher salinity waters of the Virginia portion of the bay. This turtle is a shallow water benthic feeder with a diet consisting primarily of crabs.

The principal threats to this species occur on the nesting beaches, where both deliberate and accidental disturbances interfere with nesting success and in accidental take by fisheries vessels. Restoration of the species requires protecting sub-adult and adult animals by the use of turtle excluder devices on shrimp trawls wherever turtles occur.**}**

2.4.2.2.3 **{Harvested Fish**

Nine species of fish that are harvested commercially or recreationally in the Chesapeake Bay are considered important in the project area, as shown in Table 2.4.2-5.**}**

2.4.2.2.3.1 **{**American Shad

The American Shad (*Alosa sapidissima*) is one of six shad and herring species to occur in the Chesapeake Bay. From January to June, shad older than about four years old enter the Chesapeake Bay to spawn in fresh or near-fresh tributaries as far north as the Susquehanna River. Shad usually complete the spawning run without feeding and move far enough upstream for the eggs to drift downstream and hatch before reaching saltwater. After spawning, the adult either dies or resumes its long pelagic migration. Within a month, young fish are feeding on zooplankton in the Chesapeake Bay. More than 70% die before leaving the estuary.

Historically, it is likely that American Shad spawned in suitable waters across the Atlantic coast. Current spawning runs are limited by physical barriers as well as degraded water quality. These impediments to spawning, added to overharvesting, spurned Maryland to implement a fishing moratorium in 1980. Virginia concurred in 1994, making it illegal to harvest American Shad anywhere in the Chesapeake Bay. Stocks are being enhanced in three ways: (1) Restoring native spawning habitat by removing dams or building fishways; (2) supplementing wild stocks with hatchery fish; and (3) improving water quality.

A low of several hundred American Shad per year was reported in the early 1980s. The most recent data available show an average of 101,140 per year between 2003 and 2005. The increased abundance falls short of the long term restoration goal of two million fish per year. The Atlantic States Marine Fisheries Commission has identified habitat areas of particular concern for the American Shad, including spawning sites; nursery areas; inlets that provide access to coastal bays, estuaries and riverine habitat upstream to spawning grounds; and sub-adult and adult nearshore ocean habitat.

The abundance of the closely related Hickory Shad (*Alosa mediocris*) dropped so low in the Chesapeake Bay in the late 1970s that a moratorium on commercial and recreational capture in Maryland's portion of the Chesapeake Bay was implemented in 1981. Although the population is increasing, the moratorium remains in place. Ocean landings of hickory shad are still allowed and Maryland recorded landings less than 4000 lb (1800 kg) in 2004.**}**

2.4.2.2.3.2 **{**Bay Anchovy

The Bay Anchovy (*Anchoa mitchilli*) is the most abundant fish in the Chesapeake Bay. Through predator-prey relationships, the Bay Anchovy forms a link between zooplankton and top game fish. Striped bass, bluefish, and other sport fish, as well as some birds and mammals, depend on the abundance of Bay Anchovy to sustain them. In one study, Bay Anchovy accounted for up to 65% of the biomass consumed by striped bass in the Bay.

The Bay Anchovy spawns throughout the Bay. In summer months from 1995 to 2000, Bay Anchovy eggs comprised more than 94% of the fish eggs in the plankton of the Middle Bay portion of the Chesapeake Bay. More than 75% of all larval fish collected in ichthyoplankton tows were Bay Anchovy.

The Bay Anchovy is not commercially harvested. However, Bay Anchovy populations in the Chesapeake Bay fluctuate annually. Since 1994, the Bay Anchovy population in the Chesapeake Bay has been on a long term decline, the first ever recorded for the species. In recent years, recruitment of Bay Anchovy has been lower than expected, based on the various trawl surveys. Although the specific causes of the decline are not well understood, it is known that oxygen levels below 3.0 mg/l can be lethal to eggs and larvae. Dissolved oxygen greater than 2.0 mg/ l is critical for adult survival.**}**

2.4.2.2.3.3 **{**Atlantic Menhaden

Like the Bay Anchovy, the Atlantic Menhaden (*Brevoortia tyrannus*) is a key component of the estuarine food web, consuming plankton and small fish while being consumed by larger predatory fish. Adults are present in near proximity to the CCNPP site year round. In the Middle Bay, spring egg collections were comprised of more than 80% menhaden. Unlike the Bay Anchovy, however, the Atlantic Menhaden is directly targeted by commercial harvesters. In 2004, more than 3 million lb (1.4 million kg) were landed in Maryland.

Atlantic Menhaden stocks across the Atlantic coast are stable. However, reduced abundance in the Chesapeake Bay, a key nursery area, has been reported. Due to the concern over the steady decline in recruitment in the Chesapeake Bay, fisheries managers have recently (starting in 2006) capped the commercial harvest of Atlantic Menhaden for 5 years. The limits on harvest of Atlantic Menhaden are based on the importance of Atlantic Menhaden to predatory fish, including the striped bass and bluefish.**}**

2.4.2.2.3.4 **{**Atlantic Croaker

The Atlantic Croaker (*Micropogonias undulates*) is one of the top ten recreational finfish in the Chesapeake Bay. Adults are abundant in the bay from March to October. They move offshore and south along the Atlantic coast in the fall. Juveniles are present essentially year round. Spawning occurs over the shelf in fall and winter.

The Atlantic Croaker is a bottom-feeding generalist, consuming benthic invertebrates and some fish. It is associated with muddy substrates in depths less than 400 ft (120 m), in a wide range of salinity and temperature conditions. All of the major predatory fish in the Chesapeake Bay, including striped bass, flounder, shark, spotted seatrout, other croaker, bluefish and weakfish, include croaker in their diet.

The Atlantic Croaker is a perennial favorite of the human population, as well, ranking within the top 10 species caught by anglers. Historically, the Chesapeake Bay region accounted for the majority of Atlantic Coast croaker landings. Recreational landings in the region have been declining since 1986.

After a sharp decline in commercial landings during the 1970s and 1980s, Atlantic croaker landings in Maryland increased to close to 1 million lb (454,000 kg) per year for most of the 1990s. In fact, commercial landings in 2001 were higher than at any time since 1956, indicating a rebound of the Atlantic Croaker fishery in the Chesapeake Bay.**}**

2.4.2.2.3.5 **{**Striped Bass

The Striped Bass (*Morone saxitilis*) is the dominant predator in the Chesapeake Bay. Juveniles and adults occur in the Chesapeake Bay year round. The abundance and distribution of the Striped Bass affect countless other species, including the Atlantic Menhaden. Juvenile Striped Bass feed on zooplankton and benthic invertebrates. Adults eat a variety of other important fish, including Bay Anchovy, Atlantic Menhaden, Spot, Atlantic Croaker, and White Perch.

This large anadromous species has a complex life history that centers on the Chesapeake Bay, where historically, about 90% of the Atlantic population spawned. Distribution patterns are influenced by the age, sex, degree of maturity and the river in which they were born. Successful completion of the striped bass life cycle requires a variety of habitats including spawning sites, nursery areas, passages between inland spawning and estuarine nursery habitats, and offshore wintering grounds.

Commercial and recreational landings in the Chesapeake Bay generally increased from the 1930s through the mid-1970s, then declined sharply through the mid-1980s. Aside from direct overfishing, it is thought that low dissolved oxygen increased stress on the fish, making them susceptible to disease. A moratorium on all striped bass fishing in Maryland in 1985, and in Virginia in 1989, allowed the population to rebound. According to the Maryland Department of Natural Resources (MDNR), 602,506 lb (273,292 kg) of striped bass were harvested from the south central area of the Chesapeake Bay near the CCNPP site in 2004. This was one of the top 10 years of greatest harvest since data collection began in 1944. Concerns about the future of this fishery remain. A large percentage of striped bass appear to be malnourished and up to 70% of the population is infected with mycobacteriosis, a type of wasting disease. The impact of this disease of sustainability of the stock is not well understood at this time.**}**

2.4.2.2.3.6 **{**Spot

The Spot (*Leiostomus xanthurus*), like the Atlantic Croaker, occupies a middle position in the Chesapeake Bay food web, as a consumer of benthic invertebrates and as prey for striped bass, bluefish, weakfish, shark and flounder. The Spot is a generalized omnivorous bottom feeder that ranges throughout the Chesapeake Bay from April through October. The Spot is broadly tolerant of temperature and salinity fluctuations. Spawning occurs offshore, then the young move into the estuary for rearing.

In addition to their central role in the food web, Spot are important to both commercial harvesters and recreational anglers. Inter-annual variability in spawning conditions leads to unpredictable landings. No long term declines, however, have been noted. Commercial landings are highest during the fall migration out of the Chesapeake Bay, when they are taken as by-catch from the pound net fishery in the lower Bay. According to MDNR, commercial catches in Maryland have exceeded 100,000 lb (45,000 kg) annually since 1998.**}**

2.4.2.2.3.7 **{**White Perch

White Perch (*Morone americana*) migrate from the open Chesapeake Bay into the tidal-fresh portions to spawn from April to June over the sandy bottoms of brackish or tidal-fresh rivers. Young White Perch remain nearshore downstream from their hatching areas for several months, foraging for insect larvae and crustaceans. Adult White Perch overwinter in the deeper channels of the Chesapeake Bay. They never move into the open ocean. White Perch are heavy consumers of fish eggs, including those of the striped bass.

The White Perch is considered a delicious table fish, and supports an important recreational fishery in the Chesapeake Bay. It is also commonly taken as by-catch by commercial harvesters. Large schools of White Perch are vulnerable to capture when they aggregate in large schools to feed on herring. According to MDNR, commercial catches in Maryland have exceeded 1 million lb (453,000 kg) annually since 1995.**}**

2.4.2.2.3.8 **{**Bluefish

The migratory Bluefish (*Pomatomus saltatrix*) visits the Chesapeake Bay area from spring to fall; it spawns offshore in the Chesapeake region in July. Juvenile Bluefish move into the bay during late summer. Larger juveniles and adult bluefish have broad habitat tolerances, and range throughout the Chesapeake Bay in search of forage fish. Its diet is varied, consisting of fish species at all depths, including Atlantic Menhaden, Weakfish, and Croaker. As a large, mobile predator, it competes with the striped bass for food.

About 20% of the Bluefish caught commercially in the U.S. are landed in the Chesapeake Bay, making bluefish a significant fishery in the area. The majority of the catch is in the Virginia portion of the Chesapeake Bay. Historic highs and lows in the harvest have occurred during the last 70 years. Until about 1992, commercial landings of Bluefish in Maryland routinely exceeded 200,000 lb (90,000 kg) annually. Although overall stocks of Bluefish in the Atlantic are increasing, landings in the Chesapeake Bay are on the decline, possibly due to over harvesting. According to MDNR, about 52,000 lb (23,000 kg) of Bluefish were landed by commercial fishermen in 2004.

The Bluefish ranked first in number and weight among sportfish in the Chesapeake Bay for nearly 20 years, until the current decline began in 1990. Recreational landings outnumber commercial landings by at least 5 times. MDNR implemented a management plan in 1990 in response to concerns about declining regional bluefish stocks.**}**

2.4.2.2.3.9 **{**American Eel

The American, or common, Eel (Anguilla rostrata) is a widely distributed catadromous species, which lives predominately in rivers, lakes and estuaries, but spawns in the Atlantic Ocean. The American Eel is abundant year-round in all tributaries to the Chesapeake Bay. During the 5 to 20 years the American Eel spends in the Chesapeake Bay, it feeds at night on insects, mollusks, crustaceans, worms, and other fish.

In all its life stages, the American Eel is an important prey species, as it is consumed by a variety of fish, aquatic mammals, and birds. The American Eel is caught in commercial eelpots. Most eels landed in the Chesapeake Bay area are juveniles, or “glass eels,” which are exported to Europe and Asia. Recreational anglers do not typically target the eel for consumption, although they are often bought for use as bait for striped bass and other sport fish.

In 2005 the Atlantic States Marine Fisheries Commission determine that eel abundance had fallen since the late 1970s to mid-1980s, and was at or near historic lows along the entire Atlantic coast. The decline was not attribute to any particular cause although several possible factors such as harvest, habitat loss, predation, hydroturbine mortality, disease, parasitism, and reduced fecundity resulting from pollution were noted. The commercial catch in 1981 was more than 700,000 lb (317,000 kg) in both Maryland and Virginia, but has been declining ever since.

The American Eel is currently being considered for special protection under the Endangered Species Act, which may affect the way the species is managed by the Atlantic States Marine Fisheries Commission. The American Eels mature slowly (reproducing at age 8 to 24 years), and are vulnerable to targeted harvest during seasonal migrations, which occur before the first spawning of new adults.**}**

2.4.2.2.4 {Harvested Invertebrates

Two species of invertebrates have been historically important to commercial and recreational harvesters near the CCNPP site, and throughout the Chesapeake Bay: the Blue Crab and the American Oyster. Both species are now severely depleted, and under strict management provisions.**}**

2.4.2.2.4.1 **{**Blue Crab

The Blue Crab (*Callinectes sapidus*) plays a vital role in the Chesapeake Bay region as both predator and prey. The Chesapeake Bay is the largest producer of crabs in the country, supporting major commercial and recreational fisheries. In most years, at least 30% of the nation’s Blue Crabs come from Chesapeake Bay waters. According to the CBP, annual commercial harvests can approach 100 million lb (45.4 million kg) of crab.

Blue Crabs range from the upper Chesapeake Bay near freshwater tributaries down to the mouth of the Chesapeake Bay. Although mating occurs in the areas near the CCNPP site, the females typically migrate down-bay to a spawning and hatching area approximately 70 mi (110 km) south of the CCNPP site, where an appropriate salinity of approximately 23 to 28 parts per thousand occurs.

The number of mature female Chesapeake Bay Blue Crabs, or spawning stock, remains below the long term average. The 2006 winter survey conducted by MDNR showed that the total number of crabs in the Chesapeake Bay was low compared with historical averages, but stable. In 2006, the Chesapeake Bay Foundation issued a Chesapeake Bay score of 38%, or grade C for the Blue Crab. Reasons for the observed reduction in harvest are complex, but may include over-harvesting, loss of habitat, and degradation of water quality. Juvenile crabs are closely tied to submerged aquatic vegetation, and may suffer a decline when submerged aquatic vegetation is unavailable for use as habitat and nursery grounds. Crabs are bottom feeders, and can be sensitive to low dissolved oxygen near the substrate.**}**

2.4.2.2.4.2 **{**American Oyster

The American Oyster (*Crassostrea virginica*) is highly valued in the Chesapeake Bay, but has been declining since the late 1800s due to over-harvesting, parasites, and poor water quality. After 2 to 3 weeks in the plankton, or as weak swimmers, larval oysters attach to the Chesapeake Bay substrate in a place where they will become permanently attached as adults. From there, a healthy oyster provides many services to the Chesapeake Bay ecosystem, including filtering the water, producing planktonic larvae that feed a variety of larval fish, and creating a physical structure with its shell that many other animals use for shelter and foraging.

Efforts to restore the oyster fishery include expanding the amount of clean, hard surfaces for oyster spat (juvenile oysters) to settle, increasing the number of breeding adult oysters and developing methods for controlling oyster diseases.

Oyster breeding and nursery areas occur near the CCNPP site. New beds were created during CCNPP Units 1 and 2 construction to mitigate habitat loss. However, oysters have not occurred in sufficient number for commercial fishery near the CCNPP site since at least 1971.**}**

2.4.2.2.5 {Other Important Resources

In addition to the fish and invertebrates already mentioned, submerged aquatic vegetation and plankton are considered important resources in the project area.

2.4.2.2.5.1 Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) includes a group of about 16 rooted plant species that live within the shallows of the Chesapeake Bay and its tributaries. This vital resource provides refuge and nursery habitat for numerous organisms, increases the structural complexity of the bottom, adds oxygen to the water, and prevents erosion and sedimentation. In addition, microscopic algae and protozoa use the leaves of SAV as attachment locations. Small fish are attracted to these areas for feeding. Decaying leaves are consumed by zooplankton, which are then eaten by larval fish.

SAV is considered an indicator group because the plants respond quickly and dramatically to degradation of water quality. At one time, SAV covered about 200,000 shallow and shoreline acres (81,000 hectares) of the Chesapeake Bay. Acreage has fluctuated widely over the past few decades. In 2004, bay grasses covered 72,935 acres (29,516 hectares). Although this value represented an increase over previous years, it is still only about 42% of what experts believe to be necessary for complete restoration of function. Acreage of SAV in the middle and lower Chesapeake Bay has diminished even more significantly over the past decade. In addition, late in 2005 much of the SAV in the lower Chesapeake Bay died, possibly due to high temperatures.

In 2006, the Chesapeake Bay Foundation issued a Chesapeake Bay score of 18% (failing grade) in the SAV category. No SAV were located during the surveys conducted to support CCNPP Unit 3 in the immediate vicinity of the CCNPP site.**}**

2.4.2.2.5.2 **{**Plankton (Phytoplankton and Zooplankton)

The term plankton refers to organisms of the open water that drift on currents and tides. Phytoplankton are plants or algae that manufacture their own food using nutrients in the water. Zooplankton are animals that generally consume phytoplankton. A small but significant component of the plankton consists of bacterial cells. Although most plankton are tiny, they range in size from microscopic bacteria and plants to larger animals, such as jellyfish.

In the Chesapeake Bay, plankton provides the nutritional support for the entire fisheries industry. Plankton are short-lived and highly responsive to both positive and negative environmental changes. As such, plankton are useful indicators of overall environmental quality. Phytoplankton abundance is a readily visible measure of invisible nutrient loads in the Chesapeake Bay. The composition and abundance of zooplankton are predictors of near term fisheries abundance, as most larval fish rely on zooplankton to grow to a size large enough to compete as a predator. Some species, such as Blueback Herring, Alewife, and Shad, rely on mesozooplankton food their entire lives. The influence of zooplankton on Striped Bass and White Perch in Chesapeake Bay is well-documented. Striped Bass, White Perch, and Yellow

Perch depend on mesozooplankton and microzooplankton as larvae, and shift to larger prey as they grow. The role of zooplankton in the Chesapeake Bay is an area of active research.

Zooplankton are categorized by size as the barely visible microzooplankton (20 µm - 0.2 mm) and mesozooplankton (0.2 - 20 mm), and the more familiar macrozooplankton (20 mm - 20 cm), which includes ctenophores (Comb Jellyfish), shrimp, amphipods, euphausiids, and larval fish. The megazooplankton (20 cm - 2 m) are the true jellyfish.

The overall health of the zooplankton in the Chesapeake Bay is suboptimal, and worsening in most reaches:

- Despite universal improving trends, zooplankton food levels for migratory fish larvae are currently inadequate in most major spawning/nursery areas.
- Sharp declines in mesozooplankton abundance were noted in almost all of the middle and lower Chesapeake Bay mainstem and lower tributary reaches. At the station nearest to the CCNPP site (just north of the CCNPP site), a 32% drop in abundance from 1984 to 2002 was reported.
- In contrast, abundances of the smaller microzooplankton increased in the mid Chesapeake Bay. The overall zooplankton food base for important forage fish such as bay anchovy, menhaden, and immature stages of other resident species is declining and shifting to smaller sizes.

However, some positive trends have been documented, likely in response to improvements in water quality.

- Significant increases in mesozooplankton abundance indicate an improving trend in the overall food base for fish in some areas, especially where water quality significantly improved, as in the Patuxent River.

Relationships among various components of the plankton are complex, and not well-understood. For example, phytoplankton food quality, which is influenced by water quality, appears to be an important factor affecting mesozooplankton. However, high phytoplankton biomass does not necessarily produce high mesozooplankton abundances. The specific phytoplankton groups, such as diatoms, influence the success of the zooplankton that consume them.

Monitoring of phytoplankton using a Phytoplankton Index of Biotic Integrity showed that about 9% of the Chesapeake Bay's phytoplankton communities were considered healthy in Spring 2005.**}**

2.4.2.2.6 Nuisance Species

{No nuisance aquatic species occur in the vicinity of the CCNPP site.**}**

2.4.2.3 Habitat Importance

{Onsite streams and ponds were described in terms of the typical surface water habitats in the area. Headwater streams in general are considered important; however, there is nothing of regional significance about these particular streams. All of the onsite aquatic species mentioned in this section are common in the area. No loss of onsite stream and pond critical habitat is expected.

The Chesapeake Bay is considered important estuarine habitat to most, if not all, of the estuarine species identified in the area. However, none of the important species in the vicinity of the project are endemic to Chesapeake Bay. All of them range widely throughout the mid-Atlantic coast, and most occur in the Gulf of Mexico, as well.

The portion of the Chesapeake Bay nearest the CCNPP site is of lower relative importance than other areas of the bay. Estuarine species that use the bay as nursery grounds need the submerged aquatic vegetation (SAV) and tidal marshes for nutrient-rich forage for the larvae and young of the year, as well as for protective cover from predators. The area near the CCNPP site has no SAV, and does not provide critical habitat for any species.

The National Marine Fisheries Service (NMFS) designated Essential Fish Habitat (EFH) for each life stage of federally managed marine fish species in the Chesapeake Bay area; the bluefish is the only important species in the project area that is federally managed, and for which EFH has been designated. EFH is defined in Title 50 CFR Section 600.10 (CFR, 2007c) implementing the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act (USC, 1996) as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Bluefish eggs and larvae are found only offshore, so no EFH occurs in Chesapeake Bay. For juvenile bluefish, all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida, are EFH. Generally juvenile bluefish occur in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from May through October, and South Atlantic estuaries March through December, within the "mixing" and "seawater" zones. Adult bluefish are found in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from April through October, and in South Atlantic estuaries from May through January in the "mixing" and "seawater" zones. Bluefish adults are highly migratory and distribution varies seasonally and according to the size of the individuals comprising the schools. Bluefish are generally found in normal shelf salinities (greater than 25 parts per thousand).

Four threatened and endangered aquatic species known to occur in the area include two species of sturgeon and two species of sea turtles. No sturgeon is known to have spawned in the Chesapeake in decades. The sea turtles that occasionally use the Chesapeake Bay spawn much further south, outside the Chesapeake Bay watershed.**}**

2.4.2.4 Other Preexisting Environmental Stresses

{Pollution, nutrient enrichment, and over-harvesting of estuarine species are among the key threats to the health of the Chesapeake Bay. Based on conditions throughout 2006, the Patuxent River Watershed portion of the Chesapeake Bay received a grade of D- (23%) based on very poor water clarity and chlorophyll *a*, moderate dissolved oxygen conditions, poor benthic and phytoplankton scores, and loss in bay grasses.

Section 2.4.2.1.2.3 includes information on the types of stresses that organisms have experienced.**}**

2.4.2.5 Transmission and Access Corridors

{There are no new offsite transmission or access corridors associated with CCNNP Unit 3.**}**

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USFWS, 1993. United States Fish and Wildlife Service, Puritan Tiger Beetle (Cicindela puritana G. Horn) Recovery Plan, dated, 1993.

USFWS, 1994. United States Fish and Wildlife Service, Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis* Say) Recovery Plan, dated 1994.

Table 2.4.1-1 Important Terrestrial Species and Habitats
(Page 1 of 4)

Name	Common Name	Description	Location	Rationale
Mammals				
{*Odocoileus virginianus*	White-tail Deer	Large, herbivorous mammal. Favors forest edge habitat. Game species.	Observed frequently in all habitats in the CCNPP site area. Likely to be abundant elsewhere on the CCNPP site and surrounding landscape.	Recreationally valuable species}
Birds				
{*Piranga olivacea*	Scarlet Tanager	Neotropical migratory bird that breeds in North America in late spring and early summer and winters in Central and South America in fall and winter. Favors large tracts of forest, especially forest with lots of dead or declining trees, for breeding territory.	Heard frequently throughout forested areas on the CCNPP site. Likely common in other forested areas in surrounding landscape.	Designated as "Forest Interior Bird" (FIB) by Maryland Department of Natural Resources}
{*Haliaeetus leucocephalus*	Bald Eagle	Large, piscivorous (fish-eating) bird.	Maryland Natural Heritage Program has a record of a nest on the Chesapeake Bay shoreline in the southern part of the CCNPP site, just south of the CCNPP Unit 3 construction area. Observed flying along cliffs east of the CCNPP site.	Federal Threatened Maryland Endangered}
Insects				
{*Cicindela dorsalis dorsalis*	Northeastern Beach Tiger Beetle	Small beetle inhabiting sandy beaches.	Cliffs and beaches (primarily beaches) on Chesapeake Bay (eastern edge of the CCNPP site and north of CCNPP Units 1 and 2).	Federal Threatened Maryland Endangered}

Table 2.4.1-1 Important Terrestrial Species and Habitats
(Page 2 of 4)

Name	Common Name	Description	Location	Rationale
{*Cicindela puritana*	Puritan Tiger Beetle	Small beetle inhabiting sandy shores on fresh and brackish waters. Limited to shorelines of Connecticut River in Connecticut and Chesapeake Bay in Maryland. Feeds on other insects (i.e., insectivorous). Spends approximately 23 months of roughly 2 year life cycle in shallow underground tunnels in sand.	Cliffs and beaches on Chesapeake Bay (eastern edge of the CCNPP site).	Federal Threatened Maryland Endangered**}**
Plants				
{*Centrosema virginianum*	Spurred Butterfly Pea	Perennial forb.	Maryland Natural Heritage Program has record of occurrence on the CCNPP site southwest of the CCNPP Unit 3 construction area. Observed in August 2006 in John's Creek floodplain.	Maryland Rare**}**
{*Kalmia latifolia*	Mountain Laurel	Evergreen woody shrub.	Forms dense stands in the understory of many upland forested areas throughout the CCNPP Unit 3 construction area, the CCNPP site, and surrounding landscape.	Ecosystem Critical, Biological Indicator**}**
{*Liriodendron tulipifera*	Tulip Poplar	Deciduous tree.	Dominant tree in most upland forest areas in the CCNPP Unit 3 construction area, the CCNPP site, and surrounding landscape.	Ecosystem Critical, Biological Indicator**}**

Table 2.4.1-1 Important Terrestrial Species and Habitats
(Page 3 of 4)

Name	Common Name	Description	Location	Rationale
{*Quercus prinus*	Chestnut Oak	Deciduous tree.	Dominant tree in most sloping and dry upland forest sites in the CCNPP Unit 3 construction area, the CCNPP site, and surrounding landscape.	Ecosystem Critical, Biological Indicator}
{*Quercus shumardii*	Shumard's Oak	Deciduous tree.	Possible occurrence in John's Creek floodplain.	Maryland Threatened}
{*Solidago speciosa*	Showy Goldenrod	Perennial forb with showy yellow flowerheads consisting of hundreds of small yellow flowers.	Several locations on forest edges in Camp Conoy.	Maryland Threatened}
{*Thelypteris noveboracensis*	New York Fern	Perennial fern.	Forms dense groundcover in large patches in Mesic Deciduous Forest and Bottomland Deciduous Forest.	Ecosystem Critical, Biological Indicator}
Habitats				
{Herbaceous Marsh Vegetation		Dominated by sedges, rushes, bulrushes, and grasses and forbs typical of poorly drained soils.	Fringes of Lake Conoy and other ponds; floodplain areas on the CCNPP Unit 3 construction area and elsewhere on the CCNPP site that lack tree canopy.	Wetland Floodplain}
{Poorly Drained Bottomland Deciduous Forest		Dominated by red maple, sweet gum, and black gum with understory of ferns.	Primarily in bottoms of stream valleys.	Wetland Floodplain}
{Well-Drained Bottomland Deciduous Forest		Dominated by tulip poplar, American beech, sweet gum, black gum, and red maple.	Primarily in bottoms of stream valleys.	Wetland Floodplain}

Table 2.4.1-1 Important Terrestrial Species and Habitats
(Page 4 of 4)

Name	Common Name	Description	Location	Rationale
{Flag Ponds Nature Park		327 acres (132 hectares) park comprising a matrix of sandy beach, tidal marsh, freshwater marsh, freshwater pond, and forest habitats.	Directly north of the CCNPP Unit 3 construction area.	County-Owned Preserve**}**
{Calvert Cliffs State Park		3,030 acres (1,226 hectares) forested park containing same upland and wetland habitats as natural areas on CCNPP site area. 1079 acres (436.7 hectares) are designated as wildland area and 550 acres (222.6 hectares) are designated as public hunting area.	Directly south of the CCNPP Unit 3 construction area.	State-Owned Preserve**}**

Table 2.4.2-1 Survey Results for John's Creek (Fall 2006)
(Page 1 of 1)

Parameter	Upstream (JCUS-01)**	Downstream (JCDS-01)**
Total Number of Individual Invertebrates	1,628	1,414
Total Number of Invertebrate Taxa	29	33
Total Number of Individual Fish	4	105
Total Number of Fish Species	1	8
Overall Habitat Quality *	147	167

Notes:

* Any value greater than 139 is considered optimal.
** Sample points from biological survey

Table 2.4.2-2 Survey Results for Goldstein Branch (Fall 2006)
(Page 1 of 1)

Parameter	GB-01**
Total Number of Individual Invertebrates	1,238
Total Number of Invertebrate Taxa	24
Total Number of Individual Fish	65
Total Number of Fish Species	7
Overall Habitat Quality *	149

Notes:

* Any value greater than 139 is considered optimal.
** Sample point from biological survey

Table 2.4.2-3 Dip Net Survey Results for Lakes and Ponds (Fall 2006)
(Page 1 of 1)

Parameter	Lake Davies	Pond 1	Pond 2	Lake Conoy
Total Number of Individual Invertebrates	10,719	2,972	1,817	4,157
Total Number of Invertebrate Taxa	14	20	21	31
Total Number of Individual Fish	81	8	56	213
Total Number of Fish Species	1	4	5	6

Note:

Overall habitat quality values are only calculated for streams.

Table 2.4.2-4 Summary of Functions and Values for Assessment Areas (Page 1 of 1)

Function or Value	Wetland Assessment Areas *								
	I	II	III	IV	V	VI	VII	VIII	IX
Functions									
Groundwater Recharge/Discharge	√	√	√	√	√		√	√	
Floodflow Alteration									
Fish and Shellfish Habitat		√			$\boxed{\surd}$		√		
Sediment/Toxicant Retention		√	√	√	$\boxed{\surd}$	√	√	√	
Nutrient Removal		√	√	√	$\boxed{\surd}$	√	$\boxed{\surd}$	√	
Production Export		√	√	√	$\boxed{\surd}$	√	√	√	
Sediment/Shoreline Stabilization		√			√	√			
Wildlife Habitat	√	$\boxed{\surd}$	$\boxed{\surd}$	$\boxed{\surd}$	$\boxed{\surd}$	√	$\boxed{\surd}$	$\boxed{\surd}$	√
Values									
Recreation		$\boxed{\surd}$	√	√	√		√	√	
Educational/Scientific Value			√	√	√			√	
Uniqueness/Heritage		√	√	$\boxed{\surd}$	$\boxed{\surd}$			√	
Visual Quality/Aesthetics		√						√	√

Legend:

√ Function or Value Present

$\boxed{\surd}$ Function or Value Principal

Note:

*As shown in the Wetlands Delineation Study

Table 2.4.2-5 Important Species in the Chesapeake Bay Near the CCNPP Site (Page 1 of 1)

Species (*Scientific Name*)	Commercially Harvested	Recreational Target	Keystone Species	Indicator Species
Threatened and Endangered Species				
Shortnose Sturgeon * *Acipenser brevirostrum*				
Atlantic Sturgeon *Acipenser oxyrhynchus*	**X (Moratorium since 1997)**			
Atlantic Loggerhead Turtle * *Caretta caretta*				
Kemps Ridley Turtle * *Lepidochelys kempii*				
Harvested Fish				
American Shad *Alosa sapidissima*	**X**			
Bay Anchovy *Anchoa mitchilli*	**X**		**X**	
Atlantic Menhaden *Brevoortia tyrannus*	**X**		**X**	**X**
Atlantic Croaker *Micropogonias undulatus*	**X**	**X**		
Striped Bass *Morone saxitilis*	**X**	**X**		
Spot *Leiostomus xanthurus*	**X**	**X**		
White Perch *Morone americana*	**X**	**X**		
Bluefish *Pomatomus saltatrix*	**X**	**X**		
American Eel *Anguilla rostrata*	**X**	**X**		
Harvested Invertebrates				
Blue Crab *Callinectes sapidus*	**X**	**X**		
American Oyster *Crassostrea virginica*	**X**			**X**
Other Important Resources				
Submerged Aquatic Vegetation (SAV)			**X**	**X**
Plankton			**X**	**X**

Note:

* Threatened and Endangered Species are not allowed to be taken in the Chesapeake Bay.

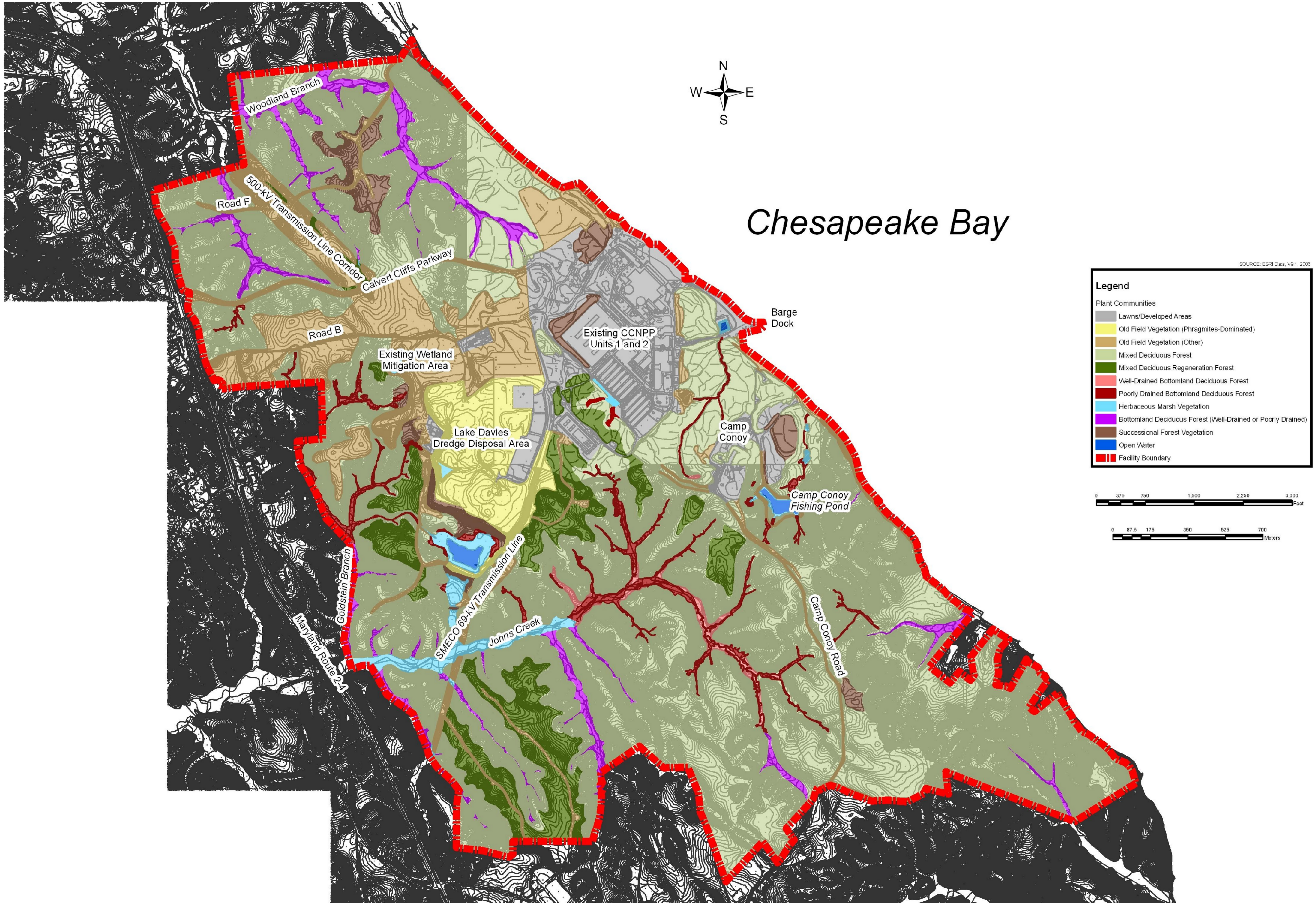

FIGURE 2.4-1 **Rev. 0**

PLANT COMMUNITY
(NATURAL HABITAT MAP)

CCNPP UNIT 3 ER

FIGURE 2.4-2 **Rev. 0**

{APPROXIMATE LOCATIONS OF KNOWN BALD EAGLE NESTS – APRIL 2007}

CCNPP UNIT 3 ER

2.5 SOCIOECONOMICS

This section describes the socioeconomic characteristics of the areas that could potentially be impacted by the construction and operation of **{**Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 on the CCNPP site**}**. This section contains four subsections: 1) Demography, 2) Community Characteristics, 3) Historic Properties, and 4) Environmental Justice. These sections include a discussion about the socioeconomic characteristics of the 50 mi (80 km) comparative geographic area and the two-county region of influence (ROI)) that includes Calvert County and St. Mary's County, which are the primary areas of concern for the socioeconomic impact assessment. In addition, socioeconomic characteristics are also described for the 10 mi (16 km) emergency planning zone and the 2 mi (3.2 km) low population zone (LPZ), which are consistent with NUREG-1555 (NRC, 1999).

The 50 mi (80 km) comparative geographic area was established by using the **{**CCNPP**}** site as the center point and drawing a 50 mi (80 km) radius circle around the **{**CCNPP**}** site. This comparative geographic area is consistent with NUREG-1555 (NRC, 1999), as a basis for conducting the socioeconomic analyses and evaluating the potential radiological and accident impacts.

{The region of influence (ROI) for the socioeconomic analyses include Calvert County and St. Mary's County, Maryland. The borders of these counties extend less than 30 mi (48 km) from the CCNPP site. These adjacent counties are located in the southern part of Maryland on a peninsula bounded by the Chesapeake Bay and the Patuxent River. Potential socioeconomic impacts, if any, arising from the proposed plant are likely to be confined to these two counties because a majority of the existing workforce for CCNPP Units 1 and 2 reside in these counties and it is assumed that the potential in-migrating construction and operational workforces for CCNPP Unit 3 are most likely to reside in this same two-county ROI. As of November 2006 a total of 833 employees work at the CCNPP site. Of this total, 793 of them are Constellation Energy employees and 40 are contractors. As shown in Table 2.5-1, more than 91% of the current workforce at CCNPP resides in Calvert County or St. Mary's County. Of the 833 employees at the CCNPP site, approximately 560 (67%) of the workers had a home address in Calvert County and approximately 200 (24%) of these workers had a home address in St. Mary's County.**}**

2.5.1 DEMOGRAPHY

2.5.1.1 Current Demographic and Economic Characteristics

The following sections describe the current demographic and economic characteristics for the 50 mi (80 km) comparative geographic area, the **{**two-county**}** region of influence, the 10 mi (16 km) emergency planning zone, and the 2 mile (3.2 km) LPZ. **{**Most demographic data generated by the U.S. Census Bureau and used in this analysis is from the year 2000, sometimes updated to 2003, 2004 or 2005, in order to have comparable data for both counties in the region of influence.**}** Census Bureau data is used because it is the most reliable, most often cited, and most detailed data available for comparison of multiple jurisdictions or areas. The U.S. Census Bureau gathers more detail and updates demographic data more often in the metropolitan areas than in the non-metropolitan or micro communities. **{**In some cases recent socioeconomic data is was not available for St. Mary's County.**}**

2.5.1.1.1 50 mi (80 km) Geographic Area of Comparison

Figure 2.5.1 presents geographical details of the area within a 50 mi (80 km) radius of the **{**CCNPP**}** site. The map shows overlaying circles which mark 10, 20, 30, 40, and 50 mi (16, 32, 48, 64, and 80 km) distances from the **{**CCNPP**}** site.

{The nearest major population centers within about 50 mi (80 km) of the CCNPP site are Washington, D.C., located approximately 55 driving miles (88 km) to the northwest and Annapolis, Maryland, 50 driving miles (80 km) to the north. Smaller cities and towns within 50 driving miles (80 km) include Glenarden, 50 driving miles (80 km) away, North Beach, 26 driving miles (42 km), La Plata at 36 driving miles (58 km), Leonardtown which is 20 driving miles (32 km) and Seat Pleasant at 49 driving miles (79 km). Calvert County is part of the Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA) and shares a high degree of economic and social integration with the metropolitan area. St. Mary's County is a part of the much smaller Lexington Park, Maryland Micro Area.

Table 2.5-2 (USCB, 2000c) (USCB, 2005) presents the demographic data for the residential population within each of the five 10 mi (16 km) circles radiating from the CCNPP site. These demographic characteristics – age and sex distributions, racial and ethnical distributions, and household income figures – are presented to familiarize the reader with the statistical profile of a portion of southern Maryland in 2000.

In 2000, approximately 90%, or 2,878,003 people, of the 3,195,170 people that resided within the 50 mi (80 km) radius of the CCNPP site lived more than 30 mi (48 km) from the CCNPP site. Within the 50 mi (80 km) radius, less than 7% were under 5 years old, 76% were 18 years old or older, and nearly 10% were 65 years old or older. Almost 52% of the population was female. The ethnic composition of the 50 mi (80 km) radius included 53% Caucasians, 36% African-Americans, and 8% were persons of Hispanic/Latino origin. Median household income in the area was $57,464 and 9% of the population lived below the poverty level. (USCB, 2000c) (USCB, 2005)

The Census Bureau does not report information about the transient population in this area.**}**

2.5.1.1.2 {Two-County} Region of Influence

{The two-county region of influence, Calvert County and St. Mary's County, has experienced steady population growth for the last three and one-half decades, from 1970 to 2005 (MDDP, 2005). Table 2.5-3 presents the population data for select years from 1970 to 2030 in these two Maryland counties (MDDP, 2005) (USCB, 2005). Within the ROI, the population grew an annual average of 3.9% from 1970 to 1980, 3.5% from 1980 to 1990, and an annual average of 2.6% from 1990 to 2000. From 2000 to 2005, the population of Calvert County grew an annual average of 3.5%, about three times the annual average U.S. population growth rate of 1.2% per year. During that same period, the population of St. Mary's County grew an annual average of 2.3%, also substantially more than the average growth rate in the U.S. The population is expected to grow by an annual average of 2.1% from 2005 to 2010 and by an additional annual average of 1.4% from 2010 to 2020 (MDDP, 2005).

Table 2.5-4 (USCB, 2005) presents data about selected demographic and economic characteristics for the years 2000 to 2004 for persons in Calvert County and St. Mary's County. The population in the ROI grew from 160,774 in 2000 to 181,355 in 2004, an annual average of 2.5%. During that same period, Calvert County grew from 74,563 people to 86,434, an annual average of 4.0%. St. Mary's County grew from 86,211 to 94,921, an annual average of 2.5%. These growth rates are significantly greater than the average annual growth rates of 1.2% for the State of Maryland and 1.1% for the U.S.

Population densities have increased noticeably in both counties from 2000 to 2005. The year 2000 population densities were 377 people per square mile in Calvert County and 239 people per square mile in St. Mary’s County. In comparison, the 2005 population density in Calvert County was 409 people per square mile and the population density in St. Mary’s County was 267.4 people per square mile. Nationally, the average population density was 83.8 people per square mile in 2005 (USCB, 2005).

The age compositions of Calvert County and St. Mary’s County are comparable to Maryland and the U.S. for persons under 5 years of age and for persons 18 years and over. However, both counties had somewhat smaller portions of people 65 years and older than found for Maryland and the U.S. The percentage of females in all four jurisdictions was similar. (USCB, 2005)

There were also similarities in the ethnic compositions of the two counties and the U.S. These three jurisdictions had comparable percentages of Caucasians and African-Americans. However, both counties had substantially fewer people of Hispanic/Latino origins. In comparison, the State of Maryland had substantially lower proportions of Caucasians and greater proportions of African-Americans than the two counties. The State also had more than twice as many persons of Hispanic/Latino origins than the two counties. (USCB, 2005)

In 2000, 52,433 workers, or 64.9% of the workers in the two-county area, were employed in either Calvert County or St. Mary’s County (USCB, 2000b). The unemployment rate in the region remains well below state and national averages. The unemployment rate in May 2006 in Calvert County was 2.8%; in St. Mary’s County the unemployment rate was 3.2%. In comparison, the May 2006 unemployment rate in the State of Maryland was 4.2%, in the MSA it was 3.8%, and nationally it was 4.6% (MDDLLR, 2006). The number of jobs in the two counties is increasing at a rate that is approximately three times the rate of job expansion in the State of Maryland as a whole (MDDLLR, 2006).

The Calvert Cliffs Nuclear Power Plant is the second largest employer in Calvert County, employing 833 people to operate CCNPP Units 1 and 2. The Patuxent River Naval Air Station is the largest employer in St. Mary’s County. It is the headquarters of the Naval Air Systems Command, the Naval Warfare Center Aircraft Division, home of the U.S. Naval Test Pilot School, and is the base for the VC-6 Unmanned Aerial Vehicle Detachment (MDDBED, 2002). There are 10,500 civilian and ex-military employees, and 9,300 contractor employment at the Patuxent River Naval Air Station in FY 2005 was 20,200 persons (SMCDEC, 2006). Eighty-three percent of the Patuxent River Naval Air Station employees lived in either St. Mary’s County or Calvert County (MDDBED, 2002).

The median household income in Calvert County was $71,488 in 2003, approximately 65% higher than the national average for that year of $43,318. The 2003 median household income in St. Mary’s County of $58,651 was approximately 35% higher than the national average that year (USCB, 2005). Much of the relatively high median household income can be attributed to growth in the number of higher income households in both counties as the area continues to attract highly paid technical and professional personnel associated with the technology base industries.

Table 2.5-5 (USCB, 2000c) presents the same demographic and economic information for several towns or communities within the two-county ROI that includes Calvert County and St. Mary’s County, as described above.**}**

2.5.1.1.3 10 mi (16 km) Emergency Evacuation Area

Figure 2.5.-2 displays overlaying circles which mark 1, 2, 3, 4, 5, and 10 mi (2, 3, 5, 6, 8, and 16 km) distances from the **{**CCNPP**}** site. The area within a 10 mi (16 km) radius of the **{**CCNPP site is predominately rural, dominated by farmland and forests, clusters of residential communities, and by the waters of the Chesapeake Bay**}**. Cities and recognizable unincorporated but named communities within a 10 mi (16 km) driving distance of the **{**CCNPP site include California, Calvert Beach-Long Beach, Chesapeake Ranch Estates-Drum Point, Lusby, and Prince Frederick**}**.

2.5.1.1.3.1 Overall Demographic and Economic Characteristics

{As shown in Table 2.5-6 (USCB, 2000b), an estimated 40,745 people reside within a 10 mi (16 km) radius of the CCNPP site. The greatest concentrations of people appear to be located to the south of the CCNPP site.**}**

Detailed information about the distribution of racial minority populations and low income populations within a 10 mi (16 km) radius of the site is discussed in Section 2.5.4.

2.5.1.1.3.2 Transient Population Levels

The term “transient” is used in this analysis to mean persons who live (are domiciled) outside the referenced area, but may be predictably expected to be in the area at some point. In this analysis, “transient population” includes:

- workers, also referred to as commuters, who live permanently outside of the area but who commute to a worksite **{**within the two-county ROI (Calvert County and St. Mary’s County)**}** on a regular basis;
- persons who live outside the area but travel at least 50 mi (80 km) from their home to visit, shop, or tend to personal business or to conduct business within the region;
- tourists and visitors recreating in the area; and
- seasonal workers employed in the agriculture sector.

A “visitor” in this study is considered to be a transient when the following definition is met: the individual travels, at least 50 mi (80 km) each way, into the area for the day, and seeks overnight accommodations. Individuals who simply travel through the area from a point outside the area to a destination outside the area are not included in this definition.

SECPOP 2000, a code developed for the Nuclear Regulatory Commission by Sandia National Laboratories to calculate populations by emergency planning zone sectors (NRC, 2003), was used to develop projections of the resident and transient populations by sectors, within the 10 mi (16 km) radius around the **{**CCNPP**}** site. **{**Population projections for the years 2010 through 2060 were projected by using year 2000 U.S. census data (USCB, 2005) (USCB, 2000c) (USCB 2000a) as the baseline data, because it is the most recent decennial census data available. The population estimates were projected using exponential growth rates calculated from state generated county population projections (DEDO, 2000) (MDP, 2005) (VEC, 2006). This data and these growth rates were then used to develop the subsequent projections. The population distribution was computed by overlaying the 2000 census block point data (the smallest unit of census data) on the grid of this calculation package.

The Calvert Cliffs Units 1 and 2 Evacuation Time Estimate report was used to obtain the estimated transient population (CCNPP, 2002). This report is distributed to the State of Maryland and the Calvert County, St. Mary’s County, and Dorchester County Emergency Management Agencies.**}**

Table 2.5-6 presents population distributions, by residential population and transient population in 2000, within each of sixteen geographic directional sectors at radii of 0 to1 mi (0 to 2 km), 1 to 2 mi (2 to 3 km), 2 to 3 mi (3 to 5 km), 3 to 4 mi (5 to 6 km), 4 to 5 mi (6 to 8 km), and 5 to10 mi (8 to 16 km) from the **{**CCNPP**}** site.

Commuters

Table 2.5-7 summarizes the commuting patterns to and from the ROI. **{**The ROI experienced a net loss of 20,931 persons during the work week/work day/work hour period based on 2000 Census Bureau County-to-County Worker Flow survey data (USCB, 2000b). This out-commuting represents a significant change to the population base in the area of interest.**}**

Visitors/Tourists

{Recreational use is considered to be the primary contributor to the transient population in the area. The Southern Region of Maryland, a term designated by the Maryland Office of Tourism Development to include Calvert County, St. Mary's County, and Charles County, had 541,791 visitors in 2004 (MDDBED, 2005). Major parks within the 10 mi (16 km) radius include Calvert Cliffs State Park and Flag Ponds Park.

Calvert Cliffs State Park, in the immediate vicinity of the CCNPP site, covers 1,400 acres (567 hectares) with 1,079 acres (437 hectares) designated as a wild land area. The park features 1.3 mi (2.1 km) of shoreline beneath fossil-bearing, 15 million year old cliffs (MDDNR, 2005). The park also includes a camping area, Bay Breeze Youth Campground, which is used by organized groups such as the Girl Scouts for camping. Calvert Cliffs State Park had 17,113 day visitors from July 2005 to June 2006 (FY 2006) and 2,175 overnight visitors. The peak month for day users was October with 5,650 people and the peak month for overnight users was July with 875 people. The month with the most visitors of both types was October with 6,035.

Flag Ponds Park, which is operated by the Calvert County Natural Resources Division, is open seven days a week from Memorial Day to Labor Day and weekends after that. The park has hiking trails and picnicking and receives approximately 20,000 annual visitors, primarily during the three summer months.**}**

Seasonal Workers in Agriculture

{No farm in Calvert County or St. Mary's County employed seasonal, migrant workers in 2004. In addition, it is highly unlikely that seasonal agricultural migrant workers would be hired in the area in the future because the number of farms and the acres devoted to farming in the region has been declining as the land is increasingly converted to non-farm uses. (MDHRSA, 2000)**}**

2.5.1.1.4 Low Population Zone

The LPZ is defined as a 2 mi (3.2 km) radius from the midpoint between the CCNPP Units 1 and 2 reactors. The 1.5 mi (2.4 km) radius from CCNPP Unit 3 is fully contained within this larger LPZ definition. Figure 2.5-3 shows both the CCNPP Unit 3 and the existing LPZ.

2.5.1.1.4.1 Overall Population Levels

{As shown in Table 2.5-8, 2,508 people resided in the LPZ in the year 2000. The communities of Lusby and Calvert Beach-Long Beach lie within the LPZ, as well as a portion of the Chesapeake Bay. Portions of Calvert Cliffs State Park and Bay Breeze Youth Campground, along with the majority of Flag Ponds Park also fall within the LPZ. No nursing homes, hospitals, prisons, or major employers (other than CCNPP) are known to exist within the LPZ (CCNPP 2002). One school, the Southern Middle School at 9615 HG Trueman Road in Lusby, is located within the LPZ 1.9 mi (3.1 km) south of CCNPP Units 1 and 2. This school had a combined student and faculty population of 771 (CCNPP, 2002).

The demographics in the LPZ are most closely compared to the Calvert Beach-Long Beach Census Designated Place (CDP) as shown in Table 2.5-5. This is the closest CDP within the LPZ.**}**

2.5.1.1.4.2 Transient Population Levels

{There is considerable variation in peak daily and seasonal transient population levels within the LPZ. Winter daytime population with its one large school (771 students and staff) sees the highest population. Of course, this occupancy is minimal at night. Residents in the LPZ would have the highest population at night as many workers commute to points beyond the LPZ during the day. The LPZ population would be lowest in the summer, when school is not in session.**}**

2.5.1.2 Demographic Projections

As described above for transient population estimates, SECPOP 2000 was used to calculate population projections for the years 2010 through 2060, using **{**2000 U.S. Census data as the baseline data (DEDO, 2000) (MDP, 2005) (USCB, 2005) (VEC, 2006).**}**

2.5.1.2.1 50 mi (80 km) Comparative Impact Area

{Table 2.5-9 presents the 2000 estimated population in concentric rings around the CCNPP site. Table 2.5-9 also displays the projected population within those rings from 2010 to 2060. CCNPP Unit 3 is estimated to start operation in 2015 and operate for 40 years until 2055. Hence, population projections, in 10 year increments, have been provided through the year 2060. Populations for 2015, the proposed startup year, have also been provided.

Within the 50 mi (80 km) radius of the site, the average annual percent change for the 10 year periods range from 0.91% (for the years 2000 to 2010) to 1.36% (for the years 2050 to 2060). The average annual change in population between the years 2000 and 2060 is projected to be 1.5%, nearly doubling the current population (an aggregate 92% increase over the 60 year period). Calvert County is currently the fastest growing of the 23 counties in the State of Maryland; St. Mary's County is the third fastest growing. Calvert County's population grew by an annual average of 4.0% from 2000 to 2004; St. Mary's County grew by an average annual of 2.5% during the same period. (NRC, 2003) (USCB, 2000)**}**

Table 2.5-10 presents residential population projections from the years 2000 through 2060 for each of the 16 geographic sectors to 50 mi (80 km) from the **{**CCNPP**}** site, with the exception of 0 to 10 mile (0 to 16 km) segments which include transient populations. Demographic characteristics for the residential population in the years beyond **{**2000**}** are assumed to reflect the ratios found in year **{**2000**}**.

2.5.1.2.2 {Two-County} Region of Influence

{Within the ROI, which is comparable to the 30 mi radius in Table 2.5-9, average annual population changes ranged from 1.9% for the 2000 to 2010 period to 2.27% for the 2050 to 2060 period. Population levels would increase from 323,602 in 2000 to 1,028,054 in 2060, an average annual increase of 2.63% (an aggregate of 218% increase over the 60 year period). (NRC, 2003) (USCB, 2000c).**}**

2.5.1.2.3 10 mi (16 km) Emergency Evacuation Area

The population projections in Table 2.5-9 reflect an upper limit of the estimated projected population, at various points during the next several decades, because the figures include both the residential population and the estimated transient population for all years in the 0 to 10 mi (0 to 16 km) circle. **{**Average annual population changes would range from 1.88% for the 2000 to the 2010 period to 2.07% for the 2040 to 2050 period and also for the 2050 to 2060 period. Population levels would increase from 48,755 in 2000 to 145,458 in 2060, an average annual increase of 3.3% (an aggregate of 198% increase over the 60 year period) (NRC, 2003) (USCB, 2000c).**}**

2.5.1.2.4 Low Population Zone

The population within the LPZ, including years **{**2015 and 2055, the initial year of operation for CCNPP Units 3, and the year of license expiration are provided in Table 2.5-8 Average annual population changes would range from 1.47% for the 2020 to the 2030 period to 1.54% for the 2040 to 2050 period. Population levels would increase from 2,508 in 2000 to 5,844 in 2060, an average annual increase of 2.2% (an aggregate of 133% increase over the 60 year period).**}**

2.5.1.3 References

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Table 2.5-1 {Counties of Residence for Existing CCNPP Units 1 and 2 Operational Employees}
(Page 1 of 1)

	CCNPP Units 1 and 2 Employees	
County of Residence	**Number**	**Percent**
Alleghany	1	0.1%
Anne Arundel	27	3.2%
Baltimore	4	0.5%
Calvert	562	67.5%
Charles	30	3.6%
Howard	2	0.2%
Prince Georges	6	0.7%
St. Mary’s	198	23.8%
Washington	1	0.1%
Out of State	2	0.2%
Total	833	99.9%

Note: The total percentage does not equal 100.0% due to rounding.

Table 2.5-2 Select Demographic and Economic Characteristics of Residential Population, By Distance from the {CCNPP Site, 2000} (Page 1 of 1)

Demographic and Economic Characteristics	Radii/Distances mi (km)					
	0 to 10 mi (0 to 16 km)	10 to 20 mi (16 to 32 km)	20 to 30 mi (32 to 48 km)	30 to 40 mi (48 to 60 km)	40 to 50 mi (60 to 80 km)	0 to 50 mi (0 to 80 km)
Total Population[1]	42,150	111,659	163,358	618,846	2,259,157	3,195,170
Age Composition:						
Person under 5 yrs old	2,992	7,588	10,873	41,578	148,788	211,819
Persons 18 yrs and over	29,458	80,295	120,226	456,584	1,738,152	2,424,715
Persons 65 yrs and older	4,203	9,721	18,951	61,657	218,766	313,298
Gender Composition:						
Females	21,169	55,925	83,981	322,859	1,161,278	1,645,212
Ethnic Composition:						
Caucasians[2]	35,454	91,113	116,465	265,801	1,170,147	1,678,980
African-Americans[2]	5,219	15,657	40,378	322,496	767,075	1,150,825
Persons of Hispanic/Latino origins[3]	782	1,885	2,578	14,135	241,685	261,065
Income Characteristics:						
Median Household Income[4], 1999	$61,369	$59,241	$57,945	$60,221	$57,464	$57,464

Notes:

(1) Resident population excludes transient populations.

(2) Persons describing themselves as of one race only.

(3) Persons of Hispanic or Latino origin may be of any race.

(4) Median Household Income is the median income for the cumulative households from the CCNPP site; for example. Median Household Income in column labeled 30 to 40 mi (48 to 60 km) is the median for all household 0 to 40 mi (0 to 60 km) from the plant site.

Table 2.5-3 Historical and Projected Populations in {Calvert County, St. Mary's County, and Maryland from 1970 to 2030} (Page 1 of 1)

	Calvert County		St. Mary's County		Region Of Influence – Calvert and St. Mary's Combined		State of Maryland	
Year	Population	Average Annual Growth Percent	Population	Average Annual Growth Percent	Population	Average Annual Growth Percent	Population	Average Annual Growth Percent
1970	20,682	--	47,388	--	68,070	--	3,923,897	--
1980	34,638	5.29%[1]	59,895	2.37%[1]	94,553	3.9%	4,216,933	0.72%[1]
1990	51,372	4.02%	75,974	2.41%	127,346	3.5%	4,780,753	1.26%
2000	74,563	3.80%	86,211	1.27%	160,774	2.6%	5,296,486	1.03%
2005	88,750	3.54%	96,550	2.29%	185,300	3.1%	5,609,200	1.15%
2010	96,950	1.78%	108,150	2.30%	205,100	2.1%	5,907,575	1.04%
2015	99,450	0.51%	119,900	2.08%	219,350	1.4%	6,127,225	0.73%
2020	101,950	0.50%	131,200	1.82%	233,150	1.3%	6,362,975	0.76%
2030	105,950	0.39%	152,150	1.49%	258,100	1.1%	6,703,800	0.52%

Note:

(1) Average Annual Growth Rate from previously noted year (example, 5.29% annual change in Calvert County from 1970 to 1980).

Table 2.5-4 Select Demographic and Economic Characteristics of Persons in {Calvert County, St. Mary's County, Maryland, and the U.S. From 2000 to 2004}
(Page 1 of 1)

Demographic and Economic Characteristics	Calvert County	St. Mary's County	State of Maryland	U.S.
Population Levels, Change, Density:				
Total Population, 2000	74,563	86,211	5,296,486	281,421,906
Total Population Estimate, 2004	86,434	94,921	5,558,058	293,656,842
Average Annual Percent Change, 2000-2004	4.0%	2.5%	1.2%	1.1%
Population per square mile, 2000	376.5	238.6	541.9	79.6
Age Composition:				
Persons under 5 years old, 2004	6.1%	7.0%	6.7%	6.8%
Persons 18 years and over, 2004	73.5%	73.4%	74.9%	75%
Persons 65 years old and older, 2004	9.2%	9.2%	11.4%	12.4%
Gender Composition:				
Females, 2004	50.7%	49.9%	51.6%	50.8%
Ethnic Composition:				
Caucasians, 2004[(1)]	84.7%	82.1%	64.5%	80.4%
African-Americans , 2004[(1)]	12.8%	13.9%	29.1%	12.8%
Persons of Hispanic/Latino origin, 2004[(2)]	1.9%	2.2%	5.4%	14.1%
Income Characteristics:				
Median Household Income, 2003	$71,488	$58,651	$54,302	$43,318
Persons below poverty, 2003	5.3%	7.4%	8.8%	12.5%

Notes:

(1). Persons describing themselves as being of one race only
(2). Persons of Hispanic or Latino Origin may be of any race

Table 2.5-5 Demographic and Economic Characteristics of Residential Populations in Select Cities And Communities within {Calvert County and St. Mary's County, 2000} (Page 1 of 2)

	Cities or Communities (CDPs)								
Demographic Characteristics	**California, CDP[1]**	**Calvert Beach-Long Beach, CDP**	**Charlotte Hall, CDP**	**Chesapeake Estates-Drum Point, CDP**	**Leonardtown**	**Lexington Park, CDP**	**Lusby**	**North Beach**	**Prince Frederick, CDP**
Total Population	9,307	2,487	1,214	11,503	1,896	11,021	1,666	1,880	1,432
Age Composition:									
Persons under 5 years old	694	184	58	974	80	1,112	86	154	92
Persons 18 years and over	6,568	1,718	994	7,558	1,594	7,554	1,191	1,366	1,118
Persons 65 years and older	678	169	403	748	578	337	216	136	372
Gender Composition:									
Females	4,635	1,246	484	5,753	1,036	5,138	861	994	830
Ethic Composition:									
Caucasians[3]	7,323	2,248	923	9,837	1,380	6,612	1,202	1,683	891
African-Americans[3]	1,370	165	245	1,210	455	3.306	412	117	484
Persons of Hispanic / Latino[2] origin	255	42	7	280	16	527	46	39	26

Table 2.5-5 Demographic and Economic Characteristics of Residential Populations in Select Cities And Communities within {Calvert County and St. Mary's County, 2000} (Page 2 of 2)

	Cities or Communities (CDPs)								
Demographic Characteristics	**California, CDP[1]**	**Calvert Beach-Long Beach, CDP**	**Charlotte Hall, CDP**	**Chesapeake Estates-Drum Point, CDP**	**Leonardtown**	**Lexington Park, CDP**	**Lusby**	**North Beach**	**Prince Frederick, CDP**
Income Characteristics:									
Median Household Income[4],1999	$62,320	$63,262	$51,111	$56,904	$35,563	$39,214	$40,769	$46,111	$44,625
Persons below poverty	407	28	169	558	330	1,219	72	203	226

Notes:

(1) CDP = Census Designated Place; a statistical counterpart of an incorporated place; a concentration of population, housing, and commercial structures that are Identifiable by name, but are not incorporated.

(2) Persons of Hispanic/Latino origin may be of any race or a combination of races.

(3) Persons describing themselves as of one race only.

(4). The Census Bureau states that the median household income for the Prince Frederick CDP is $22,321. This number is inconsistent with other Census Bureau income information and, therefore, is assumed to be incorrectly reported by them. Thus, for illustrative purposes, the median family income is reported here.

Table 2.5-6 Resident and Transient Populations, by Sector and Distance from the {CCNPP Site, 2000}
(Page 1 of 2)

	Population by Radii/Distances mi (km)						
Sector/Type of Population	**0 to 1 (0 to 2)**	**1 to 2 (2 to 3)**	**2 to 3 (3 to 5)**	**3 to 4 (5 to 6)**	**4 to 5 (6 to 8)**	**5 to 10 (8 to 16)**	**0 to 10 (0 to 16)**
N Total	0	0	0	0	0	0	0
Transient Population	0	0	0	0	0	0	0
Resident Population	0	0	0	0	0	0	0
NNE Total	0	0	0	0	0	0	0
Transient Population	0	0	0	0	0	0	0
Resident Population	0	0	0	0	0	0	0
NE Total	0	0	0	0	0	1	1
Transient Population	0	0	0	0	0	0	0
Resident Population	0	0	0	0	0	1	1
ENE Total	0	0	0	0	0	606	606
Transient Population	0	0	0	0	0	408	408
Resident Population	0	0	0	0	0	198	198
E Total	0	0	0	0	0	35	35
Transient Population	0	0	0	0	0	0	0
Resident Population	0	0	0	0	0	35	35
ESE Total	0	0	0	0	0	0	0
Transient Population	0	0	0	0	0	0	0
Resident Population	0	0	0	0	0	0	0
SE Total	0	0	283	0	188	0	471
Transient Population	0	0	283	0	0	0	0
Resident Population	0	0	0	0	188	0	0
SSE Total	0	0	33	974	3,242	4,664	8,913
Transient Population	0	0	0	535	0	0	535
Resident Population	0	0	33	439	3,242	4,664	8,378
S Total	0	67	245	189	1,504	9,006	11,011
Transient Population	0	0	217	0	0	3,163	3,380
Resident Population	0	67	28	189	1,504	5,843	7,631
SSW Total	0	43	207	143	204	6,795	7,392
Transient Population	0	0	0	0	0	1,477	1,477
Resident Population	0	43	207	143	204	5,318	5,915

Table 2.5-6 Resident and Transient Populations, by Sector and Distance from the {CCNPP Site, 2000} (Page 2 of 2)

	Population by Radii/Distances mi (km)						
Sector/Type of Population	0 to 1 (0 to 2)	1 to 2 (2 to 3)	2 to 3 (3 to 5)	3 to 4 (5 to 6)	4 to 5 (6 to 8)	5 to 10 (8 to16)	0 to 10 (0 to16)
SW Total	0	329	0	165	57	2,865	3,416
Transient Population	0	0	0	0	0	485	485
Resident Population	0	329	0	165	57	2,380	2,931
WSW Total	0	857	702	65	445	2,323	4,392
Transient Population	0	0	90	0	360	33	483
Resident Population	0	857	612	65	85	2,290	3,909
W Total	30	432	289	175	357	1,465	2,748
Transient Population	0	0	0	0	0	135	135
Resident Population	30	432	289	175	357	1,330	2,613
WNW Total	0	55	59	85	506	2,723	3,428
Transient Population	0	0	0	0	0	378	378
Resident Population	0	55	59	85	506	2,345	3,050
NW Total	0	695	1,157	1,037	319	2,416	5,624
Transient Population	0	263	151	0	32	0	446
Resident Population	0	432	1,006	1,037	287	2,416	5,178
NWW Total	0	0	0	0	0	718	718
Transient Population	0	0	0	0	0	0	0
Resident Population	0	0	0	0	0	718	718
Total Population	30	2,478	2,975	2,833	6,822	33,617	48,755
Transient Population	0	263	741	535	392	6,079	8,010
Resident Population	30	2,215	2,234	2,298	6,430	27,538	40,745

Table 2.5-7 Commuting Patterns To and From the ROI, {2000}
(Page 1 of 1)

Parameter	County/ROI	Charles County	Prince George's County	Anne Arundel County	District of Columbia	Other	Total
Worker Inflow to ROI	Calvert	640	641	1,118	59	678	3,136
	St. Mary's	2,197	378	262	126	1,357	4,320
	ROI	2,837	1,019	1,380	185	2,035	7,456
Worker Outflow from ROI	Calvert	1,178	8,243	1,739	3,967	3,909	19,036
	St. Mary's	3,313	2,244	80	1,828	1,886	9,351
	ROI	4,491	10,487	1,819	5,795	5,795	28,387
Net Worker Outflow from ROI	Calvert	538	7,602	621	3,908	3,231	15,900
	St. Mary's	1,116	1,866	(182)	1,702	529	5,031
	ROI	1,654	9,468	439	5,610	3,760	20,931

Note: ROI = region of influence (Calvert County and St. Mary's County combined)

Table 2.5-8 Current Population and Population Projections for the {CCNPP} Low Population Zone (Page 1 of 1)

Year	LPZ Population	Average Annual Percent Change for the 10 Year Period
2000	2,508	NA
2010	2,884	1.5%
2015	3,102	NA
2020	3,336	1.57%
2030	3,827	1.47%
2040	4,414	1.53%
2050	5,092	1.54%
2055	5,455	NA
2060	5,844	1.48%

Note: NA = not applicable

Table 2.5-9 Population Projections from {2000 to 2060 within 50 mi (80 km) of the CCNPP Site} (Page 1 of 1)

Year	Population Projections within Radii/Distances mi (km)							Annual Average Percent Change for the 10 Year Period
	0 to 10 mi[1] (0 to 16 km)	10 to 20 mi (16 to 32 km)	20 to 30 mi (32 to 48 km)	30 to 50 mi (48 to 80 km)	30 to 40 mi (48 to 60 km)	40 to 50 mi (60 to 80 km)	Total 0 to 50 mi[4] (0 to 80 km)	
2000[2]	48,755	112,841	162,006	2,886,668	618,907	2,267,761	3,210,270	NA
2010[3]	57,937	139,384	189,097	3,116,981	683,019	2,433,962	3,503,399	0.91%
2015[3]	63,441	155,687	204,844	3,252,151	719,341	2,532,810	3,676,123	NA
2020[3]	69,504	174,040	222,222	3,395,683	757,969	2,637,714	3,861,449	1.02%
2030[3]	83,129	216,740	263,498	3,729,663	845,378	2,884,285	4,293,030	1.12%
2040[3]	99,840	271,210	314,001	4,122,037	947,388	3,174,649	4,807,088	1.20%
2050[3]	120,508	340,666	376,926	4,586,827	1,062,906	3,523,921	5,424,927	1.29%
2060[3]	145,458	428,351	454,445	5,134,257	1,200,670	3,933,587	6,162,511	1.36%

Notes:

(1). Population estimates and projections include transient and residential population in the 0 to 10 mi (0 to 16 km) range.

(2) Residential population in 2000, US Census Bureau, Decennial Census.

(3) The populations for years 2010 through 2060 have been projected by calculating a growth rate using state population projections (by county) as the base.

(4) Transient population is only included in the 0 to 10 mi (0 to 16 km) distribution.

Table 2.5-10 Population Projections by Sector and Distance from the {CCNPP Site from 2000 to 2060} (Page 1 of 6)

Sector	Radius in mi (km)	Population Projection by Year 2000	2010[4]	2015[4]	2020[4]	2030[4]	2040[4]	2050[4]	2060[4]
N		0	0	0	0	0	0	0	0
NNE		0	0	0	0	0	0	0	0
NE		0	0	0	0	0	0	0	0
ENE		0	0	0	0	0	0	0	0
E		0	0	0	0	0	0	0	0
ESE		0	0	0	0	0	0	0	0
SE		0	0	0	0	0	0	0	0
SSE		0	0	0	0	0	0	0	0
S	0-1 (0-2)[(1)]	0	0	0	0	0	0	0	0
SSW		0	0	0	0	0	0	0	0
SW		0	0	0	0	0	0	0	0
WSW		0	0	0	0	0	0	0	0
W		30	35	37	40	46	53	61	70
WNW		0	0	0	0	0	0	0	0
NW		0	0	0	0	0	0	0	0
NNW		0	0	0	0	0	0	0	0
Total		**30**	**35**	**37**	**40**	**46**	**53**	**61**	**70**
N		-	-	-	-	-	-	-	-
NNE		-	-	-	-	-	-	-	-
NE		-	-	-	-	-	-	-	-
ENE		-	-	-	-	-	-	-	-
E		-	-	-	-	-	-	-	-
ESE		-	-	-	-	-	-	-	-
SE		0	0	0	0	0	0	0	0
SSE		0	0	0	0	0	0	0	0
S	1-2 (2-3)[(1)]	67	77	83	89	103	118	136	156
SSW		43	49	53	57	66	76	87	100
SW		329	378	407	438	503	579	668	767
WSW		857	986	1,060	1,140	1,311	1,508	1,740	1,997
W		432	497	535	575	661	760	877	1,007
WNW		55	63	68	73	84	97	112	128
NW		695	799	859	924	1,063	1,223	1,411	1,619
NNW		0	0	0	0	0	0	0	0
Total		**2,478**	**2,849**	**3,065**	**3,296**	**3,791**	**4,361**	**5,031**	**5,774**
N		-	-	-	-	-	-	-	-
NNE		-	-	-	-	-	-	-	-
NE		-	-	-	-	-	-	-	-
ENE	2-3 (3-5)[(1)]	-	-	-	-	-	-	-	-
E		-	-	-	-	-	-	-	-
ESE		-	-	-	-	-	-	-	-
SE		283	325	350	376	433	498	574	659
SSE		33	38	41	44	50	58	67	77

Table 2.5-10 Population Projections by Sector and Distance from the {CCNPP Site from 2000 to 2060}
(Page 2 of 6)

Sector	Radius in mi (km)	2000	2010[4]	2015[4]	2020[4]	2030[4]	2040[4]	2050[4]	2060[4]
		Population Projection by Year							
S		245	282	303	326	375	431	497	571
SSW		207	238	256	275	317	364	420	482
SW		0	0	0	0	0	0	0	0
WSW		702	807	868	934	1,074	1,236	1,425	1,636
W		289	332	357	384	442	509	587	673
WNW		59	68	73	78	90	104	120	137
NW		1,157	1,331	1,431	1,539	1,770	2,036	2,349	2,696
NNW		-	-	-	-	-	-	-	-
Total		**2,975**	**3,421**	**3,679**	**3,956**	**4,551**	**5,236**	**6,039**	**6,931**
N		-	-	-	-	-	-	-	-
NNE		-	-	-	-	-	-	-	-
NE		-	-	-	-	-	-	-	-
ENE		-	-	-	-	-	-	-	-
E		-	-	-	-	-	-	-	-
ESE		-	-	-	-	-	-	-	-
SE		0	0	0	0	0	0	0	0
SSE		974	1,120	1,204	1,295	1,490	1,714	1,977	2,269
S	3-4 (5-6)(1)	189	217	233	251	289	333	384	440
SSW		143	164	177	190	219	252	290	333
SW		165	190	204	219	252	290	335	384
WSW		65	75	80	86	99	114	132	151
W		175	201	216	233	268	308	355	408
WNW		85	98	105	113	130	150	173	198
NW		1,037	1,193	1,283	1,379	1,587	1,825	2,105	2,416
NNW		-	-	-	-	-	-	-	-
Total		**2,833**	**3,258**	**3,502**	**3,766**	**4,334**	**4,986**	**5,751**	**6,599**
N		-	-	-	-	-	-	-	-
NNE		-	-	-	-	-	-	-	-
NE		-	-	-	-	-	-	-	-
ENE		-	-	-	-	-	-	-	-
E		-	-	-	-	-	-	-	-
ESE		-	-	-	-	-	-	-	-
SE		188	216	232	250	288	331	382	438
SSE	4-5 (6-8)[1]	3,242	3,728	4,009	4,312	4,960	5,706	6,581	7,554
S		1,504	1,730	1,860	2,000	2,301	2,647	3,053	3,504
SSW		204	235	252	271	312	359	414	475
SW		57	66	71	76	87	100	116	133
WSW		445	512	551	592	681	783	903	1,037
W		357	411	442	475	546	628	725	832
WNW		506	582	626	673	774	891	1,027	1,179
NW		319	367	394	424	488	561	648	743
NNW		-	-	-	-	-	-	-	-

Table 2.5-10 Population Projections by Sector and Distance from the {CCNPP Site from 2000 to 2060} (Page 3 of 6)

Sector	Radius in mi (km)	2000	2010[4]	2015[4]	2020[4]	2030[4]	2040[4]	2050[4]	2060[4]
		Population Projection by Year							
Total		**6,822**	**7,847**	**8,437**	**9,073**	**10,437**	**12,006**	**13,849**	**15,895**
N	5-10 (8-16)(1)	-	-	-	-	-	-	-	-
NNE		-	-	-	-	-	-	-	-
NE		1	1	1	1	1	2	2	2
ENE		606	673	705	739	818	909	1,006	1,109
E		35	39	41	43	47	53	58	64
ESE		0	0	0	0	0	0	0	0
SE		-	-	-	-	-	-	-	-
SSE		4,664	5,521	6,035	6,597	7,856	9,391	11,281	13,547
S		9,006	10,618	11,581	12,631	14,972	17,808	21,284	25,421
SSW		6,795	8,565	9,668	10,914	13,827	17,588	22,425	28,592
SW		2,865	3,696	4,218	4,813	6,217	8,051	10,429	13,494
WSW		2,323	2,975	3,383	3,847	4,940	6,362	8,202	10,566
W		1,465	1,704	1,845	1,998	2,331	2,726	3,200	3,747
WNW		2,723	3,131	3,368	3,622	4,166	4,792	5,528	6,345
NW		2,416	2,778	2,988	3,213	3,696	4,252	4,904	5,629
NNW		718	826	888	955	1,099	1,264	1,458	1,673
Total		**33,617**	**40,527**	**44,721**	**49,373**	**59,970**	**73,198**	**89,777**	**110,189**
N	0-10 (0-16)(1)	0	0	0	0	0	0	0	0
NNE		0	0	0	0	0	0	0	0
NE		1	1	1	1	1	2	2	2
ENE		606	673	705	739	818	909	1,006	1,109
E		35	39	41	43	47	53	58	64
ESE		0	0	0	0	0	0	0	0
SE		471	541	582	626	721	829	956	1,097
SSE		8,913	10,407	11,289	12,248	14,356	16,869	19,906	23,447
S		11,011	12,924	14,060	15,297	18,040	21,337	25,354	30,092
SSW		7,392	9,251	10,406	11,707	14,741	18,639	23,636	29,982
SW		3,416	4,330	4,900	5,546	7,059	9,020	11,548	14,778
WSW		4,392	5,355	5,942	6,599	8,105	10,003	12,402	15,387
W		2,748	3,180	3,432	3,705	4,294	4,984	5,805	6,737
WNW		3,428	3,942	4,240	4,559	5,244	6,034	6,960	7,987
NW		5,624	6,468	6,955	7,479	8,604	9,897	11,417	13,103
NNW		718	826	888	955	1,099	1,264	1,458	1,673
Total		**48,755**	**57,937**	**63,441**	**69,504**	**83,129**	**99,840**	**120,508**	**145,458**
N	10-20 (16-32)(2)	-	-	-	-	-	-	-	-
NNE		403	436	454	472	513	553	598	651
NE		1,020	1,132	1,187	1,244	1,377	1,530	1,693	1,867
ENE		1,668	1,851	1,941	2,035	2,252	2,502	2,769	3,052
E		236	262	275	288	319	354	392	432
ESE		709	787	825	865	957	1,064	1,177	1,297
SE		183	203	213	223	247	275	304	335

Table 2.5-10 Population Projections by Sector and Distance from the {CCNPP Site from 2000 to 2060} (Page 4 of 6)

Sector	Radius in mi (km)	2000	2010[4]	2015[4]	2020[4]	2030[4]	2040[4]	2050[4]	2060[4]
		Population Projection by Year							
SSE		477	615	702	801	1,035	1,340	1,736	2,247
S		20,464	26,399	30,126	34,380	44,407	57,504	74,489	96,385
SSW		16,134	20,813	23,752	27,105	35,011	45,337	58,728	75,991
SW		8,487	10,948	12,494	14,258	18,417	23,848	30,893	39,974
WSW		7,558	9,750	11,126	12,697	16,401	21,238	27,511	35,598
W		11,560	14,908	17,009	19,407	25,061	32,442	42,013	54,346
WNW		11,857	14,580	16,220	18,045	22,386	27,822	34,745	43,402
NW		11,561	13,098	13,982	14,925	16,958	19,283	21,960	24,961
NNW		20,524	23,602	25,381	27,295	31,399	36,118	41,658	47,813
Total		**112,841**	**139,384**	**155,687**	**174,040**	**216,740**	**271,210**	**340,666**	**428,351**
N	20-30 (32-48)[2]	7,848	8,414	8,746	9,091	9,822	10,696	11,646	12,694
NNE		6,479	6,999	7,286	7,584	8,235	8,887	9,604	10,452
NE		8,948	9,664	10,058	10,469	11,364	12,260	13,244	14,408
ENE		17,492	19,274	20,168	21,103	23,235	25,622	28,183	30,967
E		468	519	544	571	632	702	777	856
ESE		594	659	691	725	802	891	986	1,087
SE		0	0	0	0	0	0	0	0
SSE		795	1,026	1,171	1,336	1,725	2,234	2,894	3,744
S		2,277	2,860	3,223	3,632	4,588	5,831	7,421	9,455
SSW		4,340	4,631	4,761	4,894	5,209	5,584	5,980	6,404
SW		2,985	3,251	3,387	3,528	3,869	4,292	4,787	5,373
WSW		4,213	5,389	6,106	6,918	8,869	11,360	14,584	18,682
W		8,962	11,400	12,854	14,494	18,484	23,497	29,971	38,115
WNW		54,835	69,512	78,206	87,987	111,884	141,745	180,272	228,561
NW		19,014	20,931	22,017	23,160	25,745	28,711	31,992	35,938
NNW		22,756	24,568	25,626	26,730	29,035	31,689	34,585	37,709
Total		**162,006**	**189,097**	**204,844**	**222,222**	**263,498**	**314,001**	**376,926**	**454,445**
N	30-40 (48-64)[2]	91,036	98,765	103,280	108,001	118,229	130,560	144,281	159,789
NNE		13,477	15,593	16,792	18,083	21,027	24,531	28,647	33,593
NE		19,513	21,950	23,347	24,832	28,284	32,112	36,698	42,237
ENE		9,015	10,195	10,810	11,463	12,997	14,779	16,808	19,103
E		4,739	5,349	5,660	5,989	6,754	7,613	8,579	9,651
ESE		3,635	4,039	4,245	4,462	4,976	5,510	6,136	6,836
SE		1,030	1,112	1,153	1,195	1,298	1,391	1,504	1,627
SSE		1,136	1,311	1,411	1,519	1,749	2,031	2,346	2,716
S		5,420	6,277	6,765	7,291	8,412	9,795	11,339	13,146
SSW		8,751	9,717	10,221	10,751	11,883	13,202	14,664	16,292
SW		3,412	3,706	3,850	3,999	4,321	4,691	5,095	5,526
WSW		13,953	15,980	17,096	18,289	21,154	24,577	28,771	33,733
W		8,346	10,498	11,765	13,184	16,628	20,889	26,359	33,154
WNW		67,423	82,146	90,843	100,460	123,836	152,757	189,489	235,309
NW		272,660	294,683	306,823	319,463	347,029	377,382	407,855	443,811

Table 2.5-10 Population Projections by Sector and Distance from the {CCNPP Site from 2000 to 2060}
(Page 5 of 6)

Sector	Radius in mi (km)	2000	2010[4]	2015[4]	2020[4]	2030[4]	2040[4]	2050[4]	2060[4]
		Population Projection by Year							
NNW		95,361	101,698	105,280	108,988	116,801	125,568	134,335	144,147
Total		**618,907**	**683,019**	**719,341**	**757,969**	**845,378**	**947,388**	**1,062,906**	**1,200,670**
N	40-50 (64-80)(2)	144,479	152,144	156,673	161,336	170,665	181,605	192,737	204,117
NNE		9,394	11,103	12,075	13,132	15,537	18,485	21,978	26,148
NE		14,160	17,055	18,735	20,580	24,967	30,142	36,545	44,327
ENE		29,169	32,359	34,084	35,902	39,982	44,729	50,401	56,868
E		77,460	86,067	90,484	95,128	105,554	117,211	130,550	145,254
ESE		15,217	16,596	17,291	18,015	19,759	21,432	23,439	25,649
SE		7,158	7,731	8,012	8,303	9,019	9,663	10,451	11,310
SSE		1,855	2,107	2,251	2,405	2,735	3,133	3,576	4,092
S		7,210	7,750	8,055	8,371	9,047	9,860	10,757	11,791
SSW		6,820	7,385	7,674	7,975	8,591	9,288	10,070	10,900
SW		5,020	5,411	5,615	5,826	6,249	6,734	7,278	7,846
WSW		7,842	9,149	9,905	10,723	12,591	14,762	17,436	20,567
W		25,052	32,333	36,730	41,725	54,144	70,218	91,446	119,070
WNW		346,300	413,692	452,271	494,447	592,558	713,399	861,497	1,039,292
NW		1,285,806	1,329,573	1,358,864	1,388,801	1,464,824	1,550,056	1,655,956	1,777,719
NNW		284,819	303,507	314,091	325,045	348,063	373,932	399,804	428,637
Total		**2,267,761**	**2,433,962**	**2,532,810**	**2,637,714**	**2,884,285**	**3,174,649**	**3,523,921**	**3,933,587**
N	0-50 (0-80)(3)	243,363	259,323	268,699	278,428	298,716	322,861	348,664	376,600
NNE		29,753	34,131	36,607	39,271	45,312	52,456	60,827	70,844
NE		43,642	49,802	53,328	57,126	65,993	76,046	88,182	102,841
ENE		57,950	64,352	67,708	71,242	79,284	88,541	99,167	111,099
E		82,938	92,236	97,004	102,019	113,306	125,933	140,356	156,257
ESE		20,155	22,081	23,052	24,067	26,494	28,897	31,738	34,869
SE		8,842	9,587	9,960	10,347	11,285	12,158	13,215	14,369
SSE		13,176	15,466	16,824	18,309	21,600	25,607	30,458	36,246
S		46,382	56,210	62,229	68,971	84,494	104,327	129,360	160,869
SSW		43,437	51,797	56,814	62,432	75,435	92,050	113,078	139,569
SW		23,320	27,646	30,246	33,157	39,915	48,585	59,601	73,497
WSW		37,958	45,623	50,175	55,226	67,120	81,940	100,704	123,967
W		56,668	72,319	81,790	92,515	118,611	152,030	195,594	251,422
WNW		483,843	583,872	641,780	705,498	855,908	1,041,757	1,272,963	1,554,551
NW		1,594,665	1,664,753	1,708,641	1,753,828	1,863,160	1,985,329	2,129,180	2,295,532
NNW		424,178	454,201	471,266	489,013	526,397	568,571	611,840	659,979
Total		**3,210,270**	**3,503,399**	**3,676,123**	**3,861,449**	**4,293,030**	**4,807,088**	**5,424,927**	**6,162,511**

Table 2.5-10 Population Projections by Sector and Distance from the {CCNPP Site from 2000 to 2060}
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Notes: A dash indicates that the sector covers a body of water only

(1) Includes transient and resident populations

(2) Resident population only

(3) Transients included only for 0 to 10 mi (0 to 16 km) portion.

(4) The populations for years 2010 through 2060 have been projected by calculating a growth rate using state population projections (by county) as the base.