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UniStar
NUCLEAR ENERGY

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January 14, 2009

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ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Calvert Cliffs Nuclear Power Plant, Unit 3
Intake Structure Relocation Changes for Environmental Report

Reference: Letter UN#08-059, G. Gibson (UniStar Nuclear Energy) to Document Control Desk (U.S. Nuclear Regulatory Commission), Submittal of a Listing of the Combined License Application for Calvert Cliffs Nuclear Power Plant, Unit 3 – Intake Structure Relocation Affected Sections, dated October 31, 2008

The referenced letter provided UniStar Nuclear Energy's responses to Requests for Additional Information (RAIs) related to the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Environmental Report (ER). Specifically, the referenced letter provided a list of ER Sections and Figures that will be revised to reflect the relocation of the intake structure. As a follow up to the referenced letter please find the ER revised pages and figures in Enclosure 2. These changes will be included in Revision 4 to the ER. Note that changes to the Final Safety Analysis Report (FSAR) have also been identified for the intake structure relocation. A cross referenced table of FSAR and ER figures is included in Enclosure 1 which provides preliminary information for the FSAR figure changes by reviewing the enclosed corresponding ER figure. The CCNPP Unit 3 COLA will be updated in a future revision to incorporate the ER changes identified in Enclosure 2, and to reflect relocation of the intake structure within the FSAR and other parts of the COLA.

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The regulatory commitment identified in the referenced letter is considered closed for the portion of the commitment pertaining to the Environmental Report. The regulatory commitment will be closed upon submittal of the changes to the FSAR for the intake structure relocation.

If you have any questions, please call Mr. Dimitri Lutchenkov at (410) 470-5524.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on January 14, 2009

Greg Gibson

Enclosures:
1) Cross Reference of ER and FSAR Figures
2) Revised ER Text and Figures for Intake Structure Relocation

cc: U.S. NRC Region I Office
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
Thomas Fredrichs, NRC Environmental Project Manager, U.S. EPR COL Application
John Rycyna, NRC Safety Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosures)

Enclosure 1

Cross Reference of ER and FSAR Figures
CCNPP Unit 3 Environmental Report
Intake Structure Relocation

Cross Reference of ER and FSAR Figures

FSAR FIGURES	DESCRIPTION	ER FIGURES	DESCRIPTION
1.1.3	Site Area Map	4.5.1	Site Layout of CCNPP Units 1, 2, and 3}
2.1.1	Site Area Map	6.4.1	CCNPP Site Map with Meteorological Tower Location
2.4.1	Site Area Topography and Drainage	3.1.1 and 6.4.2	Site Area Topographical Map and Detailed Topography Within 5 mi (8 km)
2.4.2	Site Utilization Plot Plan	2.3.4	CCNPP 3 Utilization Plot Plan
2.4.7	Sub Basin Drainage Boundary		
2.4.9	Drainage Ditch Cross Section		
2.4.10	Site Location	4.5.1	Site Layout of CCNPP Units 1, 2, and 3}
2.5.104	Sub Surface Investigation Location Plan (Power Block)		
2.5.129	Site Grading Plan	4.2.1	Final Site Grading Plan CCNPP Unit 3
2.5.159	Site Grading Plan	4.2.1	Final Site Grading Plan CCNPP Unit 3
2.5.161	Cross Section of Intake Structure		
2.5.171	Static Pseudo Analysis		
3.8.1	Schematic Site Plan of Seismic Category I Buried Utilities (Electrical Duct Banks)		
3.8.3	Schematic Site Plan of Seismic Category I Buried Utilities (Underground Piping)		
3.8.5	Isometric View of the GT STRUDL Finite Element Model for the UHS Makeup Water Intake Structure (Partial View of Basemat, Exterior Walls and Interior Divider Walls)		
3E4-2	Sections UHS Make Up Intake		
3E4-3	Intake FEM Model		
3E4-4	ISO UHS FEM Model		
3E4-5	Foundation UHS Electrical Building		
9B-23	Fire Barrier Location - Intake Structure (UHS)		
9B-24	Fire Barrier Location - CW Intake Structure		
9B-67	Fire Barrier Location		
9.2.4	General Area - UHS Makeup Water and CW Intake Structures	3.4.3	Circulating Water Intake/Discharge Structure Location Plan
9.2.5	UHS Makeup Water Intake Structure - Plan View	3.4.4	Plan View of Chesapeake Bay Intake System for CCNPP Unit 3
9.2.6	UHS Makeup Water Intake Structure - Section View	3.4.5	Section View of Chesapeake Bay Intake System for CCNPP Unit 3

FSAR FIGURES	DESCRIPTION	ER FIGURES	DESCRIPTION
10.4.4	Circulating Water System Makeup Pump Intake Structure (Plan View)	3.4.4	Plan View of Chesapeake Bay Intake System for CCNPP Unit 3
10.4.5	Circulating Water System Makeup Pump Intake Structure (Section View)	3.4.5	Section View of Chesapeake Bay Intake System for CCNPP Unit 3

Enclosure 2

Revised Text and Figures
CCNPP Unit 3 Environmental Report
Intake Structure Relocation

UniStar Nuclear Operating Services has been formed to be a licensee and to operate U.S. Evolutionary Power Reactor (EPR) nuclear power plants in the United States. The principal offices of UniStar Nuclear Operating Services are located in Baltimore, Maryland. UniStar Nuclear Operating Services is organized under the laws of the State of Delaware pursuant to the Limited Liability Company Agreement of UniStar Nuclear Operating Services dated May 12, 2006,by Constellation Energy UniStar Holdings, LLC, the predeccessor to Unistar-Nuclear Holding. UniStar-Nuclear Operating Services will be one of the licenses and will operate CCNPP, Unit 3.

UniStar Nuclear Holdings, LLC (Unistar Nuclear Holdings) is responsible to license, jointly develop, construct, and perform start-up testing. UniStar Holdings is a wholly owned subsidiary of Constellation New Nuclear, LLC.

Unistar Nuclear Development Company (UNDC) is responsible to license, jointly develop, construct, and perform start-up testing services. UNDC is a wholly owned subsidiary of Constellation Generation Group.}

1.2.2 SITE LOCATION

The proposed new nuclear power plant is located {south} of the existing nuclear power plant on the {CCNPP} site. The CCNPP site consists of 2,070 acres (838 hectares) in Calvert County, Maryland, on the west bank of Chesapeake Bay, approximately halfway between the mouth of the bay and its headwaters at the Susquehanna River}. The site is approximately {40 mi (64 km) southeast of Washington D.C. and 7.5 mi (12 km) north of Solomons Island, Maryland. Figures 1.2-1 and 1.2-2 illustrate the location of the {CCNPP} site.

1.2.3 REACTOR INFORMATION

{The proposed nuclear power plant consists of one} pressurized water reactor steam electric system of the AREVA U.S. EPR design. The rated core thermal power is 4,590 MWt. {The rated and design gross electrical output is 1,710 MWt.The rated and design net electrical output is approximately 1,562 MWe. Submittal of the U.S. EPR Final Safety Analysis Report for the design certificationof the U.S. EPR was completed in December 2007.}

1.2.4 COOLING SYSTEM INFORMATION

The two major cooling systems interacting with the environment are the Circulating Water System and the Essential Service Water System. Figure 1.2-3 provides a simplified diagram of these two systems.

1.2.4.1 Circulating Water System

The U.S. EPR uses a Circulating Water Supply System (CWS) to dissipate waste heat rejected from the main condenser and turbine building closed cooling water heat exchangers (via heat exchange with the auxiliary cooling water system) during normal plant operation at full station load. A closed-cycle, wet cooling system is used for {CCNPP Unit 3, a departure from the existing CCNPP Units 1 and 2 which have a once-through cooling system. {The CCNPP Unit 3 system uses a single mechanical draft cooling tower with plume abatement for heat dissipation. The plume abatement feature will eliminate any visible water vapor plume from the tower.} The exhausted steam from the low pressure steam turbine is directed to a surface condenser (i.e., main condenser), where the heat of vaporization is rejected to a closed loop of cooling water. Cooling water from the CWS is also provided to the auxiliary cooling water system. Two 100% capacity auxiliary cooling water system pumps receive cooling water from the CWS and deliver the water to the Closed Cooling Water System (CLCWS) heat exchangers.

Heat from the CLCWS System is transferred to the auxiliary cooling water system in the CLCWS System heat exchangers and heated auxiliary cooling water is returned to the CWS. The heated cooling water from the main condenser and auxiliary cooling water system is sent to the spray headers of the cooling tower, where heat content of the cooling water is transferred to the ambient air via evaporative cooling and conduction. After passing through the cooling tower, the cooled water is recirculated back to the main condenser and auxiliary cooling water system to complete the closed cycle cooling water loop. Makeup water from the {Chesapeake Bay is required to replace evaporative water losses, drift losses, and blowdown discharge.

~~{Makeup water for the CWS will be taken from the Chesapeake Bay by pumps installed in a new intake structure located next to the south end of the existing CCNPP Units 1 and 2 intake structure. The makeup water is pumped~~Makeup water for the Unit 3 CWS will be taken from the Chesapeake Bay. Two 60-in (152-cm) diameter intake pipes will run approximately 500 ft (152.4 m) south from a shoreline location near the southern edge of the Units 1 and 2 intake structure to a 100 ft (30.48 m) long, and 80 ft (24.38 m) wide unlined forebay. The forebay will be constructed on the shoreline terrace north of the existing pond and barge slip and will have vertical sheet pile sides that extend to Elevation 10 ft (93.05 m) NGVD 29 with an unlined bottom at -22 ft 6 in (-6.86 m) NGVD 29. The CWS pumphouse will be at the northern end of the forebay and the UHS pumphouse will be at the southern end. A rip-rap seawall extending approximately 75 ft (22.9 m) north from the shoreline, east of the pipeline entrance, rip-rap along the shoreline, and a trash rack will be used to protect the pipeline entrance point. The makeup water will be pumped through a common header directly to the cooling tower basin. Blowdown from the cooling tower discharges to a common retention basin to provide retention time for settling of suspended solids and to permit further chemical treatment of the wastewater, if required, prior to discharge to the Chesapeake Bay. The water is pumped through the main condenser, to and from the auxiliary cooling system (all in parallel), and then to the cooling tower to dissipate heat to the atmosphere. Figure 1.2-4 shows the location of the cooling tower for CCNPP Unit 3.}

1.2.4.2 Essential Service Water System

The U.S. EPR design has a safety-related Essential Service Water System (ESWS) to provide cooling water to the Component Cooling Water System (CCWS) heat exchangers located in the Safeguards Building and to the cooling jackets of the emergency diesel generators located in the Emergency Power Generating Buildings. The ESWS is used for normal operations, refueling, shutdown/cooldown, anticipated operational events, design basis accidents and severe accidents. The ESWS is a closed-loop system with four safety-related trains and one non-safety-related dedicated (severe accident) train to dissipate design heat loads. Each safety-related train uses one of the four safety-related two-cell mechanical draft cooling towers to dissipate heat during normal conditions, shutdown/cooldown, or design basis accident conditions. The non-safety-related train uses its associated safety-related train ESWS cooling tower (UHS) to dissipate heat under severe accident conditions. The ESWS water is pumped to the CCWS heat exchanger and to the emergency diesel generator heat exchanger for the removal of heat. Each of the four ESWS cooling towers has a dedicated CCWS heat exchanger to maintain separation of the safety-related trains. Heated ESWS water returns through piping to the spray distribution header of the {UHS} cooling tower. Water exits the spray distribution piping through spray nozzles and falls through the tower fill. Two fans provide upward air flow to remove latent and sensible heat from the water droplets as they fall through the tower fill, rejecting heat from the service water to the atmosphere. The heated air will exit the tower and mix with ambient air, completing the heat rejection process. The cooled water is collected in the tower basin for return to the pump suction for recirculation through the system. Each ESWS cooling tower has a dedicated ESWS pump. An additional pump connected to one ESWS train supplies the severe accident train. {A desalinization plant processing water from the Chesapeake Bay will provide normal makeup to the ESWS system.}

{Makeup water to the ESWS is normally supplied from the plant raw water system. The plant raw water system is supplied from a desalination plant which gets water from the Chesapeake Bay via the CWS. Reject water from the desalination plant is directed into the CCNPP Unit 3 CWS blowdown.

Under post-accident conditions lasting longer than 72 hours, brackish makeup water may be supplied from the safety-related UHS makeup water system. The UHS makeup pumps are housed in a safety-related intake structure ~~near the CWS intake structure~~at the opposite endof the forebay supplying the CWS.}

1.2.5 TRANSMISSION SYSTEM INFORMATION

{The existing transmission system consists of two circuits, the North Circuit which connects the CCNPP site to the Waugh Chapel Substation in Anne Arundel County and the South Circuit that connects the CCNPP site to the Mirant Chalk Point Generating Station in Prince George's County. The North Circuit is composed of two separate three-phase 500 kV transmission lines run on a single right-of-way from the CCNPP site, while the South Circuit is a single 500 kV line. The routes of the existing two 500 kV circuits from the CCNPP site to the Waugh Chapel Substation and single 500 kV circuit from the CCNPP site to the Chalk Point Generating Station are presented in Figure 1.2-5.

No additional transmission corridors or other offsite land use would be required to connect the new reactor unit to the existing electrical grid. On the CCNPP site, the following facilities would be constructed:

- One new 500 kV substation to transmit power from CCNPP Unit 3
- Two new 500 kV, 3500 MVA circuits, 1.0 mi (1.6 km) in length, on individual towers, connecting the CCNPP Unit 3 substation to the existing CCNPP Units 1 and 2 substation
- Two existing 500 kV, 3,500 MVA circuits that are currently connected to the existing CCNPP Units 1 and 2 substation will be disconnected from the substation and extended one mile (1.6 km) on individual towers, to the CCNPP Unit 3 substation.

Numerous breaker upgrades and associated modifications would also be required at Waugh Chapel, Chalk Point, and other substations. All of the offsite modifications would be implemented within the existing substations. Onsite line routing will be conducted so as to avoid or minimize any impact on the existing Independent Spent Fuel Storage Installation, wetlands, or threatened and endangered species identified in the local area. The layout of the new lines will not have any impact on the existing transmission corridor, and all new line construction will be contained within the CCNPP site property lines. No changes to the offsite corridors are required.}

1.2.6 PROPOSED ACTION AND CONSTRAINTS

The proposed action is to construct and operate a new nuclear power unit on the {CCNPP site. The NRC 10 CFR 52 (CFR, 2007b) licensing process will be followed to obtain a combined license. At the time of application submittal, there are no constraints on the review process. Numerous other permits and approvals are required from various Federal, State and local agencies as discussed in Section 1.3. These actions will require public meetings and hearings, as

The St. Leonard Creek watershed has a drainage area of approximately 35.6 mi^2 (92.2 km^2) (CWP, 2004) and mainly includes St. Leonard Creek and its tributaries, including the Perrin Branch, Woodland Branch, Planters Wharf Creek, Johns Creek and its tributaries, Grovers Creek, Rollins Cove, and Grapevine Cove as shown in Figure 2.3-3. The combined flow from these streams discharge into the Patuxent River through St. Leonard Creek. St. Leonard Creek is tidally influenced at the confluence with Johns Creek.

The CCNPP Unit 3 power block will be located in the Maryland Western Shore Watershed as shown in Figure 2.3-2. The circulating water system (CWS) cooling towers and switchyard will be located in the St. Leonard Creek watershed. Power transmission lines from the CCNPP Unit 3 substation will use the CCNPP Units 1 and 2 transmission corridor. From the CCNPP Unit 3 substation, the transmission lines will proceed in a northwestward direction as shown in Figure 2.3-4. Site grading for CCNPP Unit 3 will affect the headwaters of the unnamed creek, Branch 1, in the Maryland Western Shore watershed. In the St. Leonard Creek watershed, the unnamed creek, Branch 3, will be affected by the switchyard. Post-construction drainage from the CCNPP Unit 3 power block area will be directed towards the Chesapeake Bay, while drainage from the CWS cooling towers and switchyard will be directed to Johns Creek.

The design basis flood elevation at the power block area is 81.5 ft (24.8 m) NGVD 29. However, the maximum water level associated with a safety-related structure is 81.4 ft (24.8 m) NGVD 29, which is 3.2 ft (1.0 m) below the reactor complex grade slab at elevation 84.6 ft (25.8 m) NGVD 29. The design basis flood elevation at the safety-related UHS makeup water intake structure is not expected to exceed 39.4 ft (12 m) NGVD 29.

Wetlands near the CCNPP Unit 3 construction area consist of small headwater streams with narrow floodplains and associated riparian forest in the St. Leonard watershed; and minor Chesapeake Bay watershed, minor tributary streams and associated small impoundments. Major impoundments within the site include the Lake Davies stormwater impoundment, sequential perennial water bodies that drain the dredge spoil disposal area, and the Camp Conoy fishing pond, The Camp Conoy pond is located at the headwaters of unnamed creek Branch 1 as shown in Figure 2.3-4. Runoff from Lake Davis discharges west to Goldstein Branch, which then discharges to Johns Creek. The sequential ponds discharge directly to Johns Creek upstream of Goldstein Branch. Both the Camp Conoy fishing pond and Lake Davies are man-made. The U.S. Fish and Wildlife Services (USFWS, 2007) have designated the water bodies within the CCNPP site as palustrine wetlands. Camp Conoy pond and Lake Davies are further sub-classified as unconsolidated bottom permanently flooded and emergent semi-permanently flooded wetlands, respectively. Wetlands along the streams and creeks are mostly classified as forested or scrub-shrub wetlands that are seasonally or temporarily flooded.

2.3.1.1.1.2 Patuxent River Watershed

The Patuxent River is the largest river that is completely contained in Maryland. It drains an area of about 932 mi^2 (2,414 km^2) as shown in Figure 2.3-1, which includes portions of St. Mary's, Calvert, Charles, Anne Arundel, Prince George's, Howard, and Montgomery Counties (MDNR, 2006). The Patuxent River contributes slightly over 1% of the total streamflow delivered annually from the catchment of the Chesapeake Bay Basin (USGS, 1968). The river basin is situated between two large metropolitan areas, which are Baltimore, Maryland and Washington, D.C. Consequently, the Patuxent River watershed has gone through significant suburban development in the past few decades. Present land use in the basin is approximately 44% forest, 30% urban, and 26% agriculture (MDNR, 2006).

The Patuxent River watershed is divided into four sub-watersheds:

Both long-term and short-term processes are responsible for shore erosion of the Chesapeake Bay. The slow rise in sea level and wave action are the two primary long-term processes that cause the shoreline to recede. Over the past century, sea level rise in the estuary amounts to approximately 1.3 ft (0.4 m). It may rise by 2 to 3 ft (0.6 to 0.9 m) in the next 100 years, as suggested by some researchers (TSTF, 2005). Waves and surges due to occasional hurricane wind may considerably change coastal morphology. These short-term, high energy erosive waves often reach high, upland banks out of the range of normal tides and waves.

Near the middle reach of the Chesapeake Bay, sediment supply due to tidal erosion is much higher than the supply from the watersheds. In the Maryland Western Shore watershed, annual average fine grained sediment (silts and clays) loads from fluvial sources and from tidal erosion were estimated to be 0.2 and 0.4 million metric tons per year (USGS, 2003b), respectively. In a 433 mi (697 km) length of the shoreline in the Lower Maryland Western Shore watershed, where the CCNPP site is located, this erosion results in an annual average shoreline retreat of 0.47 ft (0.14 m) per year (TSTF, 2005). The local rate of shoreline change in the vicinity of CCNPP site, as estimated by the Maryland Department of Natural Resource (MDNR), is shown in Figure 2.3-25. The rate of shoreline erosion south of the existing barge jetty and near the CCNPP site has been estimated by MDNR to be between 2 and 4 ft (0.6 and 1.2 m) per year. North of the existing intake structure, MDNR has estimated the shoreline change to be between 2 ft (0.6 m) per year accretion and 4 ft (1.2 m) per year erosion. The shoreline near the CCNPP Units 1 and 2 intake structure is stabilized so that any shoreline retreat is precluded. Historic shoreline locations near the CCNPP site in 1848, 1942 and 1993 are shown in Figure 2.3-26 (MGS, 2001).

2.3.1.1.2.5 Chesapeake Bay Bathymetry

Near the CCNPP site, the Chesapeake Bay is approximately 6 mi (10 km) wide, and the bottom elevation of the Chesapeake Bay's deepest section is approximately -100 ft (-30 m) NGVD 29. The deepest portion of the Chesapeake Bay is located close to the eastern shore, opposite the CCNPP site. From the western shore to approximately 4 mi (6.4 km) across the Chesapeake Bay, the bottom elevation varies from about -15 ft to -50 ft (-5 to -15 m) NGVD 29. Near the CCNPP site, an intake channel that is perpendicular to the shoreline and is approximately 4,830 ft (1,472 m) long was dredged for CCNPP Units 1 and 2. The design bottom elevation of the dredged channel varied between -51 ft (-15.5 m) NVGD 29 near the intake to -40 ft (-12.2 m) NGVD 29 away from the intake structure. CCNPP Unit 3 will use the same intake channel for the UHS makeup water intake and the CWS makeup water intake. ~~An approximate 123 ft (37 m) long and 100 ft (30 m) wide forebay with earth retaining side walls of appropriate design will be constructed to draw water from the intake channel to the new intake structures. The new UHS and CWS makeup water intakes will be located on the southeast bank of the existing intake.~~ A recent bathymetric survey in front of the CCNPP Units 1 and 2 intake structure indicates that the bottom elevation of the intake channel near the structure has silted-in since the intake channel was dredged. The current bottom elevation of the intake channel near the intake structure is approximately -38 ft (-12 m) NGVD 29, as shown in Figure 2.3-27. The figure also shows that the bottom elevation within the intake channel remained nearly uniform over a length of about 2,000 ft (610 m).}

2.3.1.2 Groundwater Resources

{This section contains a description of the hydrogeologic conditions present at, and in the vicinity of the CCNPP site. This section describes the regional and local groundwater resources that could be affected by the construction and operation of CCNPP Unit 3. The regional and site-specific data on the physical and hydrologic characteristics of these groundwater resources are summarized to provide the basic data for an evaluation of potential impacts on the aquifers 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~~two intake pipes located on a protected section of shoreline immediately south of the existing Units 1 and 2 intake structure. The intake pipes empty into a forebay that supplies the CWS and UHS pumphouses , 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.

2.3.3.1.2.1 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 2.2-3. 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 2.3-2, 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 2.3-7, 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 intake forebay and CWS and UHS pumphouses are above the 100 year flood elevation.

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 2.3-82. 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 (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 2.3-561 and listed in Table 2.3-22, 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~~ shoreline intake pipes, 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 pipes.

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.

2.3.3.1.2.2.5 Sediments

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 2.3-83 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 2.3-12, 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

3.4 COOLING SYSTEM

The {Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3} cooling system design, operational modes, and component design parameters are determined from the U.S. EPR design documents, site characteristics, and engineering evaluations. The plant cooling systems and the anticipated cooling system operational modes are described in {Section 3.4.1}. Design data and performance characteristics for the cooling system components are presented in {Section 3.4.2}. These characteristics and parameters are used to assess and evaluate the impacts on the environment. The environmental interfaces occur at the intake and discharge structures and the cooling towers. There are two cooling systems that have intakes and cooling towers. These systems are the Circulating Water Supply System (CWS) and the Essential Service Water System (ESWS). Figure 3.4-1 is a general flow diagram of the cooling water systems for {CCNPP Unit 3}.

3.4.1 DESCRIPTION AND OPERATIONAL MODES

3.4.1.1 Circulating Water Supply System/Auxiliary Cooling Water Systems

The U.S. EPR uses a Circulating Water Supply System (CWS) to dissipate heat. A closed-cycle, wet cooling system is used for {CCNPP Unit 3. This is a different design from the existing CCNPP Units 1 and 2 which have a once-through cooling system}. {The CCNPP Unit 3 system uses a single plume abated mechanical draft cooling tower for heat dissipation. Under the restrictions imposed by Section 316 of the Federal Clean Water Act, closed-cycle cooling is the only practical alternative for CCNPP Unit 3 that would meet both the Section 316(b) intake requirements at new facilities, as well as the Section 316(c) thermal requirements at this multi-facility site.} The CWS at {CCNPP Unit 3} dissipates up to 1.108 x 10^{10} BTU/hr (2.792 x 10^{9} Kcal/hr) of waste heat rejected from the main condenser and the Closed Cooling Water System (CLCWS) during normal plant operation at full station load. The exhausted steam from the low pressure steam turbine is directed to a surface condenser (i.e., main condenser), where the heat of vaporization is rejected to a loop of CWS cooling water. Cooling water from the CWS is also provided to the auxiliary cooling water system. Two 100% capacity auxiliary cooling water system pumps receive cooling water from the CWS and deliver the water to the CLCWS heat exchangers. Heat from the CLCWS is transferred to the auxiliary cooling water system and heated auxiliary cooling water is returned to the CWS. The heated CWS water is sent to the spray headers of the cooling tower, where the heat content of the water is transferred to the ambient air via evaporative cooling and conduction. After passing through the cooling tower, the cooled water is recirculated back to the main condenser and auxiliary cooling water system to complete the closed cycle cooling water loop. The CWS has nominal flow rate of {777,560 gpm (2,943,385 lpm).}

Evaporation in the cooling tower increases the level of solids in the circulating water. To control solids, a portion of the recirculated water must be removed or blown down and replaced with clean water. In addition to the blowdown and evaporative losses, a small percentage of water in the form of droplets (drift) would also be lost from the cooling tower. {Peak anticipated evaporative losses are approximately 22,160 gpm (83,885 lpm). Maximum blowdown is approximately 22,121 gpm (83,737 lpm). Maximum drift losses are about 39 gpm (148 lpm) based upon 0.005% of the CWS nominal flow rate. Makeup water from the Chesapeake Bay is required to replace the 47,383 gpm (179,365 lpm) losses from evaporation, blowdown and drift.}

{Makeup water for the CWS will be taken from the Chesapeake Bay by pumps at a maximum rate of approximately 43,480 gpm (164,590 lpm). This is based on maintaining the CWS and supplying the desalination plant with 3,063 gpm (11,595 lpm). The pumps will be installed in a new intake structure located ~~next~~ to the south ~~end~~ of the existing CCNPP Units 1 and 2 intake

The existing intake system consists of the CCNPP Units 1 and 2 dredged channel that extends approximately 4,500 ft (13,80 m) offshore and a 560 ft (171 m) wide, 56 ft (17 m) deep curtain wall that extends the full width of the intake channel creating an embayment in which the intake structures are located (BGE, 1970). The top of the curtain wall is approximately 5 ft (1.5 m) above the water and the bottom is at elevation -28 ft (-8.5 m). Due to siltation, the effective opening is 17 ft (5.2 m), originally the opening was 23 ft (7 m) high. Velocity under the curtain wall at design depth is estimated to be approximately 0.4 ft/sec (0.12 m/sec). Velocities are currently somewhat greater due to siltation (CGG, 2005).

The new ~~The~~ CCNPP Unit 3 intake ~~channel~~ area will be constructed with a sheet pile wall extending approximately 180 linear feet from the existing shoreline to the existing baffle wall and extending approximately 90 feet channelward from the approximate mean high water shoreline creating an approximately 9,000 ft^2 ~~will~~ (836.1 m^2) ~~be)~~ wedge shaped pool. Approximately 50 ft (15.2 m) of existing shoreline armor protection will be removed to install the new sheet pile wall. Once the new sheet pile wall is in place, approximately 60 ft (18.3 m) of armor within the wedge shaped pool will be removed and temporary upland sheet piling will be installed along the makeup water pipe route. This upland sheet piling will extend out into the wedge shaped pool approximately 30 ft (9.1 m) to facilitate dewatering, installation of pipe and the associated trash rack. The area within the wedge shaped pool surrounded by the pipe line sheet piling will be dewatered and dredged by mechanical method to create an approximate 30 ft (9.1 m) wide by 30 ft (9.1 m) long by 25 ft (7.6 m) deep area, resulting in approximately 900 yds^3 (688.1 m^3) of sand and gravel which will be deposited at an existing upland, environmentally controlled area at the Lake Davies laydown area onsite. After dredging, two 60 in (152.4 cm) diameter intake pipes will be installed with trash racks at the pipe openings, extending approximately 20 ft (6.1 m) channelward to a bottom elevation of -25 ft (-7.62 m) mean low water level. After installation of the pipes and associated trash racks, shoreline armour protection approximately 80 ft (24.4 m) in length and extending 10 ft (3.1 m) channelward will be restored within the wedge shaped area. In addition, armour protection will be extended out beyond the new sheet pile wall approximately 75 ft (22.9 m) and extend 205 ft (62.5 m) channelward. As a final step, the temporary sheet pile wall around the 60 in (152.4 cm) intake pipes will be removed allowing the area to reflood and submerge the pipes. ~~an approximately 123 ft (37.49 m) long, 100 ft (30.48 m) wide structure with an earthen bottom at Elevation -20 ft 6 in (-6.25 m) NGVD 29 and vertical sheet pile sides extending to Elevation 10 ft (3.05 m) NGVD 29. The intake channel is shared between the nonsafety-related CWS and the safety-related UHS makeup water systems.~~

The new CCNPP Unit 3 intake ~~channel is located off the existing intake channel for CCNPP Units 1 and 2, which is~~ piping consists of two runs of 60 inch (152.4 cm) diameter safety related concrete pipes approximately 490 ft (149.4 m) long. These pipes convey water from the CCNPP Unit 3 intake area to a CCNPP Unit 3 common forebay approximately 100 ft (30.5 m) long by 80 ft (24.4 m) wide with an earthen bottom at Elevation -22.5 ft (-6.9 m) NGVD 29 and vertical sheet pile sides extending to Elevation 10 ft (3.1 m) NGVD 29. The nonsafety related CWS intake structure and the safety related UHS makeup water intake structure are situated at opposite ends of the common forebay.

The new CCNPP Unit 3 intake piping draws water from the intake area. The piping is oriented perpendicular to the tidal flow of the bay. This orientation ~~to~~ minimizes the component of the tidal flow parallel to the ~~channel~~ intake area flow and reduces the potential of fish entering the ~~channel and intake structure~~ piping and common forebay as shown on Figure 3.4-3. The flow velocity into the existing intake ~~channel~~ area from the bay is no more than 0.5 fps (0.15 mps). ~~The flow through the new channel is determined by plant operating conditions. Velocities will also depend on the Chesapeake Bay water level. At the minimum Chesapeake Bay level of -4.0~~

~~ft (-1.22 m) NGVD 29, the flow velocity along the new intake channel would be less than 0.5 fps (0.15 mps), based on the maximum makeup demand of approximately 43,480 gpm (164,590 lpm).~~The flow velocities at the circulating water makeup structure and the UHS makeup structure would be less than 0.3 fps (0.09 mps) and less than 0.1 fps (0.03 mps), respectively. Since the ~~intake channel~~common-forebay will also act as a siltation basin, dredging may be required to maintain the channel invert elevation.

The new CCNPP Unit 3 CWS makeup water intake structure will be an approximately 78 ft (24 m) long, 55 ft (17 m) wide concrete structure with individual pump bays. Three 50% capacity, vertical, wet pit CWS makeup pumps provide up to 44,000 gpm (166,588 lpm) of makeup water.

The CCNPP Unit 3 UHS makeup water intake structure is approximately ~~125~~75 ft (~~38~~22.9 m) long, ~~70~~60 ft (~~21~~18.3 m) wide concrete structure with individual pump bays. Four 100% capacity, vertical, wet pit UHS water makeup pumps are capable of providing up to ~~provided 2,400~~3,000 gpm (~~9,085~~11,356 lpm) of makeup water or 750 gpm (2,839 lpm) for each pump.

In the UHS makeup intake structure, one makeup pump is located in each pump bay, along with one dedicated traveling screen and trash rack. There are cross bay stop log slots to permit isolation of pumps on an individual bay basis.

For the CWS makeup water intake structure, flow from two traveling screens and trash racks into a common forebay feeds the three CWS makeup pumps. Each CWS pump is located in its own pump bay with cross bay stop log slots to permit isolation of individual pumps. Debris collected by the trash racks and the traveling screens will be collected in a debris basin for cleanout and disposal as solid waste. The through-trash rack and through-screen mesh flow velocities will be less than 0.5 fps (0.15 mps). The trash bar spacing is 3.5 in (8.9 cm) from center to center. The dual flow type of traveling screens with a flow pattern of double entry-center exit will be used for both the CWS and UHS intakes. This arrangement prevents debris carry over. The screen panels will be either metallic or plastic mesh with a mesh size of 0.079 to 0.118 in (2 to 3 mm) square. The mesh is mechanically rotated above the water for cleaning via spray water. The screen wash system consists of two screen wash pumps (single shaft) that provide a pressurized spray to remove debris from the water screens. In both intake structures, there is no need for a fish return system since the flow velocities through the screens are less than 0.5 fps (0.15 mps) in the worst case scenario (minimum bay level with highest makeup demand flow). Nevertheless, a fish return system will be provided to reduce mortality of aquatic species, consistent with the intent of Clean Water Act Section 316(b) regulations.

The growth of slime, algae and other organic materials will be monitored in the intake structure and their components as well as the accumulation of debris on the trash racks. Cleaning will be performed, as necessary.

The combined pumping flow rate from Chesapeake Bay for CCNPP Unit 3 will be a maximum of approximately 47,383 gpm (179,365 lpm)

3.4.2.1.1 Fish Return System

The existing Units 1 and 2 Fish Return System is located to the southeast side of the Units 1 and 2 Intake Forebay. Currently water from Units 1 and 2 flows through the existing Fish Return System where environmental aquatic studies can be performed. Traveling screen wash water leaving the facility then enters the Chesapeake Bay directly through a buried conduit to the shoreline outfall. The Fish Return System contains a holding pit, two isolation gates and flow trough. The main isolation gate is normally open, allowing discharge of screen wash water (containing fish) to the Chesapeake Bay. If needed, the main gate would close, and the side isolation gate opens up allowing diversion of screen wash water to the holding pit to allow environmental studies. Water overflowing the holding pit would lead to the buried conduit and exit to the bay.

A new fish collection/holding sytem, similar to that of Units 1 and 2, will be constructed for the new Unit 3 Intake Structure. It will be located on the east side (bay side) of the Unit 3 Intake Forebay. Screen wash water and fish collected from the traveling screens of the Unit 3 Circulating Water Makeup Intake Structure will be diverted to the new Fish Return System and will be released to the Chesapeake Bay via a buried pipe to a new shoreline outfall. The outfall will be submerged below low tide level to minimize any drop at the exit to facilitate the fish return to the Chesapeake Bay water. No modification to the existing fish return and holding system for Units 1 and 2 is necessary.

To construct the proposed fish return outfall, an 18 in (45.7 cm) diameter HDPE pipe will be installed in a mechanically excavated trench. The pipe will be installed 4 ft (1.2 m) below the bay bottom and will emerge from the bay bottom 40 ft (12.2 m) channelward. The outfall location will be protected with a 10 ft (3.1 m) by 10 ft (3.1 m) riprap apron extending approximately 48 ft (14.6 m) channelward. To install the pipe, approximately 40 linear ft (12.2 m) of the existing shoreline revetment will be removed, and approximately 500 yds^3 (382.3 m^3) of material will be dredged within the work area. The dredged material will be returned to the trench after the pipe is placed, and the existing shoreline revetment will be restored to its original design after pipe installation. Turbidity curtains are anticipated to be used during the work to contain suspended sediments~~}~~.}

3.4.2.2 {Final} Plant Discharge

{The final discharge consists of cooling tower blowdown from the CWS cooling tower, the ESWS cooling towers and site wastewater streams, including the domestic water treatment and circulation water treatment systems. All biocides or chemical additives in the discharge will be among those approved by the U.S. Environmental Protection Agency and the State of Maryland as safe for humans and the environment, and the volume and concentration of each constituent discharged to the environment will meet requirements established in the National Pollutant Discharge Elimination System (NPDES) permit. The types and quantities of chemicals used are discussed in Section 3.3.

The discharge flow to the Chesapeake Bay through the seal well is mainly from the retention basin. Note that treated liquid radioactive waste and effluent from the sewage treatment plant will discharge directly to the seal well. Discharge from the retention basin occurs through an approximately 30 in (76 cm) diameter discharge pipe to the seal well. From the seal well, the discharge pipe is routed to the offshore diffuser outfall where there are three 16 in (41 cm) diameter nozzles to distribute the discharge flow into the bay. The normal discharge flow will be approximately 21,019gpm (79,172 lpm) and the maximum discharge flow will be approximately 24,363 gpm (91,364 lpm). This includes the nominal and maximum discharge flow from the CWS cooling tower of approximately 18,977 gpm (71,836 lpm) and 22,160 gpm (83,885 lpm), respectively. Figure 3.4-2 and Figure 3.4-6 show the preliminary details for the retention basin and the seal well, respectively.

The discharge structure will be designed to meet all applicable navigation and maintenance criteria and to provide an acceptable mixing zone for the thermal plume per the State of Maryland regulations for thermal discharges. Figure 3.4-7 shows details of the discharge system. The discharge point is near the southwest bank of the Chesapeake Bay approximately ~~1,200~~1,151 ft (~~366~~351 m) south and 650 ft (198 m) east of the intake ~~structure~~piping-suction point for CCNPP Unit 3 (relative to plant north) and extends about 550 ft (168 m) into the bay through a buried nominal 30 in (76 cm) discharge pipe with diffuser nozzles at the end of the line. The preliminary centerline elevation of the discharge nozzles of the diffuser is 3 ft (0.9 m) above the Chesapeake Bay bottom elevation. The three 16 in (40.6 cm) diameter nozzles are spaced center-to-center at 9.375 ft (2.86 m) located 3 ft (0.91 m) above the bottom. The angle of discharge is 22.5 degrees to horizontal. Riprap will be placed around the discharge point to resist potential erosion due to discharge jet from the diffuser nozzles. Fish screens are not required on the diffuser nozzles since there will always be flow through the discharge piping, even during outages, to maintain discharge of treated liquid radioactive waste within the concentration limits of the applicable local, state and federal requirements. The length of the diffuser flow after exiting the nozzle is approximately 26 ft (7.9 m)}.

3.4.2.3 Heat Dissipation System

{The CWS cooling tower is used as the normal heat sink. The CWS cooling tower is a mechanical draft cooling tower that has a concrete shell rising to a height of approximately 164 ft (50 m). Internal construction materials include fiberglass-reinforced plastic (FRP) or polyvinyl chloride (PVC) for piping laterals, polypropylene for spray nozzles, and PVC for fill material. Mechanical draft towers use forced air conduction across sprayed water to reject latent and sensible heat from the sprayed water to the atmosphere. The CWS cooling tower will dissipate a maximum waste heat load of up to 1.108 x 10^{10} BTU/hr (2.792 x 10^{9} Kcal/hr) from the unit, operate with a 10°F (5.6 °C) approach temperature, and maintain a maximum 90°F (32°C) return temperature at design ambient conditions. Table 3.4-2 provides specifications of the CWS cooling tower. The cooling tower occupies an area of approximately 16 acres (6.5 hectares). The noise levels generated by the CWS cooling tower are approximately 65 dBA or less at the distance of approximately 1,300 feet (396 m) from the cooling tower. The State of Maryland stipulates noise limits based on the classification of the receiving land (55 dBA Ldn for residential land). Ldn is a calculated day-night time average noise level based on an hourly average of the equivalent noise level (Leq) over a 24 hour period. As a rule of thumb for a continuously and invariant operating noise source, the Ldn value is 6.4 dB higher than the average Leq value. The Leq noise limit is therefore 55 dBA to 6.4 dB (or 49.6 dBA). Based on distance losses, the 49.6 dBA (Leq) noise limit will be met within a 7,700 ft (2,347 m) radius from the towers. Figure 3.1-3 shows the location of the CWS cooling tower. Figure 3.1-2 depicts the planned mechanical draft tower, while Figure 3.4-8 provides a sectional view of a typical mechanical draft tower for CCNPP Unit 3}.

The ESWS cooling tower is a rectilinear mechanical draft structure. Each of the four ESWS cooling towers are a counterflow, induced draft tower and are divided into two cells. Each cell uses one fan, located in the top portion of the cell, to draw air upward through the fill, counter to the downward flow of water. One operating ESWS pump supplies flow to both cells of an operating ESWS cooling tower during normal plant operation. Table 3.4-1 provides system flow rates and the expected heat duty for various operating modes of the ESWS cooling towers. The ESWS cooling towers are designed to maintain a maximum 92°F (33°C) return temperature to the ESWS heat exchangers during normal operation (95°F (35°C) during both design basis accident and severe accident conditions, and 90°F (32°C) during Shutdown/Cooldown). Temperature rise through the ESWS heat exchangers will be approximately 17°F (9°C) during normal operation and 19°F (11°C) during cooldown operation based on the heat transfer rates defined in Table 3.4-1. Blowdown from the ESWS cooling towers is mixed with CWS blowdown. The ESWS cooling towers are located on either side of the power block (two ESWS cooling towers per side), to provide spatial separation, with each ESWS cooling tower occupying an area of approximately 0.19 acres (0.077 hectares). The noise levels generated by the ESWS cooling towers is approximately 65 dBA or less at the distance of approximately 1,300 feet (396 m) from the cooling towers. {The State of Maryland stipulates noise limits based on the

4.3 ECOLOGICAL IMPACT

4.3.1 TERRESTRIAL ECOSYSTEMS

{This section describes the impacts of construction on the terrestrial ecosystem. Construction would require the permanent or temporary disturbance of approximately ~~435~~437 acres (~~176~~177 hectares) of terrestrial habitat on the CCNPP site as shown in Figure 4.3-1. This area is assumed to be the maximum area of soil to be exposed at any time and is within the originally estimated 460 acres (186 hectares). Approximately ~~264~~266 acres (~~107~~108 hectares) of the affected terrestrial habitat would be permanently converted to structures, pavement, or other intensively-maintained exterior grounds to accommodate the proposed power block, cooling tower, switchyard, roadways, permanent construction laydown area, borrow area, retention basins, intake, forebay, and water supply structures and permanent parking lots. The remaining disturbed area of approximately 171 acres (69 hectares) would be only temporarily disturbed to accommodate the batch plant, temporary construction laydown areas, temporary construction offices and warehouses, and temporary construction parking. The temporarily disturbed habitats would be restored to a naturally vegetated condition once construction activities are complete. The permanent loss of affected terrestrial habitat of ~~264~~266 acres (~~107~~108 hectares) is small compared to the 1,796,718 acres (724,242 hectares) in the region as shown in Table 2.2-4. Approximately ~~14.3~~12 acres (~~5.8~~5 hectares) of the lost terrestrial habitat is wetlands compared to 240,288 acres (97,245 hectares) of wetlands in the region as shown in Table 2.2-4. Figure 2.2-1 shows the CCNPP site boundary and the major buildings to be constructed. Figure 4.3-2 shows the land to be cleared, the waste disposal area and the construction zone.

Dredging will take place at the barge area to accommodate delivery of large components. Dredging will also be performed to allow for construction at the shoreline location of the circulating water system (CWS) intake piping inlet and ~~of~~ the discharge~~-~~line.~~line from the circulating water system.~~ In addition, some dredging may be required to maintain the CWS and UHS supply forebay. Dredged material will be disposed of in the previously used disposal area known as Lake Davies.

The construction footprint was designed to minimize impacts to terrestrial ecosystems, specifically lands within the Chesapeake Bay Critical Area (CBCA), which encompasses lands within 1,000 ft (305 m) of the mean high tide level on the shoreline; locations of federally-designated or state-designated threatened or endangered species; wetlands; wetland buffers designated by Calvert County; and forest cover, especially riparian forests, forested slopes, and large blocks of contiguous forest that provide habitat for forest dwelling species forest interior dwelling species (FIDS).

The proposed footprint of construction within the CBCA would be limited to approximately ~~30.3~~32.1-acres (~~12.3~~13.0 hectares), including approximately ~~0.4~~1.3 acres (~~0.16~~0.5 hectares) in the CBCA Buffer (extending 100 ft [30.5 m] landward of mean high tide) and approximately ~~29.9~~30.8 acres (~~12.1~~12.5 hectares) in the remainder of the CBCA. The CBCA encroachment is due to the water intake structures and pipelines, the discharge pipelines, the heavy haul road from the barge dock, stormwater retention basins, and security fencing and the security perimeter gravel path. Certain areas within the CBCA will be regraded for proposed wetland mitigation and the area to accomodate equipment for the intake structure construction. The affected land within the CBCA has already been designated by Calvert County as an intensively developed area (IDA) due to the presence of a barge dock serving the existing CCNPP Units 1 and 2.

None of the sandy cliff or beach areas on the CCNPP site that provide suitable habitat for the puritan tiger beetle or northeastern beach tiger beetle will be disturbed because their habitat is north of the construction footprint. No construction will take place within 1,500 ft of three bald eagle nests known to occur on the CCNPP site. However, a new bald eagle nest first observed within the construction footprint in 2007 may have to be mitigated after consultations and in agreement with the appropriate agencies.

It is not possible to construct the proposed facilities without adversely impacting terrestrial ecosystems, including wetlands, wetland buffers designated by Calvert County, and FIDS habitat. Construction activities will start after the State of Maryland issues the appropriate permits to start clearing and grading of the site. Activities to construct nonsafety-related systems and structures are expected to begin December 2009. Construction is expected to be complete by July 2015.}

4.3.1.1 Vegetation

{Plant Communities and Habitats: Clearing and grubbing would result in the vegetation losses shown in Figure 4.3-1 and summarized in Table 4.3-1. The losses would include approximately ~~191~~192 acres (~~77~~78 hectares) of mature forest cover consisting of well developed tree canopy and understory strata and dominant trees over 12 in (30 cm) in diameter at breast height (DBH), including:

- Approximately ~~179~~180 acres (~~72~~73 hectares) of mixed deciduous forest
- Approximately 1.4 acres (0.6 hectares) of well-drained bottomland deciduous forest
- Approximately 9.8 acres (4.0 hectares) of poorly drained bottomland deciduous forest

The losses would also include approximately 61 acres (25 hectares) of younger, fast growing forest cover, including:

- Approximately 48 acres (19 hectares) of mixed deciduous regeneration forest
- Approximately 13 acres (5 hectares) of successional hardwood forest

Other vegetation losses would include:

- Approximately 125 acres (51 hectares) of old field vegetation,
- Approximately 1.8 acres (10.7 hectares) of herbaceous marsh vegetation
- Approximately ~~51~~52 acres (21 hectares) of lawns
- Approximately 3 acres (1.2 hectares) of shallow water with submerged vegetation (Camp Conoy Fishing Pond)

As indicated in Table 4.3-1, each of the affected types of vegetation is common throughout the CCNPP Site.

The boundaries of vegetated areas subject to clearing and grubbing will be prominently marked prior to site preparation. Merchantable timber within marked areas may be harvested prior to site preparation. Merchantable timber occurs only in areas of mixed deciduous forest, well-drained bottomland deciduous forest, and poorly drained bottomland deciduous forest. Remaining trees will then be felled. Stumps, shrubs, and saplings will be grubbed, and groundcover and leaf litter will be cleared to prepare the land surface for grading. Felled trees, stumps, and other woody material would be disposed of by burning, chipping and spreading the wood chips, and/or sent to an offsite landfill. Opportunities to recycle woody material for use elsewhere on the CCNPP site or for sale to the public may be considered. Recycling opportunities could include cutting logs into firewood, using wood chips to mulch landscaped areas, using logs to line pathways, piling logs and brush in open fields to improve terrestrial wildlife habitat, and placing stumps (root wads) in stream channels to prevent bank erosion and enhance aquatic habitat.

Because of the need for grading broad contiguous areas of land to construct the power block, switchyard, and cooling tower, there will be no practicable opportunities to preserve individual trees within those areas. However, a biologist would examine forested areas subject to clearing for the temporary construction parking areas, construction office and warehouse area, and construction laydown areas for aesthetically outstanding trees or clusters of trees that might be capable of preservation without interfering with construction activities. Only trees where a minimum of 70% of the critical root zone can be left ungraded without interfering with construction activities would be identified for preservation. The critical root zone is defined by the Maryland Department of Natural Resources (MDNR) as a circular zone surrounding a tree trunk with a radius of 1 ft (0.3 meter) for each inch DBH (and a minimum radius of 8 ft (2.4 m) (MDNR, 1997). The critical root zone would be marked consistent with the State Forest Conservation Technical Manual (MDNR, 1997).

Silt fences will be erected around the perimeter of the construction footprint to reduce the potential for sedimentation of adjoining vegetated areas. Detailed specifications for the silt fences and vegetative stabilization will be presented in a soil erosion and sediment control plan approved by the MDE prior to site disturbance. Soil piles will be covered with plastic or bermed until removed during backfill and final grading activities. Monitoring of construction effluents and storm water runoff will be performed as required by the Storm Water Management Plan, the NPDES permit, and other applicable permits obtained for construction.

Important Habitats: The construction footprint was designed to minimize encroachment into important habitats identified in Section 2.4.1 as important. Three habitats on the CCNPP Site were identified as important. Poorly drained bottomland deciduous forest and herbaceous marsh vegetation meet the definition of wetlands protected under federal and state regulations. Well-drained bottomland deciduous forest is important because of its occurrence in riparian settings. Site preparation will result in the permanent loss (filling) of approximately 14.3 acres (5.8 hectares) of wetland habitats, including approximately 9.8 acres (4.0 hectares) of poorly drained bottomland deciduous forest, approximately 4.5 acres (1.8 other wetlands. Site preparation also results in the permanent loss of approximately 1.4 acres (0.6 hectares) of well-drained bottomland deciduous forest. Wetland impacts are discussed in more detail in Section 4.3.1.3.

Important Plant Species: The chestnut oak, tulip poplar, mountain laurel, and New York fern were identified in Section 2.4.1 as important because they are key contributors to the overall structure and ecological function of forested plant communities on the CCNPP site. Chestnut oak, which is dominant or codominant in the canopy throughout most of the mixed deciduous forest on the CCNPP site, is a slow growing tree species that is difficult to grow and transplant (Hightshoe, 1988). Similarly hard to grow species common in the mixed deciduous forest on the CCNPP site includes white oak, bitternut hickory, and pignut hickory (TTNUS, 2007a). Mountain laurel, which forms a dense understory over much of the mixed deciduous forest (TTNUS, 2007b), is also a slow growing species and is difficult to transplant (Hightshoe, 1988). Even though mixed deciduous forest can be replanted, several hundred years could be necessary to restore the oaks, hickories, and mountain laurel to their present sizes in the restored forest cover. Any losses of cover by these species, even in areas of only temporary disturbance where forest vegetation can be replanted, must therefore be considered effectively permanent.

The showy goldenrod, Shumard's oak, and spurred butterfly pea were identified in Section 2.4.1 as important because they are listed by the State of Maryland as threatened or rare. Spurred butterfly pea was observed during a rare plant survey conducted in 2006 only in areas outside of the proposed construction footprint (TTNUS, 2007b) and therefore will not be adversely affected. Shumard's oak was observed outside of but very close to within 50 ft (15 m) the western edge of the proposed construction area for the cooling tower. The observed specimens of Shumard's oak do not have to be cut down to allow site preparation, but portions of their root systems could experience compaction or other physical disturbances. Careful protection of trees at the edge of the cooling tower construction area will be necessary to prevent mortality of the observed Shumard's oak specimens. Clusters of showy goldenrod (listed as threatened by Maryland) were observed in the 2006 surveys within the proposed construction footprint for the power block, at the edges of forested areas within Camp Conoy (TTNUS, 2007d). The clusters of showy goldenrod will be transplanted to open field areas outside of the construction footprint.}

4.3.1.2 Fauna

{The vegetation losses summarized in Table 4.3-1 will reduce the habitat available to mammals, birds, and other fauna that inhabit the CCNPP Site and surrounding region. Some smaller, less mobile fauna such as mice, shrews, and voles could be killed by heavy equipment used in clearing, grubbing, and grading. Larger, more mobile fauna will be displaced to adjoining terrestrial habitats, which could experience temporary increases in population density of certain species. If the increases exceed the carrying capacity of those habitats, the habitats could experience degradation and the displaced fauna could compete with other fauna for food and cover, resulting in a die-off of individuals until populations decline to below the carrying capacity. Potential impacts to specific fauna species identified in Section 2.4.1 as important are discussed below.

White-tail Deer: White-tail deer, which are identified in Section 2.4.1 as important because of their recreational value to hunters, are abundant throughout the CCNPP site (TTNUS, 2007c) and throughout Maryland. Deer populations have generally increased rather than decreased as Maryland and Virginia have become more densely developed (Fergus, 2003). When deer populations exceed the carrying capacity of forested habitats, as is common in Maryland and Virginia, shrubs and saplings can be killed or stunted by over-browsing (Fergus, 2003). Although some CCNPP personnel have noticed browse damage to understory forest vegetation on the CCNPP site, the damage is not yet severe (TTNUS, 2007c). Displaced deer can be expected to cause greater browsing and trampling of the understory of forested areas surrounding the proposed construction. The effects from increased browsing by displaced deer could be at least partially offset by increased hunting in public lands to the north and south.

Scarlet Tanager and Other Forest Interior Dwelling Species (FIDS): The scarlet tanager was identified as important because it represents one of several MDNR-designated FIDS (listed in "A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area" (CAC, 2000)) observed on the CCNPP Site in 2006 (TTNUS, 2007c). The construction footprint was designed to minimize fragmentation of forest cover to the extent possible. The proposed power block will be situated in an area where the forest cover has already been fragmented by the lawns and playing fields of Camp Conoy. The proposed batch plant, construction laydown areas, construction office and warehouse area, and construction parking area will be situated in areas where the forest cover has already been fragmented by former agricultural fields, dredge spoil disposal, and existing roadways. Construction of CCNPP facilities will not substantially contribute to increased fragmentation of forest cover or loss of habitat for the scarlet tanager or other FIDS.

Construction of the proposed switchyard, cooling tower, and construction offices and warehouses would encroach into areas of unfragmented forest north and east of the headwaters to Johns Creek and south of Camp Conoy. The only alternative to siting the facilities in the forested areas west and south of the proposed power block location would be to site them to the east, which would encroach into the CBCA. Construction of the facilities would therefore reduce the availability of suitable habitat in the region to the scarlet tanager and other FIDS. However, the reduction would be minimized because the forest clearing would take place in blocks beginning at the edge of the forested landscapes rather than as clearings or strips that encroach deeper into the forest interior.

Bald Eagle: The bald eagle was identified as important because of its status as a federal and state listed threatened species. Three known bald eagle nesting sites were present on the CCNPP site in 2006, although one nest was determined in 2007 to no longer be active (TTNUS, 2007c). The proposed construction footprint does not encroach within a 1,500 ft (457 meter) circular setback surrounding each of the three nesting sites. However, bald eagles established a new nest after the 2006 breeding season in a tree adjoining a ball field in Camp Conoy (Figure 2.4-2). The new nest was first observed in April 2007. Two adult bald eagles were observed circling the nest, suggesting that it was active. Because the nest is located within an area that will be impacted by construction, the Maryland Department of Natural Resources and U.S. Fish and Wildlife Service will be consulted regarding avoidance and appropriate mitigation measures.

Puritan Tiger Beetle and Northeastern Beach Tiger Beetle: The proposed construction activities would have ~~no~~little potential to affect the puritan tiger beetle or northeastern beach tiger beetle, which were identified as important because of their federal threatened status. Both species have highly specific habitat requirements that limit their potential occurrence on the CCNPP site to the sandy cliffs adjoining undeveloped shoreline stretches of the Chesapeake Bay (USFWS, 1993; USFWS, 1994). No construction activities would take place on or within 500 ft (152 m) of any cliff or beach habitats which are all located ~~further~~ south of ~~CCNPP Units 1 and 2~~of the existing barge slip. The proposed CCNPP Unit 3 intake inlet area, associated structures, and discharge pipeline have been located, and the~~s and~~ heavy haul road ~~have~~has been routed, to impact the Chesapeake Bay shoreline ~~at either~~between-the existing CCNPP Units 1 and 2 intake structure ~~or just to the south near~~and the barge slip where the shoreline consists of armored fill soil, a habitat unsuitable for either tiger beetle species.

The results of the 2006 survey (Knisley, 2006) indicated that the work proposed at the CCNPP site will not have any effect on the puritan or northeastern beach tiger beetles or their habitats. However, since the beach south of the barge slip is favorable habitat for the puritan tiger beetle, mitigation measures will consist of administrative controls such as posting signage or fencing off the beach south of the barge slip area, to restrict personnel access.

Bird Collisions: The tallest structure constructed as part of CCNPP Unit 3 is the cooling tower, with a height of 164 ft (50 m). The tower will be the tallest structure in the vicinity, which is predominantly rural. Assuming a tree canopy height of approximately 80 ft (24 m), the tower would protrude 84 ft (36 m) over the surrounding tree canopy. Because the tower would be constructed at a location with a ground surface elevation of 98 ft (30 m) above mean sea level (USGS, 1987), its top would be approximately 262 ft (80 m) above mean sea level, and hence 262 ft (80 m) above the water surface of the Chesapeake Bay.

habitats. The ditches will be constructed of base materials that promote infiltration of runoff from low intensity rainfall events. However, for large storms the infiltration capacity of the base materials will be exceeded and the overflow pipes will direct the runoff to the stormwater retention basins. The stormwater retention basins will be unlined impoundments, vegetated with regionally indigenous wetland grasses and herbs, with simple earth-fill closure on the down stream end and will include discharge piping to the adjacent watercourses.

Construction impacts to water resources will be avoided or minimized through best management practices and good construction engineering practices such as stormwater retention basins and silt screens (MDE, 2007b). The Stormwater Pollution Prevention Plan, which provides explicit specifications to control soil erosion and sediment intrusion into wetlands, streams and waterways will be followed. The Spill Prevention, Control and Countermeasure Program will also be used to clean up and contain oil spills from construction equipment to avoid or minimize the impact to wetlands and waterways.}

4.3.2.2 Impacts to {Chesapeake Bay}

{As discussed in Section 2.4.2, 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 CCNPP site 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 compared to other areas of the Chesapeake Bay. Estuarine species that use the Chesapeake 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 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 CCNPP site area that is federally managed, and for which EFH has been designated. 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 waters with normal shelf salinities (greater than 25 parts-per-thousand).

The threatened and endangered species known to occur in the area are two species of sturgeon and two 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.

No effects of sedimentation or runoff into the Chesapeake Bay are expected. However, construction of the CWS intake ~~structure~~inlet area and discharge pipeline, and enlargement of the barge slip, will cause some disturbance in the Chesapeake Bay. As described in Section 4.2.1, a sheet pile cofferdam and dewatering system ~~will~~may be installed on the south side of the CCNPP Units 1 and 2 intake structure to facilitate the construction of the CCNPP Unit 3

~~circulating and service water~~CWS intake piping and trash rack structure ~~and pump house~~. Pilings may also be driven into the seabed to facilitate construction of new discharge system piping. Enlargement of the barge slip is estimated to require removal of about 15,000 cubic yards (11,500 cubic meters) of sediment. Dredging of the barge slip would result in increased suspended sediment in the immediate area for approximately two weeks. Excavation and dredging of the CWS intake ~~structure~~piping-area would have similar effects. All dredging will conform to guidance provided by the Maryland Port Authority and dredging permit conditions including mitigation measures to minimize suspended sediment and other impacts.

Dredging inevitably causes an increase in suspended sediment in the immediate area, and may result in a plume of suspended sediment some distance from the site. In a study of the effects of hopper dredging in Chesapeake Bay, near-field concentrations of suspended sediment, < 980 ft (< 300 m) from the dredge, reached 840 to 7,200 mg/L or 50 to 400 times the normal background level. Far-field concentrations (> 980 ft (> 300 m)) were enriched 5 to 8 times background concentrations and persisted 34% to 50% of the time during a dredging cycle (1.5 to 2.0 hr) (Nichols, 1990).

The ecological effect of the suspended sediment depends on a variety of factors, including the type of dredge used, the timing and duration of the dredging, the particle size of the suspended sediment, the presence of toxins in the sediment, the success of environmental controls to contain suspended sediment, and the life stage of the species present. Both short term direct behavioral effects (such as entrainment, turbidity, fish injury, and noise) and long term cumulative effects (such as possible contaminant release and habitat alteration) on marine organisms can result from dredging (Nightingale, 2001). Although effects may be similar, concern is often greater at the disposal site than at the dredge site; controversy over the effects of disposal of dredge spoils in the Chesapeake Bay has been ongoing since the 1970s (MSG, 2000). A thorough independent scientific investigation of the effects of disposing of large volumes of sediment in a deep channel of the Chesapeake Bay concluded that, apart from possibly affecting migrating sturgeon, no significant biological effects resulted from the deposition of sediment in the channel. Although this study is not directly applicable to the small-scale dredging proposed for CCNPP Unit 3, it serves as reassurance that the Chesapeake Bay is so large, and has such an enormous volume of water flowing through it, that even extremely large disturbances, such as the deposition of dredged material from Baltimore Harbor, have a negligible long term effect on the Chesapeake Bay ecosystem (MSG, 2000).

Small-scale dredging like that required to construct CCNPP Unit 3 is not considered a significant impact to the Chesapeake Bay. A report by the NOAA Chesapeake Bay Office, developed by a Technical Advisory Panel comprised of top fisheries scientists from area universities and senior government fisheries scientists, presented a Fisheries Ecosystem Plan for the Chesapeake Bay; it is notable that the only mention of the effects of dredging in the 450 page report were the following two general statements: "Dredging and the displacement of dredge spoil to other parts of the Chesapeake Bay can affect fish and shellfish by removing or inundating slow-moving or sessile species and their prey. Dredge spoil can also reintroduce sedimentary inventories of nutrients and contaminants into the water" (Chesapeake Bay Fisheries Ecosystem Advisory Panel (NOAA, 2006)). The report also acknowledged that the effects of even widely-used methods of harvest that disturb bottom sediments, such as trawling and crab dredging, remain unknown.

Excavation and dredging of the intake structure, discharge pipe, and barge slip will continue through CCNPP site preparation into plant construction. Excavated and dredged material will be transported to the onsite Lake Davies dredge spoils area as shown in Figure 4.3-1. Figure 3.4-8 show the show location of the intake and outfall structures areas and the barge slip.

Important species in the project area that may be temporarily affected by dredging include eggs, larvae, and adults of invertebrates and fishes. Based on the monitoring of the baffle wall and intake screens for CCNPP Units 1 and 2, Bay anchovy and Atlantic menhaden are the most common mid-water fish species in the immediate area (EA, 2006). These species may be temporarily affected by high levels of suspended sediment, which can interfere with foraging and respiration, as well as cause dermal abrasion to delicate fishes. No invertebrate sampling data are available in the intake area. In a study of dredging in Chesapeake Bay, benthic communities survived the deposition of suspended sediment despite the exceedance of certain water quality standards (Nichols, 1990).

No threatened or endangered species are expected to be affected by the proposed dredging. During the license renewal review process in 1999 for CCNPP Units 1 and 2, the National Marine Fisheries Service concluded that CCNPP license renewal would not adversely affect either the shortnose sturgeon or the loggerhead turtles because the CCNPP Units 1 and 2 discharge/intake do not lie within the areas normally used by either species (NRC, 1999). Neither the shortnose sturgeon nor the loggerhead turtle has been found impinged on the CCNPP Unit 1 and 2 intake screens during the 21 years of monitoring data (NRC, 1999).

The assemblage of aquatic species present near the CCNPP site varies throughout the year, due to spawning and migration patterns of individual fish and invertebrate species, as described in Section 2.4.2. The season of the year in which dredging and construction occur would determine to a large extent the impact on specific aquatic resources within the Chesapeake Bay. However, because the area to be dredged is small and in a protected near shore area that is in close proximity to an area already dedicated to intake and other industrial functions, the overall impact on eggs and larvae is expected to be SMALL and TEMPORARY.}

4.3.2.3 Impacts on the Transmission Corridor and Offsite Areas

{The new transmission lines do not cross over any onsite water bodies. At one point, the transmission corridor right-of-way is near Johns Creek. No important aquatic species and their habitat will be impacted by the transmission corridor.

Transmission line construction will be limited to onsite construction of short connections from the new switchyard to the existing 500 kV transmission line that runs from near the center of the CCNPP site northward. Construction of a 500 kV transmission line from the CCNPP Unit 3 switchyard to the existing 500 kV transmission line on the CCNPP site will require clearing trees in 0.31 acres (0.13 hectares) of additional forested wetlands in Wetland Assessment Area IV (adjoining 520 linear feet (158 m) of intermittent stream channel), as well as in 1.85 acres (0.75 hectares) of additional forested uplands designated as non-tidal wetland buffer by Calvert County. No grading will be conducted in the subject wetlands or wetland buffer; disturbance will be limited to tree and shrub removal only. Surface soils within the affected wetlands and buffer will remain undisturbed, as will the pattern of surface runoff. The vegetation impacts to the affected wetlands and buffer are necessary because trees growing close to a 500 kV electric conductor must be removed to prevent possible outages. The transmission line is needed to convey electric power generated by the CCNPP Unit 3 power block to existing transmission lines that connect to the regional power grid.

The onsite transmission corridor for CCNPP Unit 3 is within the construction area. The information provided above pertaining to control of erosion and sedimentation applies to streams and wetlands within the transmission corridor.

No incremental effect on aquatic resources beyond what currently occurs within the transmission corridor is expected for the construction of CCNPP Unit 3.

Table 4.3-1—{Vegetation (Plant Community) Impacts in Acres (Hectares) Construction of Proposed CCNPP Unit 3}

(Page 1 of 1)

			Permanent Losses					Temporary Losses					
Habitat (Plant Community Type)	Forest (MDNR Definition)	Wetland (Federal and MDE Definition)	CBCA IDA 0-100′ (0-30 meters)	CBCA IDA 100-1,000′ (30 -305 meters)	CBCA RCA 0-100′ (0-30 meters)	CBCA RCA 100-1,000′ (30 -305 meters)	Rest of Site	CBCA IDA 0-100′ (0-30 meters)	CBCA IDA 100-1,000′ (30 -305 meters)	CBCA RCA 0-100′ (0-30 meters)	CBCA RCA 100-1,000′ (30 -305 meters)	Rest of Site	Total
Lawns/Developed Areas	No	No	1.33~~0.25~~ (~~0.10~~0.54)	1.76 (0.71)	-	5.21 (2.11)	19.33 (7.82)	-	-	-	-	24.30 (9.80)	~~50.85~~51.93 (~~20.58~~21.01)
Old Field Vegetation	No	No	0.09 (0.04)	1.13 (0.46)	-	0.23 (0.09)	27.35 (11.07)	-	-	-	-	96.00 (38.80)	124.80 (50.50)
Mixed Deciduous Forest	Yes	No	0.01 (0.004)	~~13.96~~14.75 (~~5.65~~5.9)	-	5.20 (2.10)	133.81 (54.15)	-	-	-	-	26.44 (10.70)	~~179.42~~180.21 (~~72.61~~72.92)
Mixed Deciduous Regeneration Forest	Yes	No	-	-	-	-	36.28 (14.68)	-	-	-	-	12.00 (4.90)	48.28 (19.54)
Well-Drained Bottomland Deciduous Forest	Yes	No	-	-	-	-	1.37 (0.55)	-	-	-	-	0.05 (0.02)	1.42 (0.57)
Poorly Drained Bottomland Deciduous Forest	Yes	Yes	-	0.15 (0.06)	-	0.50 (0.20)	8.87 (3.59)	-	-	-	-	0.31 (0.13)	9.83 (3.98)
Herbaceous Marsh Vegetation	No	Yes	-	0.05 (0.02)	-	0.02 (0.01)	1.74 (0.70)	-	-	-	-	1.63 ()	1.81 (0.73)
Successional Hardwood Forest	Yes	No	-	-	-	1.71 (0.69)	3.50 (1.40)	-	-	-	-	7.82 (3.16)	13.03 (5.27)
Open Water	No	Yes	-	0.02 (0.01)	-	0.01-(0.01)-	2.66 (1.08)	-	-	-	-	-	2.69 (1.09)

ER Section 4.0

Table 4.3-1—{Vegetation (Plant Community) Impacts in Acres (Hectares) Construction of Proposed CCNPP Unit 3}

(Page 1 of 1)

Habitat (Plant Community Type)	Forest (MDNR Definition)	Wetland (Federal and MDE Definition)	Permanent Losses: CBCA IDA 0-100′ (0-30 meters)	Permanent Losses: CBCA IDA 100-1,000′ (30-305 meters)	Permanent Losses: CBCA RCA 0-100′ (0-30 meters)	Permanent Losses: CBCA RCA 100-1,000′ (30-305 meters)	Permanent Losses: Rest of Site	Temporary Losses: CBCA IDA 0-100′ (0-30 meters)	Temporary Losses: CBCA IDA 100-1,000′ (30-305 meters)	Temporary Losses: CBCA RCA 0-100′ (0-30 meters)	Temporary Losses: CBCA RCA 100-1,000′ (30-305 meters)	Temporary Losses: Rest of Site	Total
Total			~~0.35~~1.43 (~~0.14~~0.57)	~~17.07~~17.86 (~~6.91~~7.22)	-	12.86 (5.20)	233.58 (94.53)	-	-	-	-	166.61 (67.35)	~~432.13~~436.5 (~~174.88~~176.64)
			Total Permanent: ~~263.86~~265.73 (~~106.78~~108.10)					Total Temporary: 170.77 (69.11)					

Notes:

- MDNR: Maryland Department of Natural Resources
- MDE: Maryland Department of the Environment
- CBCA: Chesapeake Bay Critical Area
- IDA: Intensive Developed Area (within CBCA)
- RCA: Resource Conservation Area (within CBCA)

ER Section 4.0

outages. This increase in fresh water demand correlates to an increase in makeup water demand for the desalinization plant of approximately 39 gpm (148 lpm) at a 40% recovery rate. Sanitary effluents are estimated at 20 gpm (76 lpm), during normal operations, and would increase to 36 gpm (136 lpm) during major outages, which is the design capacity for the conceptual design of the Waste Water Treatment Plant. These increases represent relatively small fractions of the Chesapeake Bay demand and plant effluent.}

5.2.1.2.1 Surface Water

{CCNPP Unit 3} is designed to use the minimum amount of water necessary to ensure safe, long-term operation of the plant. {~~The intake for CCNPP Unit 3 will be located inside the existing intake structure for CCNPP Units 1 and 2.~~The intake for the pipes supplying the CWS and UHS intake forebay for CCNPP Unit 3 will be located on a protected section of shoreline adjacent to the south side of the existing intake structure for Units 1 and 2. The discharge outfall piping will enter the bay near the existing barge slip and extend approximately 550 ft (170 m) offshore through a 30 in (80 cm) diameter buried pipe to a multi-port diffuser system. Additional details on the intake and discharge systems are presented in Section 3.4. Water withdrawals for the operation of CCNPP Unit 3 are described in detail in Section 3.3.1.}

5.2.1.2.1.1 Plant Construction

The primary water demands during construction are concrete mixing and curing, dust control, and potable water. Water for construction will come from {the existing CCNPP Units 1 and 2 onsite groundwater production wells, trucked in supply, desalinization plant, and storage tanks. Estimated average construction water demand is 250 gpm (946 lpm) during working hours (i.e. 8 hours per day, 265 days per year), and the peak water use is estimated at 1,200 gpm (4,542 lpm). Construction uses of water are described in more detail in Table 5.2 2.

Any groundwater withdrawals made to support CCNPP Unit 3 construction will be performed within the limits of existing groundwater permit for CCNPP Units 1 and 2. It is anticipated that groundwater needs will be reduced during the final construction years when the desalinization plant becomes operational to meet freshwater supply needs. Groundwater withdrawals will not be made to support operation of CCNPP Unit 3.

Construction water use is assumed to be entirely consumptive. Groundwater withdrawals required for construction of CCNPP Unit 3 will be small and temporary, and the effect on the groundwater supply will be small. Section 4.2 further addresses water-related impacts of plant construction.}

5.2.1.2.1.2 Circulating Water Supply System

{CCNPP Unit 3 will utilize a closed-loop Circulating Water Supply System (CWS). The system will use a single mechanical draft cooling tower for heat dissipation. The CWS cooling tower is a hybrid design wherein heat is added just above the demisters to evaporate all the entrained water that would pass through the demisters and eliminate the visible plume. The cooling tower system requires makeup water to replace that lost to evaporation, drift (entrained in water vapor), and blowdown (water released to purge solids).

Makeup water for the hybrid mechanical draft CWS cooling tower system will be withdrawn from the Chesapeake Bay. As indicated in Section 3.4, makeup water for the CWS will be pumped at a maximum rate of 40,440 gpm (153,082 lpm). At the maximum makeup rate, water lost by evaporation and blowdown returned to Chesapeake Bay will each be approximately equal at 20,200 gpm (76,465 lpm). Average makeup water flow to the Circulating Water Supply System is expected to be approximately 34,748 gpm (131,535 lpm), with water lost by

Circulating Water Supply System is expected to be approximately 34,748 gpm (131,535 lpm), with water lost by evaporation and blowdown returned to Chesapeake Bay each being approximately equal at 17,355 gpm (65,695 lpm).

The water balance is affected minimally by drift. Maximum drift losses will be less than 0.0005% of the circulating water flow (785,800 gpm (3.0 million lpm)). This results in a maximum drift of 3.9 gpm (14.8 lpm).

The cooling tower will operate at 2 cycles of concentration. Minimum makeup and blowdown values occur at this value. If evaporation and drift are not changed, makeup is reduced to approximately two thirds of its maximum value and blowdown is reduced to approximately one third of its maximum value.

The Essential Service Water System (ESWS), under normal plant operations with two trains operating, will operate at a nominal recirculated flow rate of approximately 19,075 gpm (72,207 lpm). The maximum fresh water makeup rate from the desalinization plant required under normal operations is estimated to be 629 gpm (2,381 lpm) to offset maximum evaporation rate (approximately 566 gpm (2.142 lpm)), maximum blowdown rate (approximately 61 gpm (4,231 lpm)), and drift loss (approximately 2 gpm (8 lpm).

Water released to the Chesapeake Bay as blowdown is not lost to downstream users or downstream aquatic communities. Evaporative losses and drift losses are not replaced and are considered "consumptive" losses.}

5.2.1.2.1.3 {Desalinization Plant

During operations, CNPP Unit 3 will not withdraw groundwater for use at the site. Consequently, operation of CCNPP Unit 3 will require a consistent source of fresh water makeup for cooling purposes. A reverse-osmosis (RO) desalinization plant will be used to provide fresh water for the plant demineralized water system, potable and sanitary water systems, and UHS makeup water system. The desalinization plant will use stage media filtration, with a one pass seawater reverse osmosis (SWRO) at 40% recovery. The system will also include seawater feed pumps, multimedia filters, chemical injection system, and an RO permeate tank. The Chesapeake Bay will be the source of water for the desalinization plant.

The desalinization plant will remove the high concentration of salts and minerals from the Chesapeake Bay source water. During the production of desalinated water, a percentage of the source water is concentrated and is unusable. The product water recovery relative to input water flow is 15% to 50% for most seawater desalinization plants. That is, for every 100 gal (379 L) of seawater, 15 to 50 gal (57 to 189 L) of desalinated water is produced along with brine wastewater containing a higher concentration of dissolved solids. A desalinization plant's recovery rate varies, mainly because plant operations and efficiencies depend on site-specific conditions. Depending on the efficiency of the desalinization plant, briny wastewater could represent as much as 85% of the intake water (CCC, 2004).

The general process of reverse osmosis is described as follows. High pressure makeup water enters the RO trains, where the water passes through the membranes, and the dissolved salts are rejected. Permeate, or product water, is collected from the end of each membrane element, and becomes the product of the purification process. As the raw water flows along the "brine channel", or coarse medium, it becomes increasingly more concentrated.

This concentrated raw water is called the reject stream, or concentrate stream. Operation at 50% recovery would result in a reject stream that is twice as concentrated as the feed, which is essentially the same concentration as the blowdown from the CWS cooling tower. The desalinization plant is expected to operate at a 40% recovery rate that will result in a less concentrated reject stream. The reject stream carries the concentrate from the RO trains to the waste water retention basin prior to being released to the Chesapeake Bay along with the cooling tower blowdown.

Preliminary studies indicate that desalinization plant water capacity will be 1,750,000 gpd (1,215 gpm, or 4,599 lpm). Desalinization plant demand for CCNPP Unit 3 will be approximately 1,250,000 gpd (4,731,000 lpd), with an additional capacity of 500,000 gpd (1,893,000 lpd) available. The conceptual water requirements for the systems that will be served by the desalinization are shown in Table 5.2-1.

Makeup water for the desalinization plant will be taken from the makeup line for the CWS, which utilizes the Chesapeake Bay as its source. The desalinization plant will have a membrane filtration pretreatment followed by the reverse osmosis process. Therefore, assuming 10% filtration waste and operation at 40% recovery, 3.89 million gpd (14.7 million lpd) of water will be

The desalinization plant reject stream would be directed to a retention pond where it will mix with, and be diluted by, circulating water blowdown from CCNPP Unit 3 prior to discharge to the Chesapeake Bay.}

5.2.1.2.2 Groundwater Use

{Groundwater monitoring wells are installed on the site to study and model the groundwater in the CCNPP site vicinity as described in Section 2.3. Groundwater withdrawals will not be used to support operation of CCNPP Unit 3. Groundwater withdrawals during construction are discussed in Section 4.2. As discussed in Section 2.3.2, temporary groundwater dewatering controls are expected during construction activities; however, a permanent groundwater dewatering system is not anticipated to be a design feature for the CCNPP Unit 3 facility.}

5.2.1.3 Hydrological Alterations

Operational activities that could result in hydrological alterations within the site and vicinity and at offsite areas are described in Sections 3.3, 3.4, and 3.7.

{The principal hydrological alteration onsite associated with CCNPP Unit 3 will occur during construction, when at least one impoundment and several tributaries to Johns Creek will be filled. Some onsite streams may be impacted by either sedimentation or reduced water flow due to measures taken to reduce sedimentation, as described in Section 4.3.2. Once construction is completed, and normal operations begin, it is expected that the streams will experience little ongoing impact.

There have been no clearly discernible onsite or offsite effects of hydrologic alterations for operation of CCNPP Units 1 and 2, and the supply of surface water and groundwater has been sufficient. Operation of CCNPP Unit 3 with a closed loop cooling system will result in much smaller effects on withdrawals and discharges and correspondingly reduced operational effects than would be expected for an open loop cooling system. The provision of a desalinization plant will provide adequate fresh water for operation of CCNPP Unit 3 systems, and will have some additional capacity.

~~The CCNPP Unit 3 intake structure will be located within the existing intake area for CCNPP Units 1 and 2. A sheet pile cofferdam and dewatering system will be installed on the south side~~

~~of the CCNPP Unit 1 and 2 intake structure to facilitate construction of the CCNPP Unit 3 circulating and service makeup water intake structure and pump house.~~ The actual CCNPP Unit 3 intake pumphouse structure will be located in a forebay constructed on the shoreline terrace north of the barge slip within the existing intake area for CCNPP Units 1 and 2. Seawater will be supplied via two pipelines reaching the Chesapeake Bay shoreline near the south side of the CCNPP Unit 1and 2 curtain wall. A sheet pile cofferdam and dewatering system will be installed on the south side of the CCNPP Unit 1 and 2 intake structure to facilitate construction of in the CCNPP Unit 3 shoreline intake piping and trash rack area. A rip-rap seawall extending approximately 75 ft (22.9 m) north from the shoreline, east of the pipeline entrance, and rip-rap along the shoreline will be used to protect the pipeline entrance point. circulating and service water intake structure and pump house. Pilings may also be driven to facilitate construction of new discharge system piping.

~~Excavation and dredging of the intake structure, pump house erection~~Excavation and dredging of the shoreline entrance area for the seawater supply pipelines and trash rack, fish return outfall from the new forebay intake structure, pump house erection and the installation of mechanical, piping, and electrical systems follow the piling operations and continue through site preparation into plant construction. Excavated and dredged material will be transported to an onsite spoils area located outside the boundaries of designated wetlands.

The barge slip will be dredged to accommodate the construction shipments. New sheet pile will be installed and 15,000 yds^3 (11,500 m^3) of spoils are estimated to be generated from this activity. No maintenance dredging had been performed to keep the slip open and none is anticipated after the construction shipments are received. Placement of the discharge pipeline will require excavating and backfilling a trench on the Chesapeake Bay floor. No additional spoils are expected to be generated.

Dredging of the barge slip, ~~intake, and~~shoreline pipeline entrance and fish return outfall areas are expected to be one time event and are not expected to require maintenance dredging. Consequently, any hydrologic alterations, such as disruption of the longshore current and drift mechanism, are expected to be local, transitory, reversible, and small. Additionally, based on operational experience at CCNPP Units 1 and 2, it is expected that no maintenance dredging will be needed to keep the ~~intake area clear.~~shoreline pipeline entrance clear. However, since the common forebay will also act as a siltation basin, dredging may be required to maintain the forebay depth and intake area clearances.

5.2.2 WATER USE IMPACTS

5.2.2.1 Surface Waters

5.2.2.1.1 Consumptive Use

{The maximum evaporation loss for the Unit 3 CWS cooling tower system is estimated to be approximately 20,200 gpm (76,500 lpm). Additionally, makeup water for the ESWS cooling towers is normally supplied from the plant potable water system (e.g., desalinization plant). Evaporation from the circulated ESWS flow will occur at the cooling towers, and will be approximately 940 gpm (3,558 lpm).

Consumptive uses of water during construction of CCNPP Unit 3 include concrete mixing and curing, dust control, and potable and sanitary water. Peak consumptive water use will occur for several years during construction, and will be 39.3 million gpy (148 million lpy). A breakdown of construction water use by year is provided in Table 5.2-2.

The Chesapeake Bay contains nearly 18 trillion gallons (68 trillion liters) of water and is refreshed by rivers at an annual average rate of 77,500 ft^3/s (2,190 m^3/s), and a flowrate of 30,800 ft^3/s (872 m^3/s) during periods of low freshwater input to the Chesapeake Bay. The volume of water that will be lost to evaporation from the CCNPP Unit 3 cooling towers and ESWS cooling towers is negligible compared with the amount of water in the Chesapeake Bay, and consumptive losses of this magnitude will not be discernible. No measurable impact of consumptive water use on the Chesapeake Bay water level is expected, and operation of CCNPP Unit 3 will therefore have a SMALL impact on the availability of water from the Chesapeake Bay.}

5.2.2.1.2 Non-Consumptive Use

{Non-consumptive uses of water downstream from the plant are described in Section 2.3.2.1.3. The major non-consumptive surface water use categories in the vicinity of the site are recreation, fisheries, marinas, parks, and transportation. The recreational activities include swimming, fishing and boating along the Patuxent River and in the Chesapeake Bay. Fisheries in the Chesapeake Bay are described in Section 2.4.2. Transportation on the Chesapeake Bay will not be affected by the construction or operation of CCNPP Unit 3. No effect on fisheries navigation, or recreational use of the Chesapeake Bay is expected.

The existing intake system for CCNPP Units 1 and 2 includes an intake channel, and an embayment established by a curtain wall. ~~The CCNPP Unit 3 intake for the CWS will be located on the southern edge of the intake embayment, while the intake for the UHS makeup system will be located to the east immediately adjacent to the CWS intake. The CCNPP Unit 3 intakes will be set back from the intake embayment and situated at the end of a 123 ft (37 m) long, 100 ft (30 m) wide channel.~~The CCNPP Unit 3 intake will be located in a forebay constructed on the shoreline terrace approximately 500 ft (152.4 m) south of the southern edge of the CCNPP Units 1 and 2 curtain wall. Seawater will be supplied to the forebay via two intake pipes running south from a protected area of the shoreline. The CWS pumphouse will be at the northern end of the forebay and the UHS pumphouse will be at the southern end. Based on operational experience at CCNPP Units 1 and 2, it is expected that no maintenance dredging will be needed to keep the intake area clear.

The CCNPP Unit 3 CWS and UHS makeup intakes will meet the U.S. Environmental Protection Agency (EPA) Phase 1 design criteria, as described in Section 5.3.1.1. The overall percentage of Chesapeake Bay water entrained will remain less than 1%, with the maximum additional makeup required to meet the CCNPP Unit 3 cooling water requirement of 40,440 gpm (153,082 lpm).

While fish impingement and entrainment will occur, CCNPP Unit 3 will employ the impingement/entrainment mitigation techniques (low velocity approach, screens, etc.) currently utilized by CCNPP Units 1 and 2 to minimize the impact on aquatic resources. ~~The fish loss associated with impingement/entrainment will be negligible.~~A fish return system and outfall will be used at the CCNPP Unit 3 CWS makeup water intake to reduce the mortality of aquatic species. Details of the fish return system are provided in Section 3.4.

Design approach velocities for both CCNPP Unit 3 intake structures will be less than 0.5 ft/s (0.15 m/s). The intake structures will incorporate fish and invertebrate protection measures that maximize impingement survival. The through trash rack and through screen mesh flow velocities will be less than 0.5 ft/s (0.15 m/s). The screen wash system ~~will~~ provides a pressurized spray to remove debris from the water screens. In both intake structures, ~~there is~~ a fish return system is provided even thoughthe flow velocities through the screens are less than 0.5 ft/s (0.15 m/s) in the worst case scenario (minimum Chesapeake Bay level with highest makeup demand flow). The fish return system and outfall, as described in Section 3.4, will be used at the CCNPP Unit 3 CWS makeup water intake to reduce the mortality of aquatic species.

U.S. EPA declared the Chesapeake Bay an impaired water body in 1998 under the Federal Water Pollution Control Act because of excess nutrients and sediments. The area of the Chesapeake Bay near the CCNPP site is included in the Maryland Clean Water Act Section 303(d) list for impaired watersheds. Chesapeake Bay water is required to meet federal regulatory water quality standards by 2010. The potential effects of the discharge from all CCNPP units will be considered in developing the NPDES Permit for CCNPP Unit 3. CCNPP Unit 3 will comply with the applicable State of Maryland regulations requiring the design of the cool ing water intake and discharge structures to incorporate the Best Technology Available (BTA) to minimize adverse environmental impacts. (COMAR 2007c) The primary external impact will be the discharge of cooling tower blowdown water to the Chesapeake Bay. The CCNPP maximum Unit 3 CWS cooling tower discharge is estimated to be 20,200 gpm (76,500 lpm). A common retention basin will hold cooling tower blowdown and effluents from the Desalination Plant and wastewater treatment plant before discharging, further reducing thermal impacts to receiving waters. Effluent from the retention basin, which will contain dilute quantities of chemicals and dissolved solids, and be slightly elevated in temperature. will be discharged to the Chesapeake Bay within the limits of the NPDES permit. When discharged and diluted, this small amount of slightly contaminated water, approximately 0.001% of low flow cond itions in the Chesapeake Bay, would be expected to have SMALL impacts.}

5.2.2.2 Groundwater

{Groundwater withdrawals will not be used to support operation of CCNPP Unit 3. Limited groundwater withdrawals are anticipated to support CCNPP Unit 3 construction and will be performed within the limits of existing groundwater permit for CCNPP Units 1 and 2. It is anticipated that groundwater needs will be reduced during the final construction years when the desalinization plant becomes operational to meet freshwater supply needs for the operation of CCNPP Unit 3. Thus, the operation of CCNPP Unit 3 will have no impact on the inventory of local groundwater systems.}

5.2.3 WATER QUALITY IMPACTS

{Water quality data for the Chesapeake Bay are presented in Section 2.3.3. The U.S. EPA declared the Chesapeake Bay as an impaired water body in 1998 based on the Federal Water Pollution Control Act (USC, 2007) because of excess nutrients and sediments. The Chesapeake Bay water is required to meet Federal regulatory water quality standards by 2010.}

5.2.3.1 Chemical Impacts

{The area of the Chesapeake Bay near the CCNPP site is included on the Maryland Clean Water Act Section 303(d) list. The effects of the discharge from all CCNPP units will be considered in developing the National Pollutant Discharge Elimination System (NPDES) Permit for CCNPP Unit 3.

CCNPP Unit 3 will utilize cooling tower based heat dissipation systems that remove waste heat by allowing water to evaporate to the atmosphere. The water lost to evaporation must be continuously replaced with makeup water. To prevent build up of solids, a small portion of the circulating water stream with elevated levels of solids is drained or blown down.

Because cooling towers concentrate solids (minerals and salts) and organics that enter the system in makeup water, cooling tower water chemistry must be maintained with anti-scaling compounds and corrosion inhibitors. Similarly, because conditions in cooling towers are

5.3 COOLING SYSTEM IMPACTS

This section describes potential impacts from operation of the cooling systems at {CCNPP Unit 3. The CCNPP Unit 3 Circulating Water Supply System (CWS) and Essential Service Water System (ESWS) (Ultimate Heat Sink (UHS)) will be closed-cycle systems. Water is recirculated through cooling towers to remove waste heat. Thus, the amount of water necessary for these systems is small compared to that of once-through cooling systems. To replace evaporative losses, blowdown, and drift losses, makeup water from the Chesapeake Bay is supplied to the CWS and to the ESWS under post-accident conditions lasting longer than 72 hours. In addition, Chesapeake Bay waters are supplied to the desalinization plant, which, in turn, supplies makeup water to the cooling towers associated with the ESWS during normal and shutdown/coldown conditions.

Potential physical and aquatic impacts are associated with water withdrawal at the intake structures, heat dissipation to the atmosphere, and elevated temperature of the blowdown as it ~~is~~ returns~~ed~~ to the Chesapeake Bay}.

5.3.1 INTAKE SYSTEM

{The existing intake system consists of the CCNPP Units 1 and 2 intake channel, and an embayment established by a curtain wall. The CCNPP Unit 3 intake for the CWS makeup will be ~~located on the southern edge of the intake embayment, and the intake for the UHS makeup will be located to the east immediately adjacent to the CWS intake. The CCNPP Unit 3 intakes will be set back from the intake embayment and situated at the end of a 123 ft (38 m) long, 100 ft (31 m) wide channel.~~ located in a forebay constructed on the shoreline terrace approximately 500 ft (154.2 m) south of the southern edge of the Units 1 and 2 curtain wall. Seawater will be supplied to the forebay via two intake pipes running south from a protected area of the shoreline. The CWS pumphouse will be at the northern end of the forebay and the UHS pumphouse will be at the southern end. Section 3.4 provides the details regarding the design of these structures and systems.

The desalinization plant is the source of the makeup water for the ESWS during normal and shutdown/cooldown conditions. The desalinization plant is supplied by the Chesapeake Bay via the intake structure for the CWS.

Section 3.4.1.1.1 identifies that the maximum makeup rate from Chesapeake Bay to the CWS and desalinization plant is 43,490 gpm (164,590 lpm). This accommodates the maximum evaporation rate, maximum blowdown rate, and drift loss for the CWS cooling tower, and the demand for the desalinization plant.

Section 3.4.1.2 identifies that the maximum makeup rate from the Chesapeake Bay to the ESWS cooling towers will be 3,748 gpm (14,188 lpm) to accommodate the maximum evaporation rate and drift loss for two ESWS cooling towers (UHS) during design basis accident conditions.

The flow velocity into the existing intake channel from the Chesapeake Bay is no more than 0.5 ft/sec (0.15 m/sec). The flow through the CCNPP intake ~~channel~~pipes is determined by plant operating conditions. Velocities also depend on the water level of the Chesapeake Bay. At the minimum Chesapeake Bay operating level (-4.0 ft NGVD 29 (-1.2 m NGVD 29)), the flow velocity along the CCNPP Unit 3 intake ~~channel~~forebay would be less than 0.5 ft/sec (0.15 m/sec), based on the CCNPP Unit 3 maximum cooling water intake flow as discussed in Section 3.4.2.1. The flow velocities at the CWS and UHS makeup intake structures would be less than 0.3 ft/sec (0.09 m/sec), and less than 0.1 ft/sec (0.03 m/sec), respectively as flow velocities are discussed in Section 3.4.2.1.

m/sec), and less than 0.1 ft/sec (0.03 m/sec), respectively as flow velocities are discussed in Section 3.4.2.1.

For the CWS makeup water intake structure, flow from two traveling band screens and trash racks flows to a common forebay that feeds the three CWS makeup pumps. The through-trash rack and through-screen mesh flow velocities will be less than 0.5 ft/sec (0.15 m/sec). The screen wash system consists of two screen wash pumps that provide a pressurized spray to remove debris from the water screens. In both intake structures, there is a fish return system, and the flow velocities through the screens are less than 0.5 ft/sec (0.15 m/sec) in the worst case scenario (minimum Chesapeake Bay level with highest makeup demand flow) as discussed in Section 3.4.2.1. The fish return system, described in Section 3.4, will be provided to reduce mortality of aquatic species.}

{CCNPP Unit 3 CWS intake has a fish collection and holding facility similar to that of Units 1 and 2. It is located on the east side of the CCNPP Unit 3 intake fore bay. Screen wash water and fish collected from CCNPP Unit 3 cooling water makeup intake structure traveling screens are diverted to the CCNPP Unit 3 fish return facility and released to the bay via a buried conduit to the shoreline. Conduit outfall is submerged below tide level to minimize drop at the exit and facilitate fish return to the bay. The pipe will be installed 4 ft (1.22 m) below the Chesapeake Bay bottom and will emerge 40 ft (12.2 m) channelward. The outfall location will be protected with a 10 ft (3.1m) by 10 ft (3.1m) riprap apron extending approximately 48 ft (14.63 m) channelward. The installation of the pipe will require removal of 40 linear ft (12.2m) of the existing shoreline revetment and approximately 500 yd^3 (582.3 m^3) of material within the dredged work area. The dredged material will be returned to the trench after the pipe is placed and existing revetment will be restored to its original design. Section 3.4 provides the details of the fish return system as well as construction activities.}

In the UHS makeup water intake structure, one makeup pump will be located in each pump bay, along with one dedicated traveling band screen and trash rack.

5.3.1.1 Hydrodynamic Descriptions and Physical Impacts

Physical impacts of cooling water intake operation could include alteration of site hydrology {and increased sediment scour. Given that the amount of additional cooling water withdrawn for CCNPP Unit 3 is small compared to that of CCNPP Units 1 and 2 and that the CCNPP Unit 3 intake ~~pipess~~ pipes are located within the existing intake embayment, any incremental effects will be small. Design of the intake configuration for CCNPP Units 1 and 2 followed extensive hydrodynamic modeling including development of a physical scale model of the Chesapeake Bay area potentially affected by the facility. The purpose was to develop an intake system that would minimize hydraulic and ecological impacts on the Chesapeake Bay (BGE, 1970).

Hydrographic information relevant to potential physical impacts attributable to the CCNPP intakes includes water temperature, salinity, tidal excursion, depth, ambient velocities and circulation in the area of the intake. Maximum tidal flow past CCNPP was estimated to be about 1,500,000 ft^3/sec (42,475 m^3/sec), and the average flow was about 800,000 ft^3/sec (22,653 m^3/sec). Tidal excursion in the vicinity of CCNPP site was determined to extend about 6 mi (9.6 km). The CCNPP Units 1 and 2 design cooling water withdrawal rate (5,400 ft^3/sec (152 m^3/sec)) was found to represent less than one percent of the tidal flow and about six percent of non-tidally influenced flow (BGE, 1970). In-situ monitoring indicated salinity and temperature stratification during summer. Salinity increased with depth and temperature decreased. The additional cooling water intake flow required for CCNPP Unit 3 will increase the total site withdrawal from Chesapeake Bay by about 2%.

Design criteria that resulted from the model study included: 1) a limitation on change in temperature rise across the condensers; 2) the withdrawal of cooler waters from below the thermocline; 3) limiting impact on organisms in the upper photosynthetic zone; and 4) intake velocities less than 0.5 ft/sec (0.15 m/sec). Construction of a curtain wall outboard of the intake structures was undertaken to address these design criteria (BGE, 1970). Collectively, these mitigating measures serve to limit the potential impact of the addition of a closed-cycle unit to the CCNPP site.

Because the intake velocities approaching the CCNPP Unit 3 intake structures are expected to be low, periodic dredging may not be required to maintain intake ~~channel~~forebay elevation as discussed in Section 3.4.2.1. Dredging activities will be performed in accordance with U.S. Army Corps of Engineers and Maryland State requirements, if needed.

ER Section 4.3.2.2 discusses potential dredging effects both physical and ecological. This discussion is specific to intake construction but the information also applies to maintenance dredging. Siltation rate determines the amount of sediment disturbed during maintenance dredging. ~~The channel to be dredged for CCNPP Unit 3 is approximately 123 ft (37.49m) long and 100 ft (30.48m) wide.~~ The incremental amount of dredged material related to CCNPP Unit 3 will be small assuming that CCNPP Unit 3 maintenance dredging in conducted in conjunction with that for CCNPP Units 1 and 2. Dredging will cause temporary suspended sediment in the immediate area but studies of similar activities as discussed in ER Section 4.3.2.2 demonstrate that CCNPP Unit 3 dredging, for either cnstruction or maintenance, will have no significant biological effect on Chesapeake Bay. The area near Calvert Cliffs does not provide critical spawning habitat for any federally managed marine fish species, thus CCNPP Unit 3 dredging is expected to have no significant effect on their eggs or larvae. Moreover, the dominant fish species in the area have no designated Habitat Areas of Particular Concern (HAPC). Studies demonstrate that the CCNPP site area is not a major spawning area for invertebrates, such as the American Oyster, thus they will not be significantly affected. Neither the shortnose sturgeon nor the loggerhead turtle are commonly found in the CCNPP area. No threatened or endangered species are expected to be significantly affected by the CCNPP Unit 3 dredging.

The potential physical impacts associated with nuclear plant cooling water intakes were considered by the NRC in developing its generic environmental impact statement for license renewal and in its site-specific supplement for CCNPP Units 1 and 2 (NRC, 1996) (NRC, 1999). Potential intake physical impacts considered to be Category 1 issues at CCNPP Units 1 and 2 included altered current patterns and salinity gradients, scouring and water use conflicts. The NRC concluded that the impacts related to these issues are small, and that plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted (NRC, 1999). The comparatively small incremental water use and the placement of the intakes for CCNPP Unit 3 inside the existing embayment should not alter this determination.

Based on the facts that (1) the amount of additional cooling water withdrawn for CCNPP Unit 3 is small compared to that of CCNPP Units 1 and 2, (2) ~~CCNPP Unit 3 intakes for the CWS and the UHS are to be located within the existing intake embayment, and (3)~~ intake velocities will be less than 0.5 ft/sec (0.15 m/sec), it is concluded that the physical impacts of the intakes for the CCNPP Unit 3 CWS and UHS will be SMALL and will not warrant mitigation measures beyond the design features previously discussed.}

5.3.1.2 Aquatic Ecosystems

{Aquatic impacts attributable to operation of the CCNPP Unit 3 intake structures and cooling water systems are impingement and entrainment. Impingement occurs when larger organisms become trapped on the intake screens and entrainment occurs when small organisms pass

Dry cooling towers require high capital and operating and maintenance costs that are sufficient to pose a barrier to entry to the marketplace for some facilities (USEPA, 2001b). Dry cooling technology has a detrimental effect on electricity production by reducing the energy efficiency of steam turbines. Dry cooling requires the facility to use more energy than would be required with wet cooling towers to produce the same electricity. This energy penalty is most significant in warmer southern regions during summer months, when the demand for electricity is at its peak. The energy penalty would result in an increase in environmental impacts because replacement generating capacity would be needed to offset the loss in efficiency from dry cooling.

9.4.1.1 Evaluation of Alternative Heat Dissipation Systems

Heat dissipation system alternatives were identified and evaluated. The alternatives considered were those generally included in the broad categories of "once- through" and "closed-loop" systems. The evaluation includes the following types of heat dissipation systems:

- Other heat dissipation systems
  - Cooling Ponds
  - Spray Ponds
- Once-through cooling
- Natural draft cooling tower
- Mechanical draft cooling tower
- Hybrid (plume abated) cooling towers
- Dry cooling systems (closed-loop cooling system)

An initial evaluation of the once-through cooling alternative and the closed-loop alternative designs was performed to eliminate systems that are unsuitable for use at {CCNPP Unit 3}. The evaluation criteria included aesthetics, public perception, space requirements, environmental effects, noise impacts, fog and drift, water requirements, capital and operating costs, and legislative restrictions that might preclude the use of any of the alternatives.

~~The screening process identified the hybrid, cooling tower, without plume abatement, as the preferred closed-loop heat dissipation system for {CCNPP Unit 3}. The analysis of this alternative is discussed in Section 9.4.1.2. The discussion of non-preferred alternatives that were considered is provided below. Selection of the preferred heat dissipation alternative was supported by detailed net present value (NPV) analysis.~~

The evaluation identified the mechanical forced draft cooling tower, with plume abatement, as the preferred closed-loop heat dissipation system for CCNPP Unit 3. Under the restrictions imposed by Section 316 of the Federal Clean Water Act, closed-cycle cooling is the only practical alternative for CCNPP Unit 3 that would meet both the Section 316(b) intake requirements at new facilities, as well as the Section 316(c) thermal requirements at this multi-facility site. The analysis of this alternative is discussed in Section 9.4.1.2. The discussion of non-preferred alternatives that were considered is provided below. Selection of the preferred heat dissipation alternative was supported by detailed net present value (NPV) analysis.

Discharge into the Chesapeake Bay at this location would have no/insignificant impact on plant operation caused by recirculation back to the existing intake channel. It also requires the fewest additional environmental permits because the intake and the discharge structures would be located in the existing IDA and would require shorter runs of piping. In addition, access and security constraints during construction would be avoided because construction would occur on the site of operating CCNPP Units 1 and 2.

Intake System

The Chesapeake Bay intake system would consists of the CCNPP Units 1 and 2 intake channel; the CCNPP Unit 3 intake piping, the CCNPP Unit 3 non-safety-related CWS makeup water intake structure and associated equipment, including the non-safety-related CWS makeup pump; the safety-related UHS makeup water intake structure and associated equipment, including the safety-related UHS makeup water pumps; and the makeup water chemical treatment system.

~~The intake channel will be an approximately 100 ft (30.4 m) long, by 123 ft (37.5 m) wide structure, with an earthen bottom at elevation -20 ft, 6 in (-6.2 m) msl, and vertical sheet pile sides extending to elevation 10 ft (3.0 m) msl. The general site location of the new intake system is shown in Figure 3.1-3, while Figure 3.4-2 and Figure 3.4-3 show the intake structure and channel in more details.~~

The CCNPP Unit 3 intake piping consists of two runs of 60-inch diameter safety related concrete pipes approximately 490 ft (149.4 m) long. These pipes convey water from the CCNPP Units 1 and 2 intake channel to a common forebay approximately 100 ft (30.48 m) long, 80 ft (24.38 m) wide structure with an earthen bottom at Elevation -22 ft 6 in (-6.86 m) NGVD 29 and vertical sheet pile sides extending to Elevation 10 ft (3.05 m) NGVD 29. The nonsafety-related CWS intake structure and the safety-related UHS makeup water intake structure are situated at opposite ends of the common forebay.

The new CCNPP Unit 3 intake piping draws water from the existing intake channel for CCNPP Units 1 and 2. The piping is oriented perpendicular to the tidal flow of the bay. This orientation minimizes the component of the tidal flow parallel to the channel flow and reduces the potential of fish entering the piping and common forebay as shown on Figure 3.4-3. The flow velocities at the circulating water makeup structure and the UHS makeup structure would be less than 0.3 feet per second (fps) (0.15 mps) and less than 0.1 fps (0.003 mps), respectively.

The new CCNPP Unit 3 CWS makeup water intake structure will be an approximately 78 ft (24 m) long, 55 ft (17 m) wide concrete structure with individual pump bays. Three 50 percent capacity, vertical, wet pit CWS makeup pumps provide makeup water.

~~The CCNPP Unit 3 CWS makeup water intake structure will be an approximately 70 ft (21.3 m) long, 68 ft (20.7 m) wide concrete structure with individual pump bays. Three 50% capacity pumps will provide saltwater makeup to the CWS.~~ The new UHS makeup water intake will be ~~an~~ approximately ~~66 ft (20.1 m) long, 84 ft (25.6 m) wide concrete structure with individual pump bays. Four 100% capacity, makeup pumps will be available to provide makeup water.~~

75 ft (222.9 m) long, 60 ft (18.3 m) wide concrete structure with individual pump bays. Four 100 perc ent capacity, vertical wet pit UHS makeup pumps will be available to provide saltwater makeup water.

In both the CWS and UHS makeup intake structures, one makeup pump is located in each pump bay, along with one dedicated traveling band screen and trash rack. Debris collected by the trash racks and the traveling water screens will be collected in a debris basin for cleanout and disposal as solid waste. The through-trash rack and through-screen mesh flow velocities will be less than 0.5 fps (0.15 m/s). Table 9.4-3 summarizes the environmental impacts of the circulating water intake alternatives for CCNPP Unit 3. In both intake structures, there is no need for a fish return system since the flow velocities through the screens are less than 0.5 fps (0.15 mps) in the worst case scenario (minimum bay level with highest makeup demand flow). Nevertheless, a fish return system will be provided as part of the combined makeup water intake structure design to reduce mortality of aquatic species.

The fish return system will be located on the east side (bay side) of the Unit 3 intake forebay. Screen wash water and fish collected from the traveling screens of Unit 3 makeup water structure will be diverted to the new fish return facility and returned to the Chesapeake Bay via a buried pipe to a new shoreline outfall. The outfall will be submerged below low tide to minimize impacts to fish into the Chesapeake Bay from any drop at the pipe exit.

Section 316(b) of the federal CWA requires the U.S. EPA to ensure that the location, design, construction, and capacity of CWIS reflect the best technology available (BTA) for minimizing adverse environmental impact. The objective of any CWIS design is to have adequate sweeping flow past the screens to meet entrainment and impingement reduction goals established under Section 316(b) requirements. In addition to the impingement and entrainment losses associated with CWIS, there are the cumulative effects of multiple intakes, re-siting or modification of CWIS contributing to environmental impacts at the ecosystem level. These impacts include disturbances to threatened and endangered species, keystone species, the thermal stratification of water bodies, and the overall structure of the aquatic system food web.

Consequently, in addition to evaluating alternative screen operations and screening technologies, such as fine mesh traveling water screens or wedge wire screens, additional means of reducing impingement, such as curtain walls, fish return systems, or other physical barriers, must also be assessed. There are a number of different alternatives for reducing impingement and entrainment impacts, including changes in intake structure operation, fish handling, external structure design; however no single operational or technological change will have the same effects or benefits at all facilities so therefore site specific studies and evaluations are critical to successful, cost-effective reductions of CWIS impacts.

The new intake ~~channel~~piping will be located off the existing intake channel for CCNPP Units 1 and 2, which is perpendicular to the tidal flow of the Chesapeake Bay to minimize the component of the tidal flow parallel to the channel flow and the potential for fish to enter the channel and intake structure. Flow velocities at the intake structure will depend on the Chesapeake Bay water level. At the minimum Chesapeake Bay water level of -4.0 ft (-1.2 m) msl the flow velocity along the new intake channel will be less than 0.5 fps (0.15 m/s) ~~based on the maximum makeup demand of 43,480 gpm (164,590 lpm)~~.

It is expected that addition of the CCNPP Unit 3 using closed cycle cooling will increase fish impingement and entrainment by less than 3.5% (based on preliminary cooling tower performance) over the existing condition. CCNPP Unit 3 will utilize methods similar to those employed at CCNPP Units 1 and 2 to minimize fish impingement and entrainment at the intake structure (e.g., low-velocity approach and screens). Therefore, it is anticipated that use of closed-loop cooling systems at CCNPP Unit 3 will have minimal impact on fish impingement and entrainment.

CCNPP Unit 3 relies on makeup water from the Chesapeake Bay for safe shutdown, and is designed for a minimum low water level of -4.0 ft (-1.2 m) msl and can continue to operate at an

ER Section 10.0

10.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

This section summarizes adverse impacts of {CCNPP Unit 3} construction and operation that cannot otherwise be avoided, and for which there may be no practical means of mitigation. Chapter 4 and Chapter 5 provide supporting details.

10.1.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF CONSTRUCTION

Most construction related environmental impacts can be avoided or minimized through the application of best management construction plans and conformance with applicable Federal, State and Local regulations that protect the environment. CCNPP Unit 3 requires use of a site footprint where permanent structures and roads are located. Construction activities, on the other hand, can be managed in ways that limit long-term loss of habitat and impacts to workers and the public.

Construction impacts and potential mitigation measures are discussed in Section 4.6, and summarized here in Table 10.1-1 summarizes the potential environmental impacts of construction and their mitigation. Considering the planned mitigation measures, the level of unavoidable adverse impacts from construction is expected to be SMALL.

10.1.2 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF OPERATIONS

Operational impacts of CCNPP Unit 3 are discussed in Chapter 5. Expected impacts and their mitigation are summarized in Table 10.1-2. Unavoidable impacts are limited to operation of the cooling water systems and the generation of additional non-radioactive and radioactive waste. Actions to minimize these impacts include use of closed-cycle cooling and waste minimization. As a result, the unavoidable adverse impacts of operation are also expected to be SMALL.

10.1.3 SUMMARY OF UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS FROM CONSTRUCTION AND OPERATIONS

{Construction and operation will require the disturbance of approximately ~~420~~445 acres (180 hectares) of the originally estimated 460 acres (~~170~~186 hectares) of land for construction, of which 281 acres (114 hectares) will be permanently committed to power plant structures and roads for CCNPP Unit 3. Temporary storage and lay-down areas will be restored following construction to reduce the size of the footprint affected during operations. The infrastructure required for CCNPP Unit 3 will be consistent with existing site use, with exception of the cooling tower that is being installed to limit water consumption and related ecological impacts. The use of existing offsite transmission right-of-ways for CCNPP Unit 3 will eliminate the need for construction of new corridors further limiting the plant's utilization of available land.

Protection of surface and subsurface water resources during construction will require limitations on the amount of groundwater withdrawn and the discharge of construction waste waters from dewatering activities. Best Management Practices will be implemented to limit construction related erosion and sedimentation of surface waters. Water quality monitoring will be conducted to verify that control measures are adequate. Use of groundwater during construction will be within existing appropriations and, to further limit long-term groundwater use, CCNPP Unit 3 will employ desalination technology to produce freshwater for use in the essential service water system during operations. Long-term protection of surface waters will be managed through an onsite Storm Water Pollution Prevention Plan required under current regulations.

Certain natural resources on site will be affected including unavoidable encroachment on non-tidal wetlands and surface waters. Activities within these areas will conform to applicable state and federal regulations to ensure that impacts are limited and controlled. Impacts to aquatic resources are expected to be minimal given the limited area to be committed to permanent use and the absence of threatened and/or endangered species in these freshwaters.

Construction of permanent CCNPP Unit 3 structures such as the reactor and turbine buildings and the cooling towers will require the removal of mixed deciduous forest occupying this portion of the site. Available old field will allow for reforestation efforts following construction.

There are sensitive archaeological and architectural sites located in the construction area and their protection and/or mitigation of impacts will be administered through cooperative efforts with the Maryland State Historic Preservation Officer (SHPO).

Measures to promote public health and safety will be implemented during construction and operation. The temporary increase in workforce during construction will require actions to minimize traffic congestion. A new access road and interconnection with Maryland State Highway 2/4 will facilitate traffic flow during shift change over. Noise levels at the site boundary are predicted to conform to applicable state and federal environmental standards. Non-routine noise, such as blasting, will be limited to day time. Measures to control fugitive dust and emissions from equipment will be implemented along with a general Safety and Health Plan. Emissions from the testing of diesel generators will conform to applicable Maryland state permit requirements and related federal emission standards.

Radiological dose to workers on site and to the general public have been calculated and are estimated to be well within applicable regulatory limits. Continuing monitoring of radioactivity in the environment surrounding the CCNPP site will ensure that radiological consequences of station operation are maintained within applicable environmental and health based standards. While some radioactive solid wastes will be created, efforts to control and limit their production will be implemented.

Impacts associated with the CCNPP Unit 3 cooling water systems include construction and operation of the intake and discharge structures, as well as evaporative losses from the operating cooling towers. Construction of the CCNPP Unit 3 circulating water supply system~~-~~ (CWS) makeup water intake structure~~-~~and the ultimate heat sink (USHS) makeup intake structure will take place ~~within the existing CCNPP Unit 1 and 2 embayment behind a temporary sheet pile coffer dam~~along the shoreline terrace approximately 500 ft (152.4 m) south of the southern edge of the Units 1 and 2 intake channel curtain wall. Two intake pipes that originate at the southeastern edge of the existing Unit 1 and 2 intake channel will deliver cooling water to a common Unit 3 UHS intake and CWS intake forebay. As a result, sedimentation potentially released ~~either~~ into the CCNPP Units 1~~,~~-2 and ~~2~~3 intakes, or into the Chesapeake Bay, will be limited. Periodic maintenance dredging of the ~~combined~~ intake areas will be required for the continued operation of all three CCNPP units. These activities will conform to applicable State and U.S. Army Corps of Engineers regulations, including proper disposal of dredge spoils.

Since CCNPP Unit 3 will employ a closed-cycle cooling water system that conforms to the U.S. Environmental Protection Agency (EPA) Phase I Clean Water Act 316(b) regulations, the withdrawal of cooling water from the Chesapeake Bay will be small. The effect will be to limit impact on near shore hydrology and the potential effects of impingement and entrainment. Measures to further reduce impingement will include intake approach velocities less than 0.5 ft/sec (0.15 m/sec)~~.~~

) and a CWS makeup water intake fish return system. Details of the fish return system are described in Section 3.4.

Evaporative loss from the cooling tower will not create a visible plume. Salt deposition is likely to occur but will be below NUREG-1555 (NRC, 1999) significance levels at which visible vegetation damage may occur. Offsite noise from tower operations is predicted to be within applicable state regulatory requirements.

A portion of the CWS and ESWS cooling towers water will be discharge back into the Chesapeake Bay as blowdown to maintain water quality of the cooling water as it is recirculated. The maximum blowdown water temperature rise will be approximately 12°F (6.7°C). The resulting thermal plume is predicted to be small and should not pose a threat to marine biota. The thermal discharge will contain small amounts of chemicals used in plant systems and small quantities of radioactive liquids. Concentrations of these waste water constituents will be limited by NPDES permit requirements and applicable NRC radiological release limitations.

Socioeconomic impacts of CCNPP Unit 3 construction and operation are expected to be SMALL. It is estimated that many of the skilled construction laborers will commute to the site from outside the immediate geographic area and temporary housing and other related public services appear to be adequate to absorb both the temporary increase in workers during construction and the long-term, but smaller, increase in operational staff. Beneficial increases to the local economy from taxes and spending are likely to occur but are estimated to be a small percentage of the existing economy. There are no unique minority or low-income populations within the comparative environmental impact areas surrounding the CCNPP site. Therefore, it is not likely that these groups would be disproportionately affected by construction or operation. }

10.1.4 REFERENCES

{**(NRC, 1999).** Environmental Standard Review Plan, NUREG-1555, Nuclear Regulatory Commission, October 1999.}

Table 10.1-1— {Construction-Related Unavoidable Adverse Environmental Impacts}
(Page 1 of 6)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
Land Use	Approximately ~~420~~445 acres (~~170~~180 hectares) of the originally estimated 460 acres (186 hectares) of land will be disturbed of which 281 acres (114 hectares) will be permanently committed to power plant structures and roads for CCNPP Unit 3	Comply with applicable federal, state and local construction permits/approvals including Coastal Zone Management guidelines. Clear only areas necessary for installation of power plant infrastructure and implement construction Best Management and Storm Water Protection Plans. Limit activities in the 500 year flood plain to those associated with the intake structures. Implement a Site Resource Management Plan. Acreage will be restored/revegetated following construction to the maximum extent possible. Use of existing transmission corridor right-of-ways. Implement Storm Water Pollution Prevention Plan (SWPPP), including sediment and erosion control. Implement Spill Prevention Control and Countermeasures (SPCC) Plan. Use site Resource Management Plan and Best Management Practices (BMP) to protect resources such as wetlands and streams in vicinity; also, onsite land is not used for farmland nor is it considered prime or unique. Obtain individual U.S. Army Corps of Engineers 404 Permit; comply with BMP requirements. Obtain Maryland Non-Tidal Wetlands Protection Act permit; comply with BMP requirements.	281 acres (114 hectares) of land will be permanently occupied by nuclear plant infrastructure.

ER Section 10.0

Table 10.1-2— {Operations-Related Unavoidable Adverse Environmental Impacts}

(Page 1 of 4)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
Land Use	The CCNPP Unit 3 footprint will permanently occupy a portion of the site.	Limit area required during design and construction.	Land use is consistent with current operations at the site.
	Some potential impact on land and water courses from spills and discharges.	Maintain Storm Water Pollution Prevention Plan (SWPPP), including sediment and erosion control. Maintain Spill Prevention Control and Countermeasures (SPCC) Plan.	No unavoidable impacts
	Operation of the new unit will increase radioactive and non-radioactive waste disposal in landfills and onsite in long-term storage facilities.	Implement a waste minimization, pollution prevention program to limit waste generation.	Some land will be dedicated to offsite and onsite waste storage and will not be available for other uses.
	Transmission line maintenance may have some impact on vegetation and wildlife.	Best management practices will mitigate potential impacts from vegetation control and other ROW activities.	Unavoidable but small impacts may occur as a result of keeping the ROWs in a safe condition.
Hydrologic and Water Use	Circulating water supply system makeup water will be withdrawn from Chesapeake Bay potentially affecting near-shore hydrology.	Implement closed-cycle cooling and reduce water use.	No unavoidable impact.
	Evaporative loss of water from the cooling tower represents a consumptive use.	Use desalination to supply makeup water; minimize use of groundwater resources.	A limited amount of cooling water taken from Chesapeake Bay will be consumed through evaporative loss.
Aquatic Ecology	Cooling water withdrawal will result in impingement and entrainment.	Implement closed-cycle cooling. Limit intake velocity. <u>Implement the use of a fish return system.</u>	Some limited entrainment and impingement will occur.

ER Section 10.0

10.5 CUMULATIVE IMPACTS

Sections 10.1 through 10.3 summarize the adverse environmental impacts from construction and operation of {Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3} that are potentially unavoidable, irreversible or irretrievable. Measures to mitigate these impacts are also discussed. Section 10.4 compares the environmental and economic costs and benefits of the facility. This section summarizes the potential cumulative adverse environmental impacts to the {CCNPP} region. Cumulative impacts include those that are incremental to past and ongoing activities on the site, along with those that are reasonably foreseeable in the future.

This evaluation of cumulative impacts is based on a comparison between the existing environmental conditions presented in Chapter 2 and the potential adverse environmental impacts of construction and operation detailed in Chapter 4 and Chapter 5, respectively. The evaluation also considers continued operation and license renewal of {CCNPP Units 1 and 2}.

{CCNPP Unit 3 will be co-located on the existing nuclear power plant site currently occupied by CCNPP Units 1 and 2. CCNPP Units 1 and 2 occupy approximately 220 acres (89 hectares), while CCNPP Unit 3 construction is expected to utilize approximately ~~420~~445 acres (~~170~~180 hectares) of the originally estimated 460 acres (186 hectares) of which 281 acres (114 hectares) will be permanently committed to structures and roads.

The CCNPP site consists of approximately 2,070 acres (838 hectares) located in Calvert County, Maryland, on the west bank of the Chesapeake Bay. Other major facilities located nearby include the Patuxent Naval Air Test Center 10 mi (16 km) south of the CCNPP site, and the Dominion Cove Point Liquefied Natural Gas site 3.6 mi (5.8 km) to the south. The 50 mi (80 km) radius surrounding the site includes parts of Maryland, Virginia, Delaware and Washington D.C.

Land use in Calvert County is predominantly farm, forest and residential housing. The CCNPP site consists mostly of mixed deciduous forest in various stages of succession, with a smaller percentage occupied by fields associated with an employee recreational campground and an area consisting of dredge spoils. None of the construction area is farmland. Topography is gently rolling, with steeper slopes along water courses. The site average height above sea level is approximately 100 ft (30 m).

The eastern boundary of the CCNPP site is the Chesapeake Bay. The Chesapeake Bay is approximately 195 mi (313 km) long and varies in width from 3 to 35 mi (5 to 56 km). Freshwater input comes from several major tributaries throughout its length, the largest being the Susquehanna River. The average depth is approximately 21 ft (9 m).

The Chesapeake Bay is a valuable natural resource in that it sustains active commercial and recreational fisheries for blue crab, oyster and several migratory fish species. Harvest, transport and marketing these resources are culturally and economically important to the region.}

10.5.1 CUMULATIVE IMPACTS FROM CONSTRUCTION

Construction impacts associated with {CCNPP Unit 3} include grading and clearing, allocation of land to material lay-down and parking, use of ground and surface waters, equipment noise and emissions, increased traffic and use of public resources. These activities are consistent with those conducted during the construction of {CCNPP Units 1 and 2.} Many of the impacts will be temporary and most can be mitigated through the use of best management construction practices and stormwater pollution prevention planning required under State and Federal regulation.

{Groundwater is currently utilized by CCNPP Units 1 and 2 for domestic, plant service and demineralized makeup water needs. Groundwater use conforms to an allocation imposed by the Maryland Department of the Environment. Of the 450,000 gpd (1,700,000 lpd) allocated, CCNPP Units 1 and 2 utilize, on average, approximately 388,000 gpd (1,470,000 lpd). Groundwater use during construction will remain within that allocated and its use will eventually be replaced with an onsite desalinization plant for CCNPP Unit 3. However, to date, neither saltwater intrusion nor land subsidence has been reported.

Additional impacts on wetlands, surface waters and groundwater resources may occur due to excavation or other activities that change flow patterns such as construction of sedimentation impoundments, stormwater runoff and dewatering, or that receive construction related waste effluents. It is anticipated that several vernal streams and impoundments will be affected by these activities. Environmental controls will conform to applicable regulations to minimize these effects. Efforts to reclaim areas not occupied by permanent structures or to provide offsetting habitat such as constructed wetlands will also be undertaken.

Protection of important or otherwise unique terrestrial habitats, flora and fauna were also considered in developing the construction plan for CCNPP Unit 3. Surveys of the site were undertaken to identify sensitive locations and protected species and efforts made to limit encroachment on these areas. Examples include the Chesapeake Bay Critical Area that encompasses lands within 1,000 ft (305 m) of mean sea high tide, locations with federally or state designated threatened or endangered species, wetland buffers and contiguous forest blocks. While certain state or federal designated vegetation and faunal species were found onsite, their presence was not found to be unique to areas potentially affected by construction.

Impacts to aquatic organisms found within freshwater impoundments and streams may be realized to the extent these surface waters are removed or water quality is affected. A survey of aquatic resources identified no unique aquatic species occurring with the construction zone. Typical fauna included the eastern mosquito fish, bluegill sunfish, invertebrate larvae, and submerged vegetation. Construction activities that may affect these natural resources, such as erosion and waste water discharge, will be managed using best management practices in conformance with applicable State and Federal permits and regulations.

Because of the preventive measures and corrective actions identified above and the short-term nature of construction activities, the cumulative impact on surface and groundwater from CCNPP Unit 3 construction in conjunction with the continued operation of CCNPP Units 1 and 2 should be small. Further, use of the existing offsite transmission right-of-way will limit the amount of land and related natural resources potentially impacted by construction.

An archaeological survey identified 14 sites potentially eligible for listing on the National Register of Historic Places. Four of these are located within the construction footprint. Phase II archaeological investigations, and subsequent consultation with the Maryland State Historic Preservation Officer (SHPO) will be performed for the four potentially eligible archeology sites to determine their National Register of Historic Places eligibility if they cannot be avoided.

Potential impacts to the Chesapeake Bay would be associated with construction of the cooling water intake and discharge structures and improvements to the barge unloading facility. The Circulating Water Supply System (CWS) and the Essential Service Water System (ESWS) (Ultimate Heat Sink) will utilize independent structures located in ~~the southern portion of the existing CCNPP Units 1 and 2 intake embayment.~~

a forebay constructed on the shoreline terrace approximately 500 ft (152.4 m) south of the southern edge of the Units 1 and 2 curtain wall. Included will be the installation of two 60-inch diameter pipes that will deliver cooling water from the Unit 1 and 2 intake channel to the Unit 3 cooling water system intake forebay. Dredging of the areas approaching the new ~~structures~~ intake pipes and the installation of sheet pile during construction may create some suspended sediment and removal of benthic substrate. Similarly, the dredging required for installation of the subsurface multi-port discharge structure will also require removal of sediment. Refurbishment of the barge slip will include new sheet pile and widening of the slip to receive heavy equipment. Activities in navigable waters will conform to applicable State of Maryland and U.S. Army Corps of Engineers regulations.

Impacts to marine biota will be negligible as previous studies conducted for CCNPP Units 1 and 2 indicate that the benthic substrate will reestablish following construction and that benthic species will quickly recolonize. Further there are no endangered or threatened marine species in the CCNPP site area that could be affected by sedimentation or sediment removal. As a result, cumulative construction impacts in the Chesapeake Bay are not expected.

Potential adverse cumulative impacts to public health and wellbeing stem from construction related noise, increased vehicular traffic, aesthetics and emissions. Noise levels will increase during construction with operation of heavy equipment and vehicles. The State of Maryland has established maximum decibel levels for different land use zones, the most sensitive being residential housing. Estimated noise levels that may occur during construction indicate that due to distance, topography and surrounding forest, levels at the site boundary are expected to meet applicable criteria. For onsite workers, it will be necessary to meet Occupational Safety and Health Administration (OSHA) exposure limits through training and use of personal protective equipment. Cumulative impacts are not expected as construction related noise will cease upon completion of the construction activities.

Traffic will increase during construction as workers commute from within and outside Calvert County. The main highway, Maryland State Highway 2/4, will experience additional traffic during shift change over. A new access road and an additional perimeter road will be constructed onsite to accommodate the excess traffic resulting from CCNPP Unit 3 construction. The access road will remain the primary entrance for CCNPP Unit 3 during operation when the number of workers is dramatically reduced. Heavy equipment and plant components will be barged in avoiding temporary blockage of local highways. Construction of the access road, use of the barge slip for heavy equipment and the decrease in workers following construction will limit cumulative impacts of traffic.

Dust, engine exhaust and other facility operations will result in construction related emissions. Protective actions will be required to ensure that applicable ambient air quality and hazardous pollutant regulations are met. Applicable permits will be obtained and construction practices, such as dust control, will be implemented so that cumulative impacts onsite from emissions are limited and are discontinued following construction.

Topography of the site and its forest canopy will limit visibility of construction activities. The Chesapeake Bay shoreline consists of high 100 ft (31 m) vertical cliffs. Construction activities, except for activities related to intake and discharge construction, will occur inland of the 1,000 ft (305 m) set back further reducing visibility from the water surface. Following construction, the multi-port diffuser will be beneath the surface. The intake structures will be confined to the southern end of the intake embayment and will be visible from certain portions of the Chesapeake Bay but their appearance will be consistent with CCNPP Units 1 and 2 intake structure.

The ESWS will utilize closed-cycle cooling, and will have 4 mechanical draft cooling towers. The ESWS cooling towers will each be rectilinear structures, 96 ft (29 m) high, by 60 ft (18.3 m) long, by 60 ft (18.3 m) wide. The ESWS cooling towers will typically be supplied with fresh water makeup from storage tanks that are supplied from a desalinization plant. Makeup flow to the ESWS cooling towers during normal operations will be approximately 1,880 gpm (7,100 lpm). Blowdown from the ESWS cooling towers will be routed to the retention basin, and ultimately the Chesapeake Bay, and will be approximately 940 gpm. Maximum ESWS cooling water makeup demand is approximately 3,764 gpm (14,248 lpm).

Physical impacts of cooling system water withdrawal could include alteration of site hydrology in the immediate vicinity of the intakes structures. Previous hydrodynamic modeling for CCNPP Units 1 and 2 indicated that their operation would represent less than 1% of tidal flow. Since the amount of cooling water to be used for CCNPP Unit 3 is a small fraction of the intake flow from CCNPP Units 1 and 2, there should be no incremental cumulative adverse impact to the Chesapeake Bay hydrology.

Aquatic impacts attributable to operation of the CCNPP Unit 3 intake structures and cooling water systems include impingement of organisms on the traveling screens and entrainment of fish and invertebrate eggs and larvae within the cooling system. Use of closed-cycle cooling systems at CCNPP Unit 3 will significantly reduce these impacts compared to power plants that operate open-cycle (once-through). In addition, CCNPP Unit 3 will incorporate additional design criteria to limit impingement including intake approach velocities to less than 0.5 ft/sec (0.15 m/sec) as well as a fish return system that is detailed in Section 3.4.

Although some small amount of entrainment will occur, studies indicate that the CCNPP site area is not a spawning area for key species of commercial or recreational value, and that entrainment at CCNPP Units 1 and 2 has not resulted in detectable changes in population levels. Further, the dominant species that occur in the CCNPP site area of the Chesapeake Bay have not been identified as requiring habitat protection.

Blowdown from the cooling towers is returned to the Chesapeake Bay through a submerged multi-port diffuser. The temperature of this discharge will be several degrees above ambient creating a small thermal plume. Modeling of this plume shows that its size and distribution will meet all State water quality criteria and will be sufficiently small that it is unlikely to cause impacts to marine benthos or motile organisms migrating through the area.

Included in the blowdown discharge are chemicals used in biocide treatment and in plant process control. The concentrations discharged will be in conformance with National Pollutant Discharge Elimination System (NPDES) permit conditions and applicable water quality criteria. Further the amount of water being discharge from the closed-cycle system will be small compared to tidal flow such that concentrations of chemicals discharged will rapidly disperse. Solids will be allowed time for settlement and chemical treatment in an onsite retention basin, if required.

Because the use of closed-cycle cooling will limit cooling water requirements, the incremental impact from operation of CCNPP Unit 3 should not result in cumulative adverse ecological impacts.

Excess heat within the CWS will be dissipated to the environment using a hybrid mechanical draft cooling tower with drift eliminators installed. No visible plume is created when a portion of the cooling water evaporates as it leaves the tower and undergoes partial condensation. Fogging is predicted to occur most frequently onsite and is expected to occur less than 38

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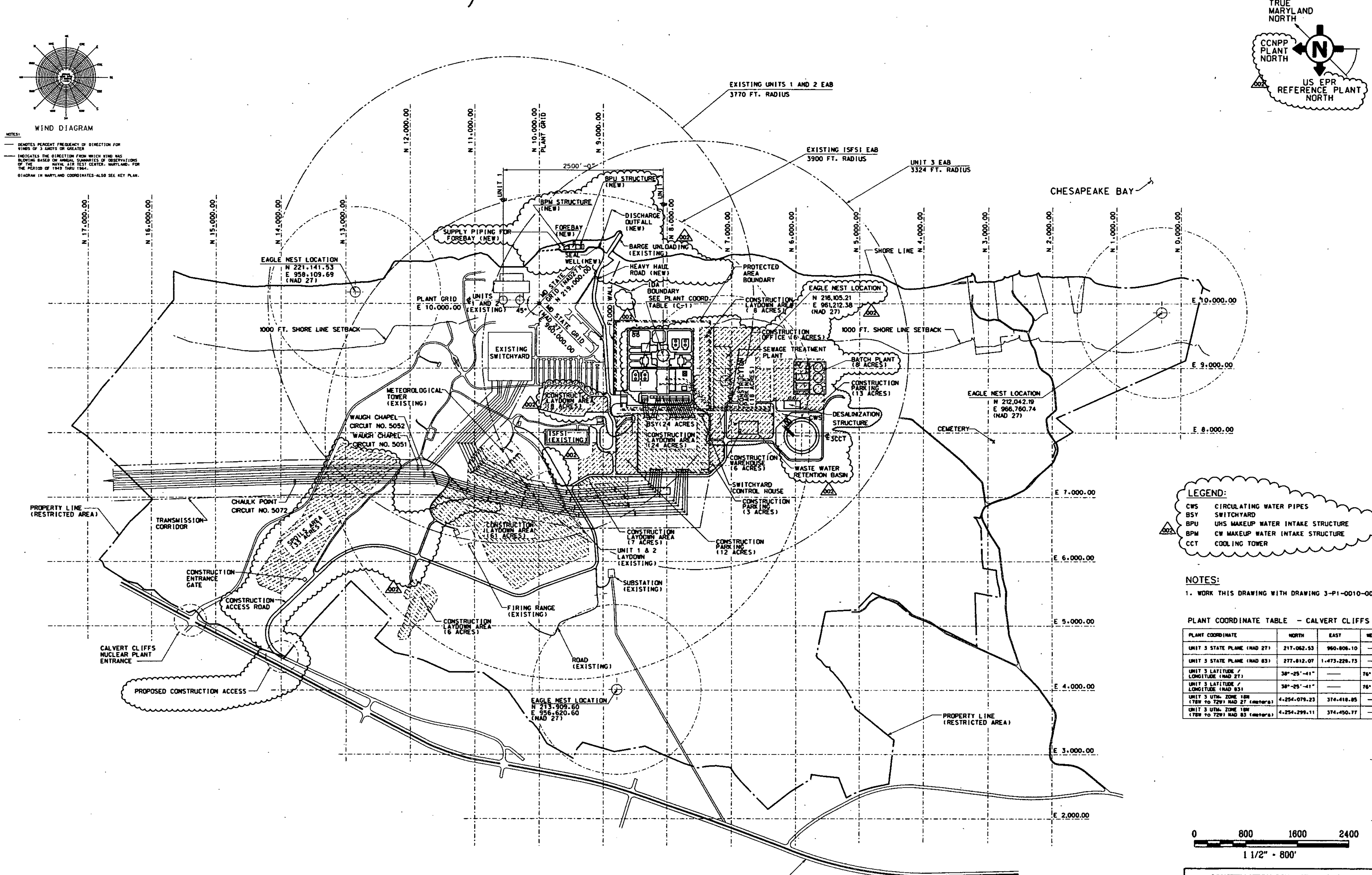
Figure 2-103 and 4.5-1



LEGEND:

CWS	CIRCULATING WATER PIPES
BSY	SWITCHYARD
BPU	UHS MAKEUP WATER INTAKE STRUCTURE
BPM	CW MAKEUP WATER INTAKE STRUCTURE
CCT	COOLING TOWER

NOTES:

1. WORK THIS DRAWING WITH DRAWING 3-P1-0010-00002.

PLANT COORDINATE TABLE - CALVERT CLIFFS

PLANT COORDINATE	NORTH	EAST	WEST
UNIT 3 STATE PLANE (NAD 27)	217,062.53	960,806.10	—
UNIT 3 STATE PLANE (NAD 83)	277,812.07	1,473,228.73	—
UNIT 3 LATITUDE / LONGITUDE (NAD 27)	38°-25'-41"	—	76°-26'-19"
UNIT 3 LATITUDE / LONGITUDE (NAD 83)	38°-25'-41"	—	76°-26'-17"
UNIT 3 UTM, ZONE 18N (78W to 72W) NAD 27 (meters)	4,254,079.23	374,418.85	—
UNIT 3 UTM, ZONE 18N (78W to 72W) NAD 83 (meters)	4,254,299.11	374,450.77	—

DESIGN VERIFICATION REPORT: 25237-103-3VR-P04G-00003

This drawing is issued for Design Certification (DC)/ Combined Operating Construction License (COL) use only and shall not be used for Construction/Procurement

AQ

REV. NO.	DATE	REVISIONS	BY	CHK	DES SUPV.	ENGR.	PROJ ENGR	APPR	ACCEPT
002	12/11/08	REVISED AND UPDATED TO REFLECT LATEST PERMIT SUBMITTAL	RNG	BH		-		-	
001	12/21/07	REVISED TO UPDATED NORTH ARROW	MN	BH	CED	—	EAS	—	
000	05/22/07	ISSUED FOR COLA USE	CK	JAM	CED	—	EAS	—	
00B	03/30/07	REVISED TO REFLECT ONE UNIT PLOT PLAN AND UPDATED AS NOTED	BH	JAM	CED	—	EAS	—	
00A	10/31/06	ISSUED FOR REVIEW	CK	CM	CED	—	EAS	—	

CONSTELLATION GENERATION GROUP, LLC
CONSTELLATION COL

BECHTEL
FREDERICK, MARYLAND

JOB NO. 25237

U.S. EVOLUTIONARY POWER REACTOR (EPR)

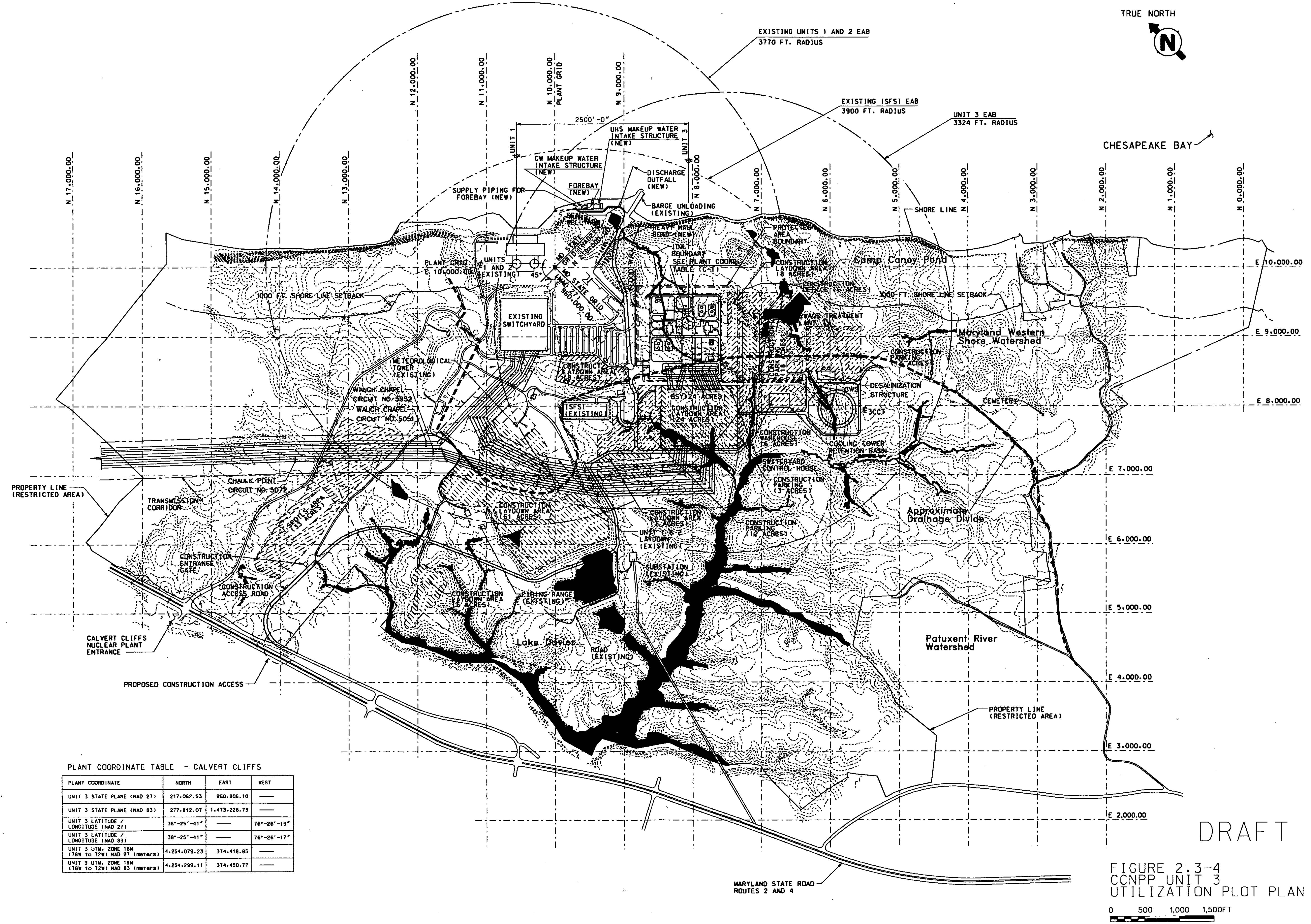
CALVERT CLIFFS UNIT 3
SITE UTILIZATION PLOT PLAN
AT GRADE ELEVATION

CONSTELLATION SERIAL NO. (REFERENCE) FIGURE 2.1-3 — REV. 000

BECHTEL DRAWING NO. 3-P1-0010-00001 — REV. 002

DOC. TYPE | SIZE E | SCALE 1" = 800'

34"X44"E SIZE



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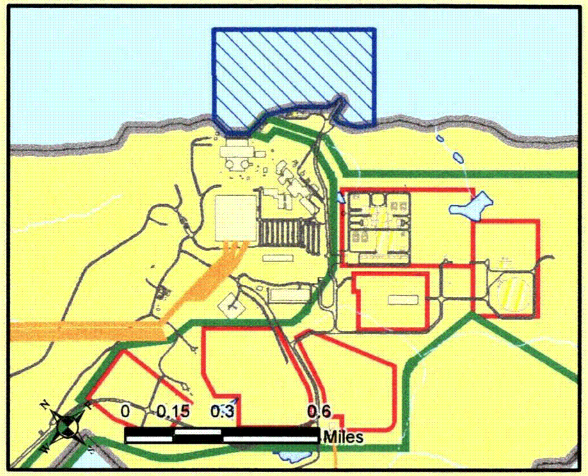
UNIT 3 UTM, ZONE 18N (78W to 72W) NAD 27 (meters)	4,254,079.23	374,418.85	——
UNIT 3 UTM, ZONE 18N (78W to 72W) NAD 83 (meters)	4,254,299.11	374,450.77	——

FIGURE 2.3-4
CCNPP UNIT 3
UTILIZATION PLOT PLAN

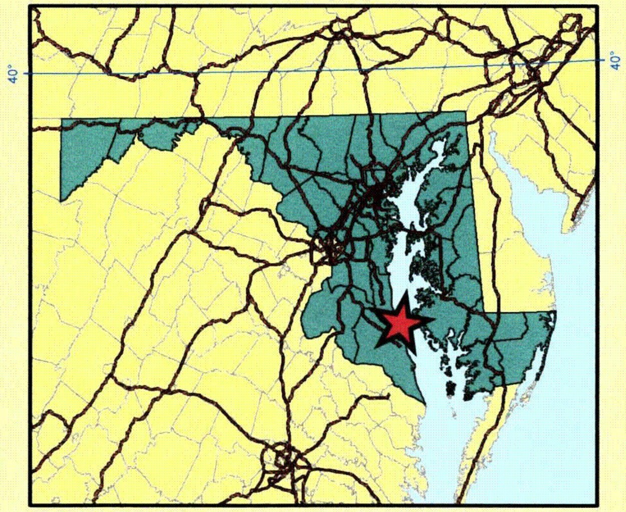
DRAFT

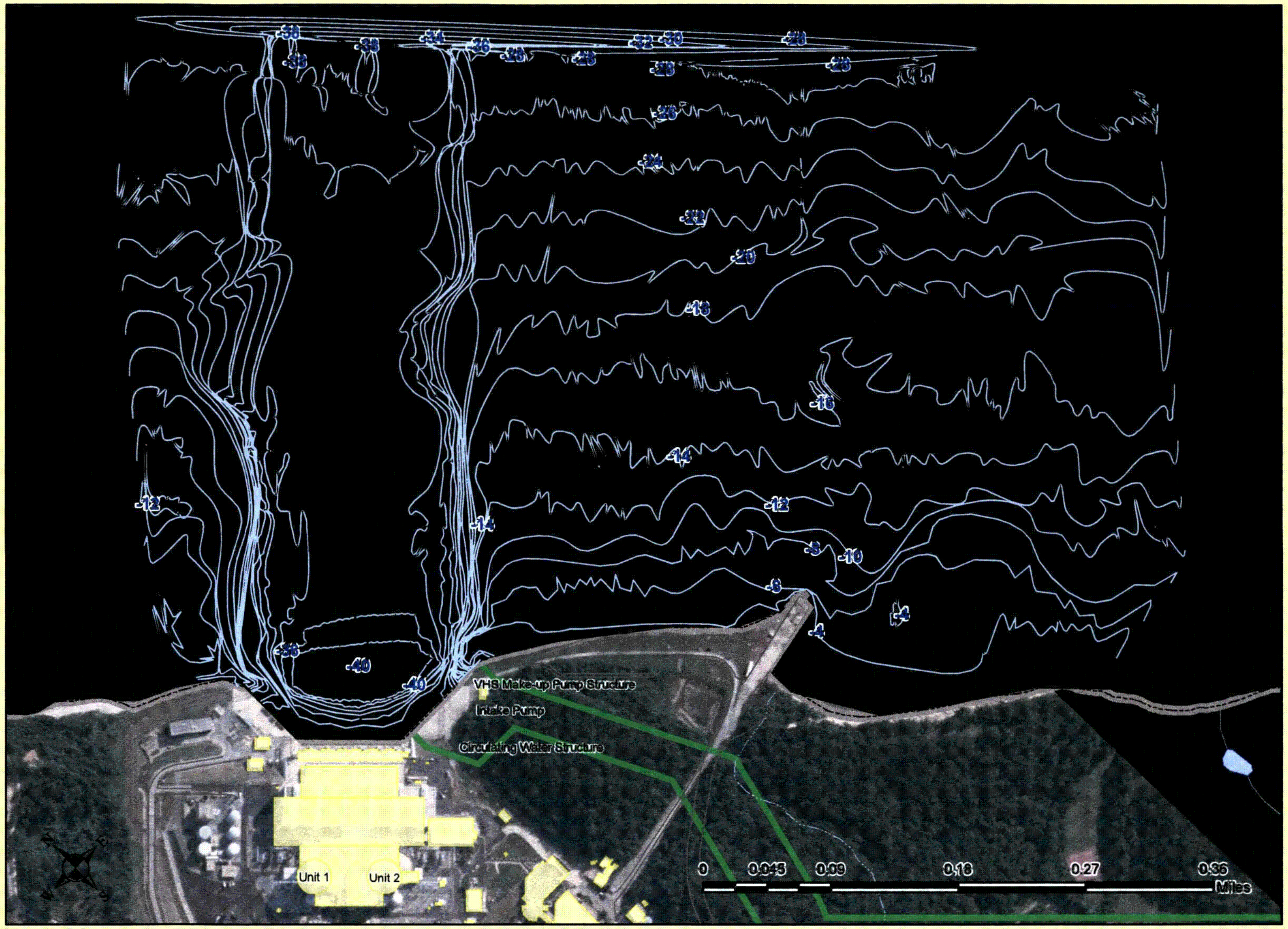
Figure 2.3-27 Bathymetry

Calvert Cliffs



Maryland





GIS Map Code: US-CALV-000103_R004A
Projection: Maryland State Plane, FIPS 1900
Horizontal Datum: North American Datum 1927
Vertical Datum: National Geodetic Vertical Datum 1929
Display: Calvert Cliffs Plant Grid

Bathymetry Contour (2 ft Interval)
Calvert Cliffs Site Boundary
Calvert Cliffs Plant Grid
Cooling Tower
Transmission Line
Road, Existing
Road, Proposed
Power Block
Stream, Permanent
Stream, Intermittent
Shoreline
Site Surface Cal
Structure, Existing
Lake or Pond
Reserve Areas

Note: The vertical elevation refers to the Mean Lower Low Water (MLLW) at the site.

The nearest location to the site where a datum relationship is available is Cove Point, MD, at which point the NGVD 29 datum is 0.01 ft below the Mean Lower Low Water (MLLW).

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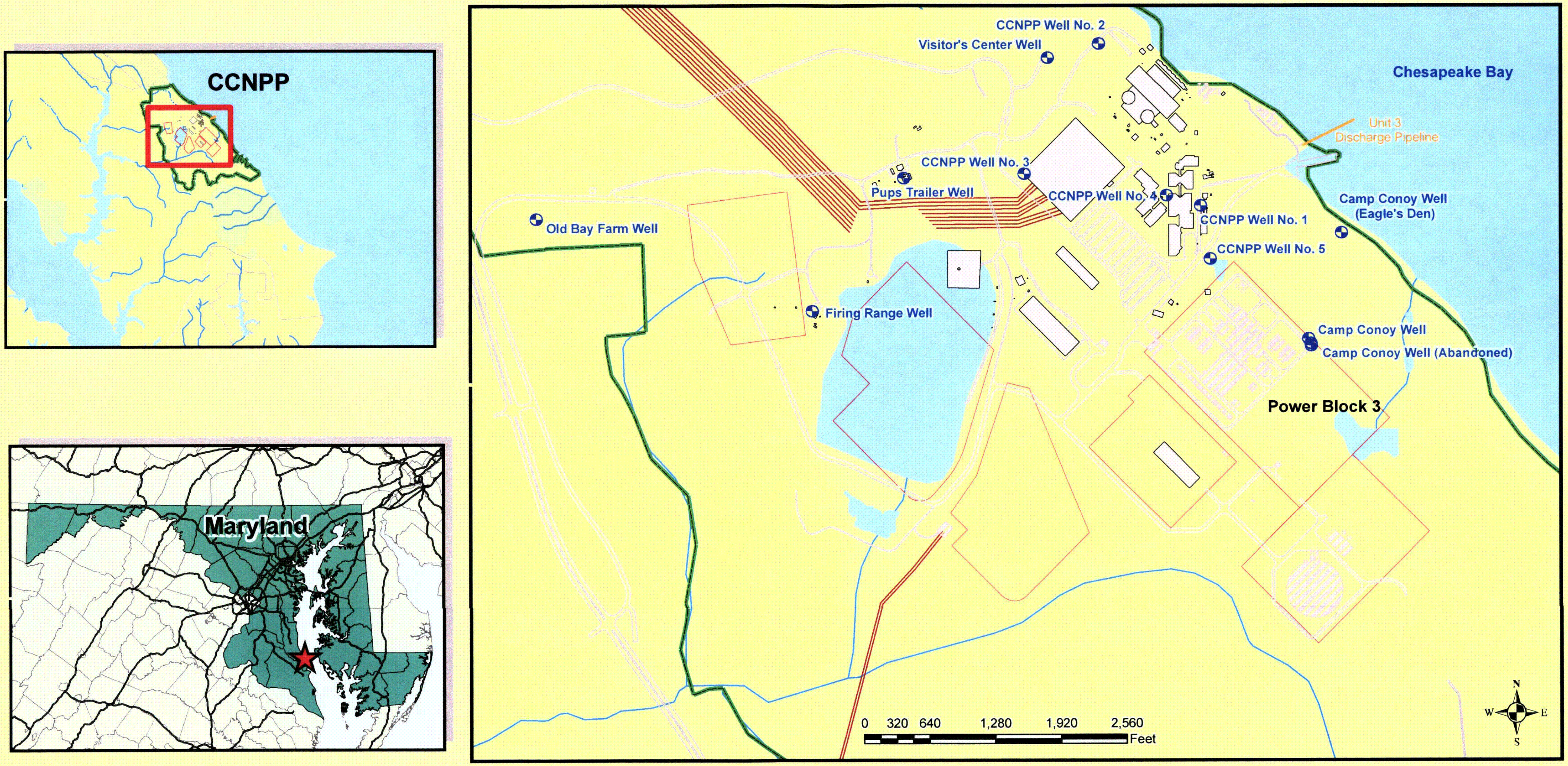
Figure 2.3-68 CCNPP Water Production Wells



GIS Map Code: US-CALV-000102-R000A
Projection: Maryland State Plane
Datum: North American Datum 1927
Display: Calvert Cliffs Plant Grid

Legend

- CCNPP Production Wells
- Unit 3 Discharge Pipeline
- Calvert Cliffs Site Boundary
- Transmission Lines
- Roads
- Perennial Stream
- Intermittent Stream
- Intermittent Canal
- Planned Structures
- Existing Structures
- Future Land Use
- Waterbodies

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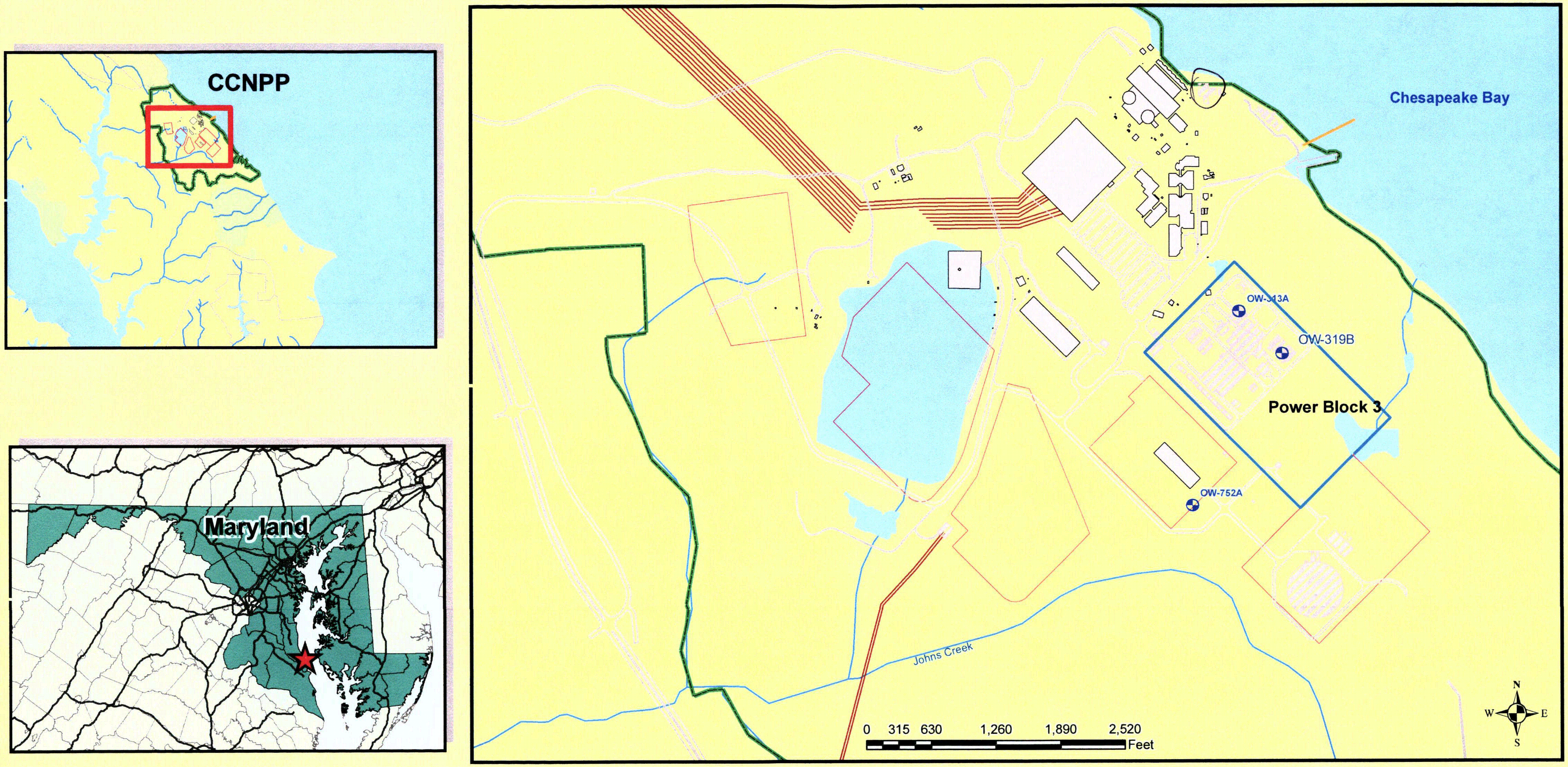
Figure 2.3-85 Groundwater Sampling Locations at CCNPP, May 2007



Legend

CCNPP Groundwater Wells
Calvert Cliffs Site Boundary
Transmission Lines
Roads
Perennial Stream
Intermittent Stream
Intermittent Canal
Planned Structures
Existing Structures
Future Land Use
Waterbodies

GIS Map Code: US-CALV-000104-R000A
Projection: Maryland State Plane
Datum: North American Datum 1927
Display: Calvert Cliffs Plant Grid

Figure 3.1-1: Site Area Topography Map

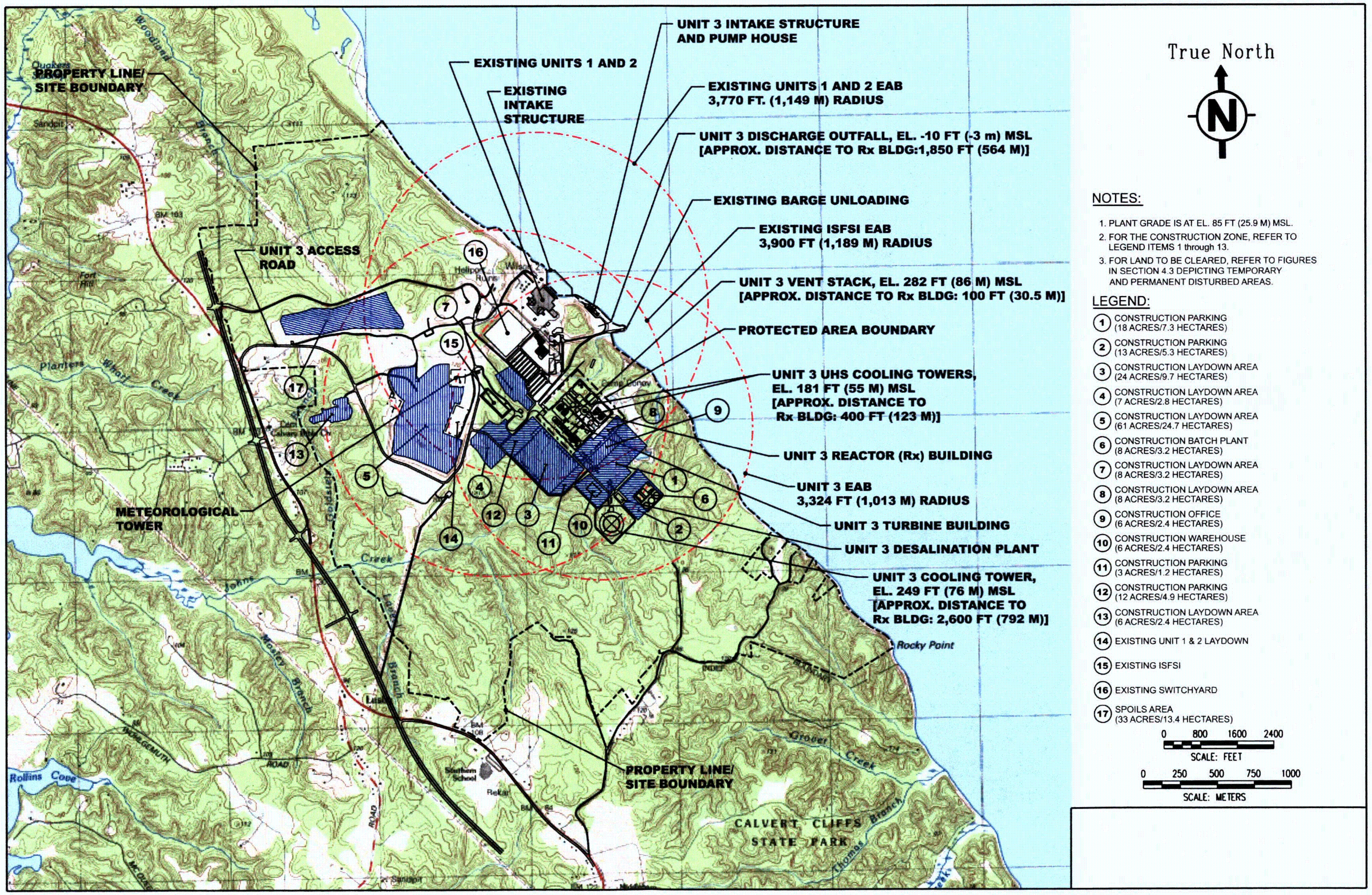
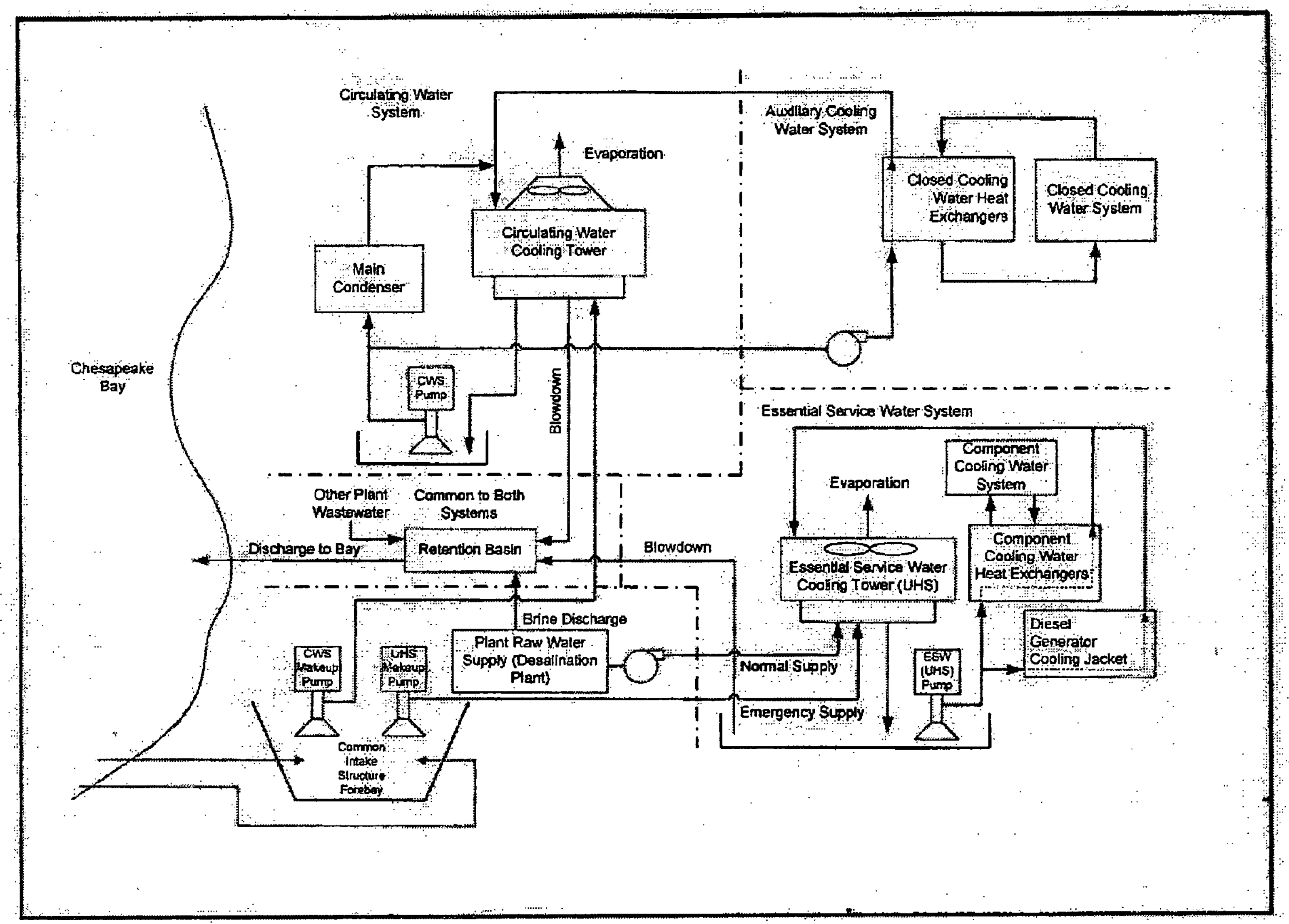


Figure 3.4-1—{{General Cooling System Flow Diagram for CCNPP Unit 3}



ER Section 3.0

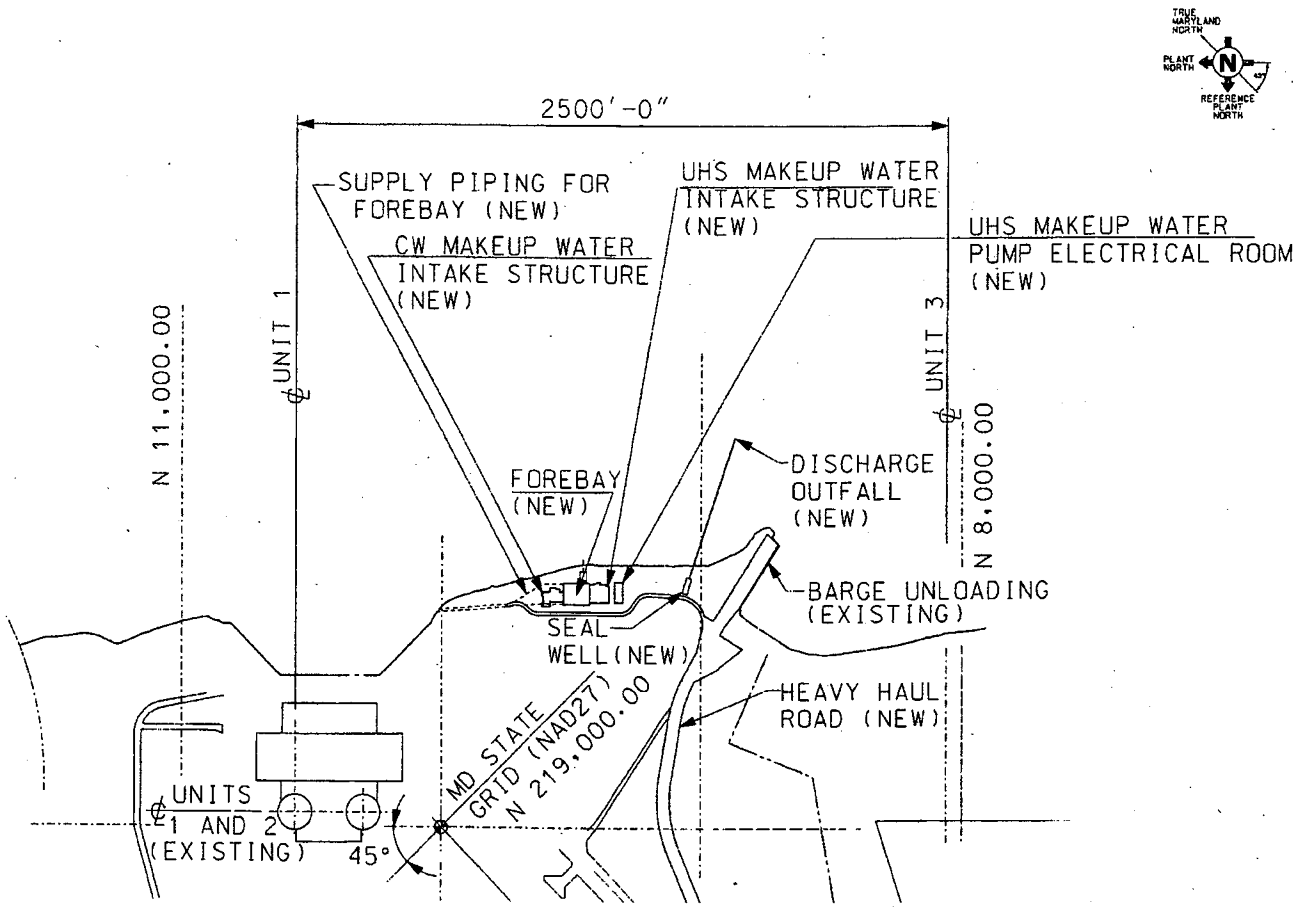


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FIGURE 3.4-3
CIRCULATING WATER INTAKE/DISCHARGE
STRUCTURE LOCATION PLAN
FOR CCNPP UNIT 3.

TRUE NORTH

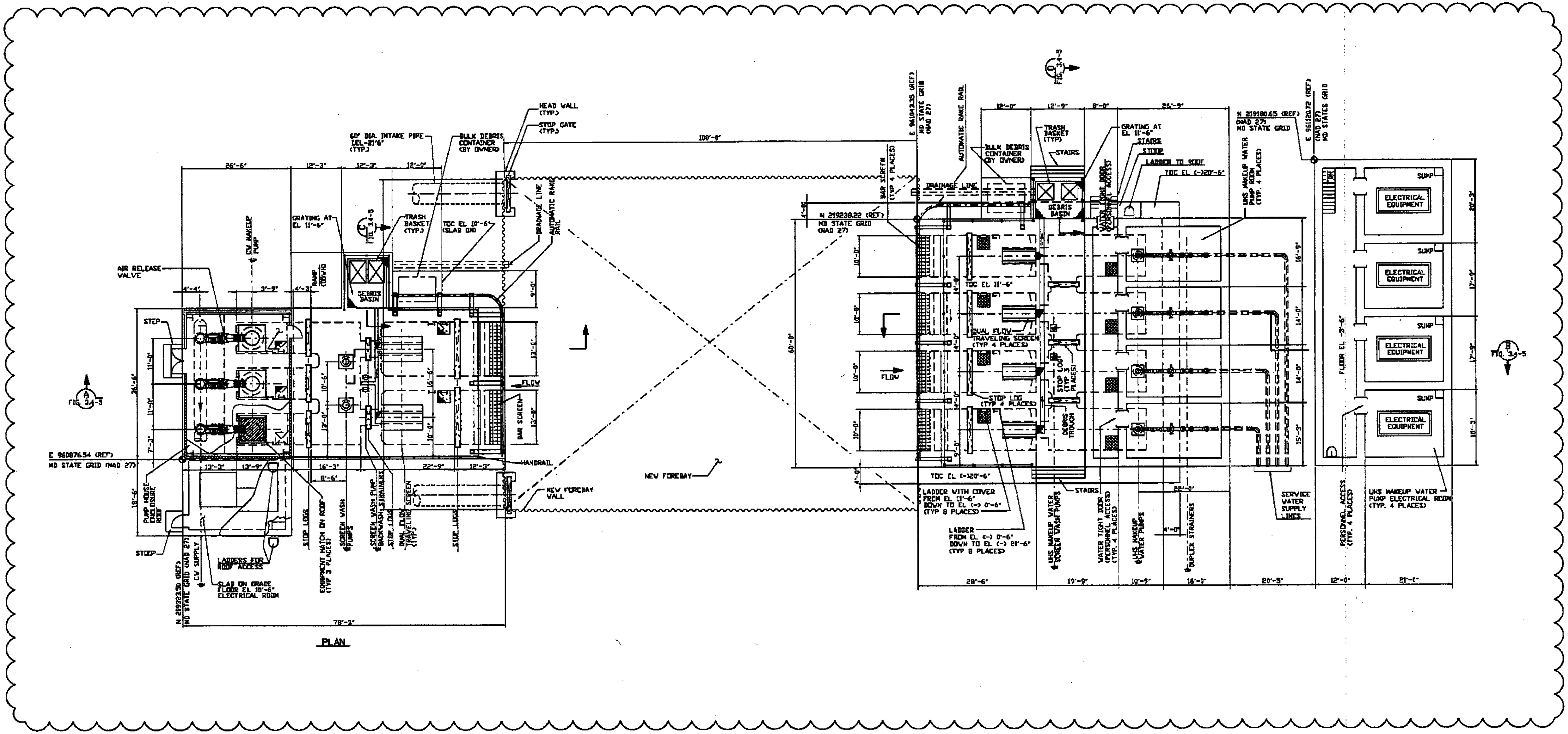
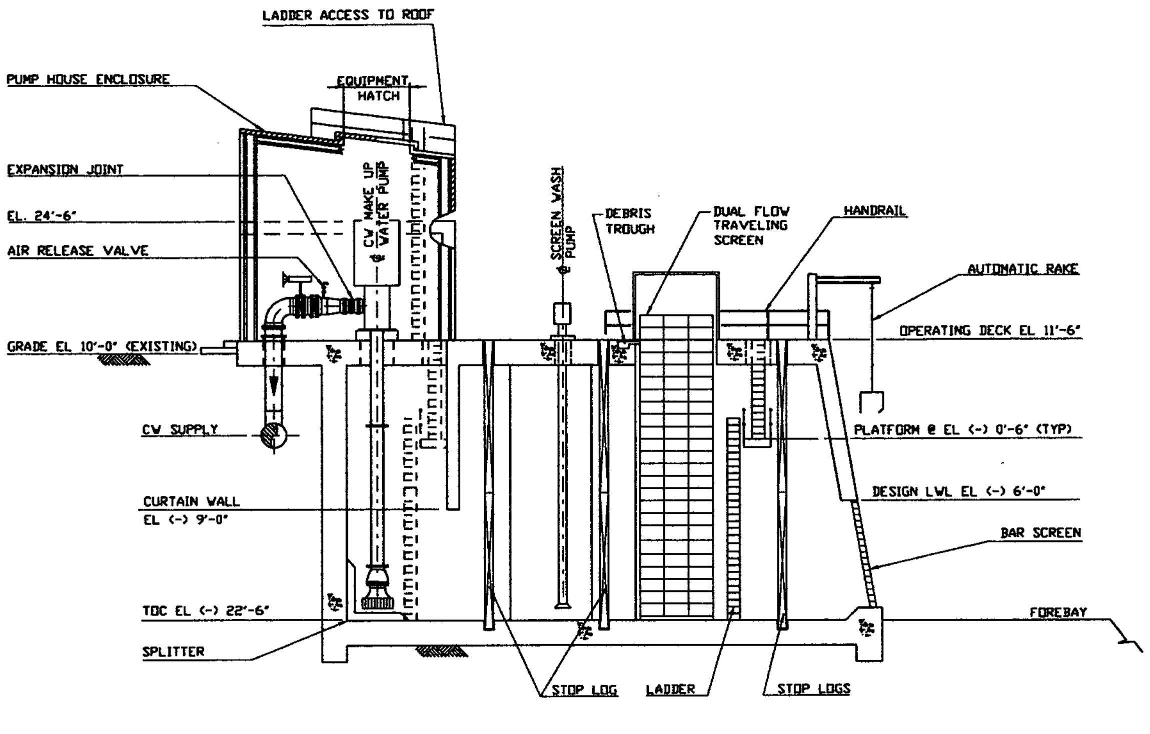
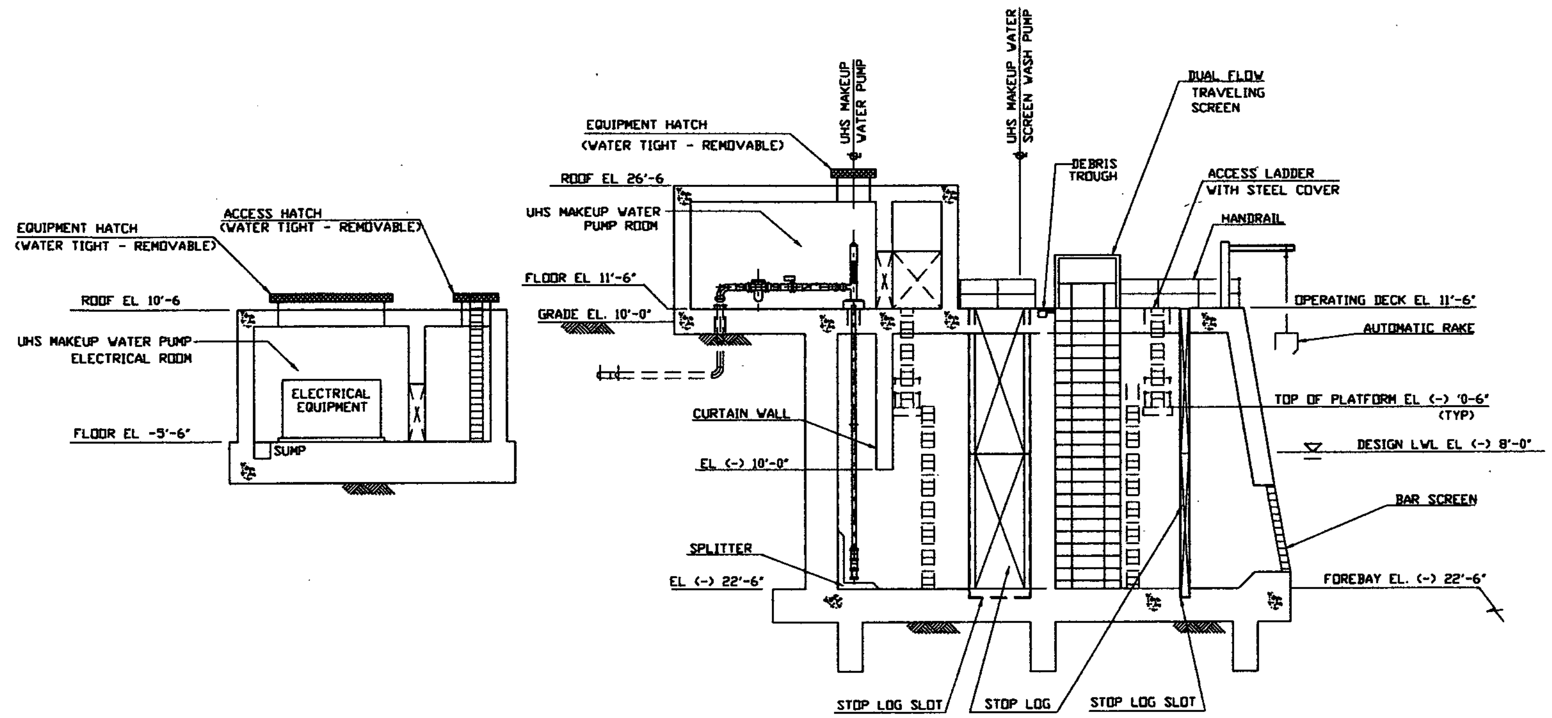


FIGURE 3.4-4

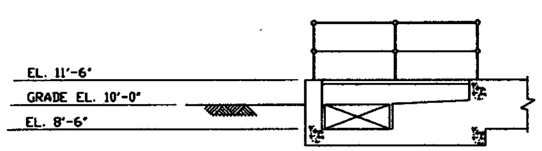
PLAN VIEW OF CHESAPEAKE BAY INTAKE SYSTEM FOR CCNPP UNIT 3



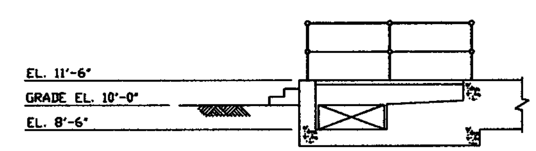
SECTION A
FIG. 3.4-4



SECTION B
FIG. 3.4-4



SECTION C
FIG. 3.4-4



SECTION D
FIG. 3.4-4

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0 8 16 24 32FT

FIGURE 3.4-5

SECTION VIEW OF CHESAPEAKE BAY INTAKE SYSTEM FOR CCNPP UNIT 3.

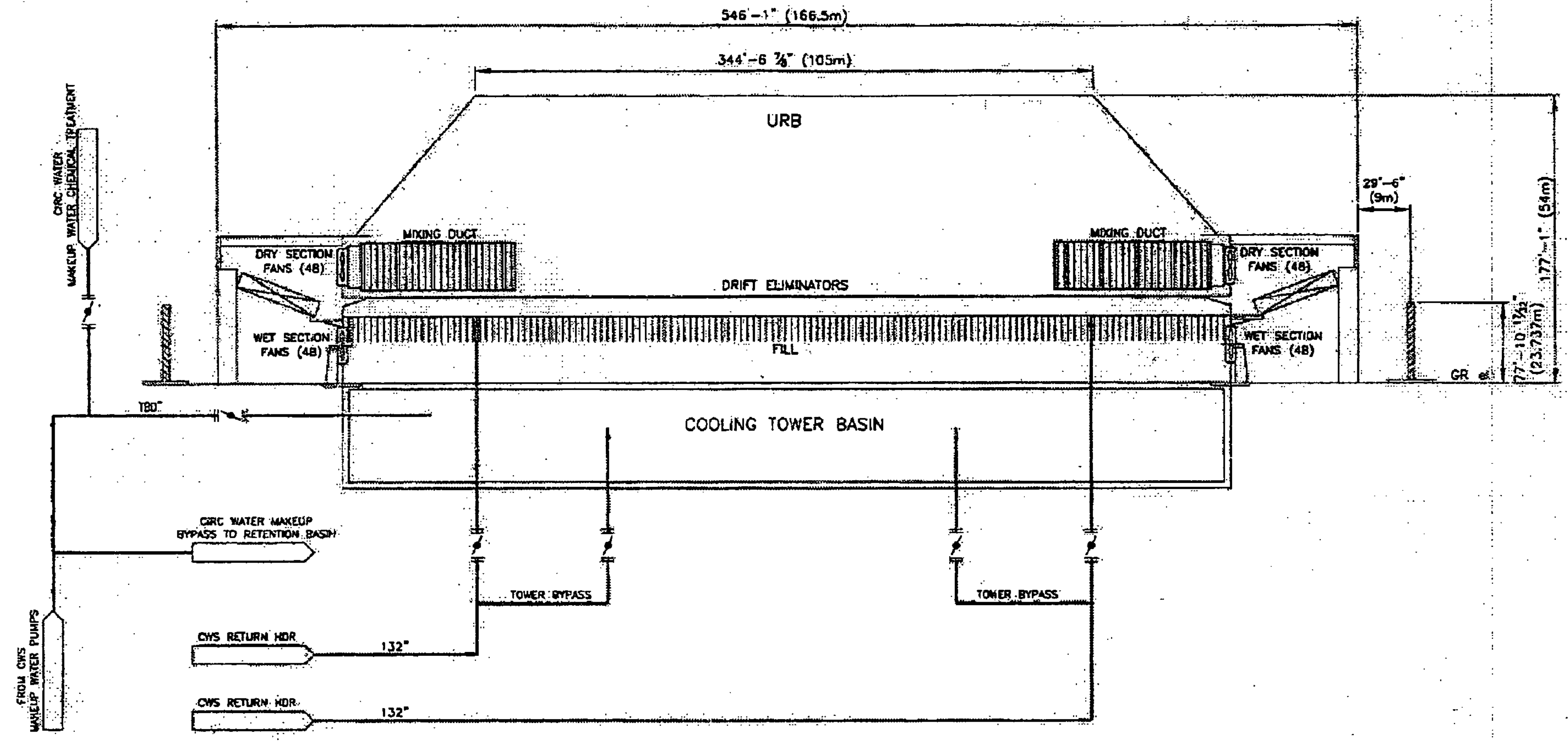

FIGURE 3.4-8 **Rev. 4**

{MAIN COOLING TOWER ELEVATION VIEW}

CCNPP UNIT 3 ER

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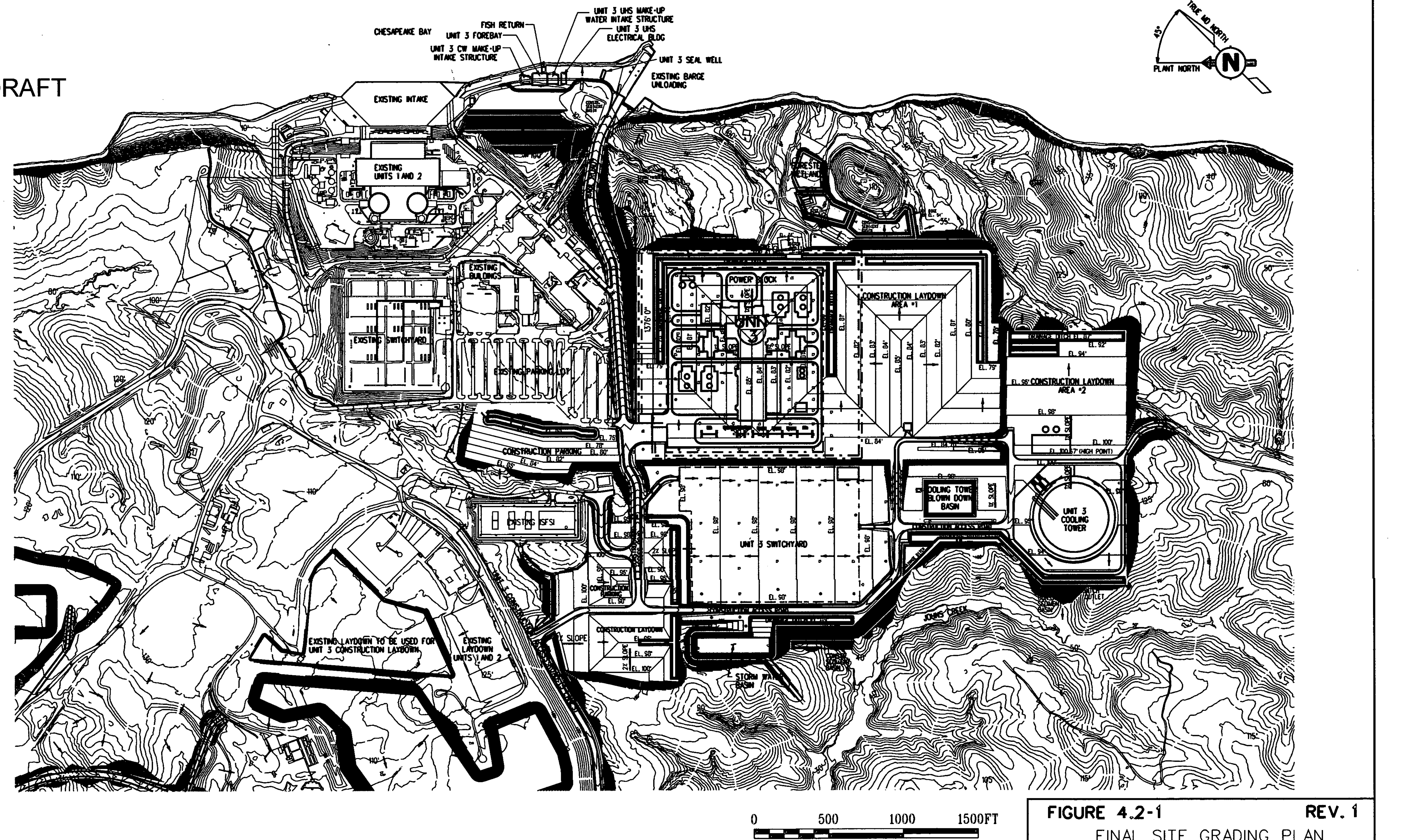

FIGURE 4.2-1 REV. 1

FINAL SITE GRADING PLAN
{CCNPP UNIT 3}
CCNPP UNIT 3 ER

Figure 4.5-7: Dose Rate Estimated in 2015 in Units of mrem per 8760 Hours

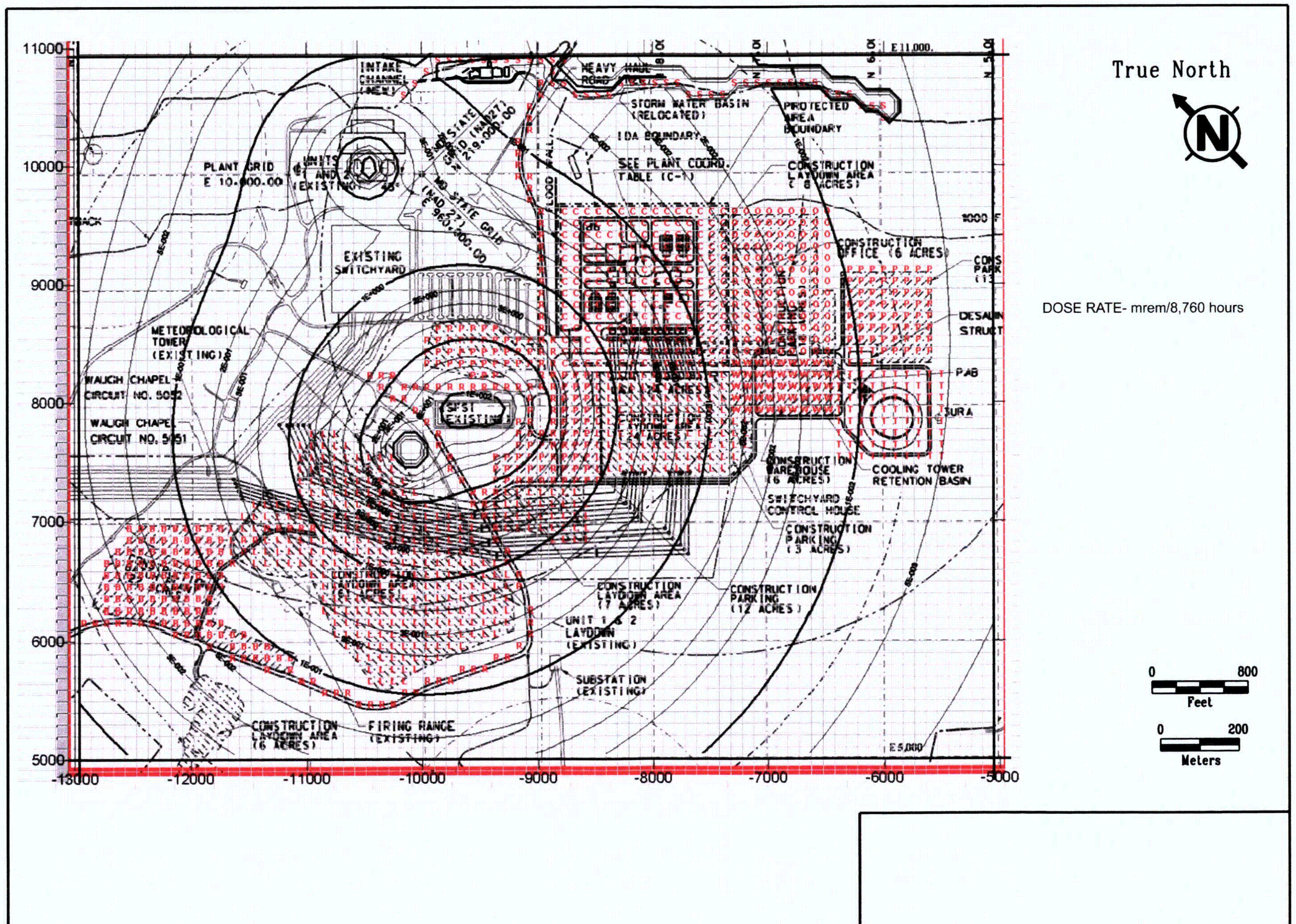

Figure 5.8.1-~~1~~: Predicted Sound Contours (dBA) of Hybrid Cooling Tower during Leaf On conditions

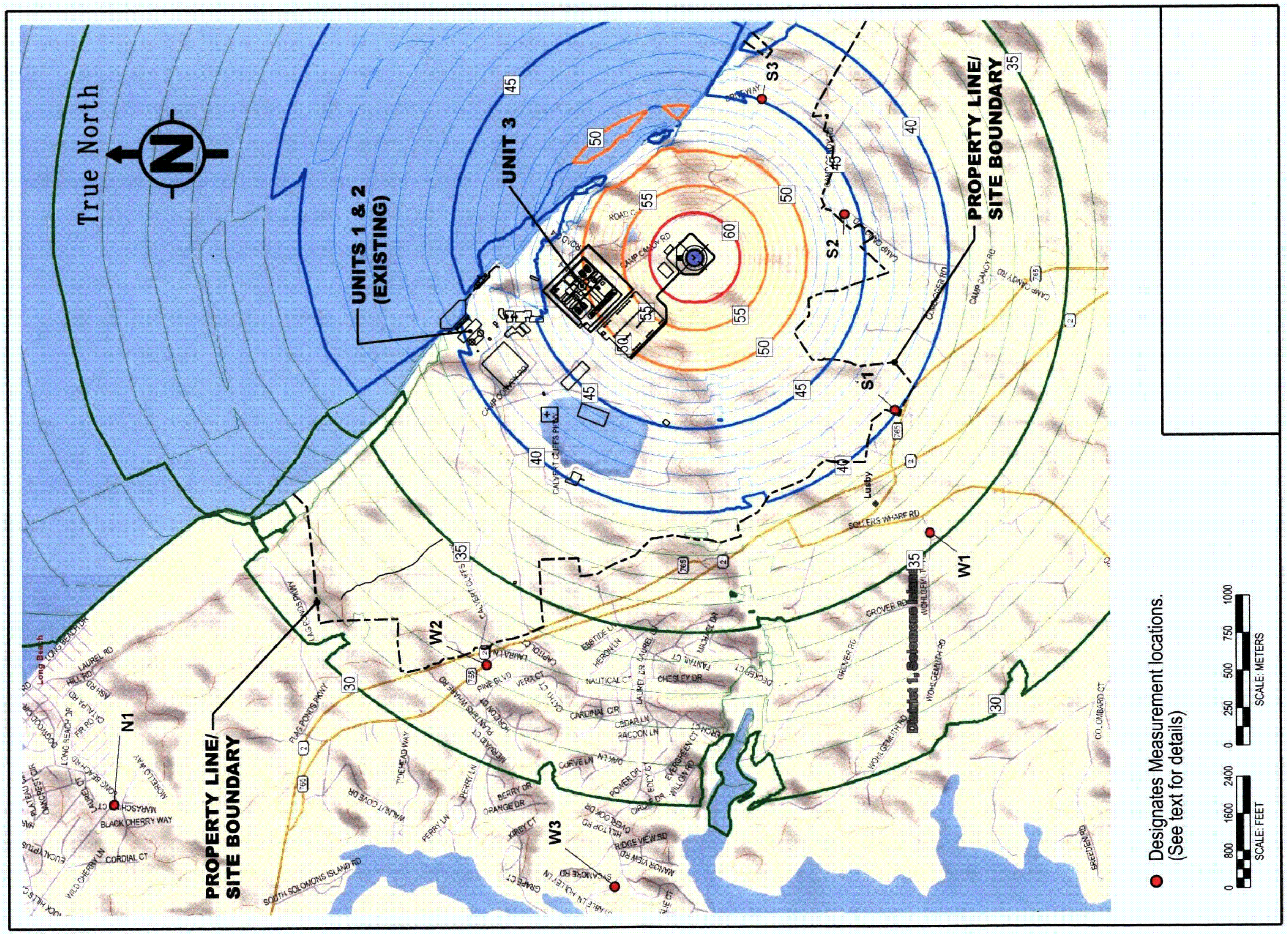

Figure 5.8.1-~~1~~2: Predicted Sound Contours (dBA) of Hybrid Cooling Tower during Leaf Off conditions

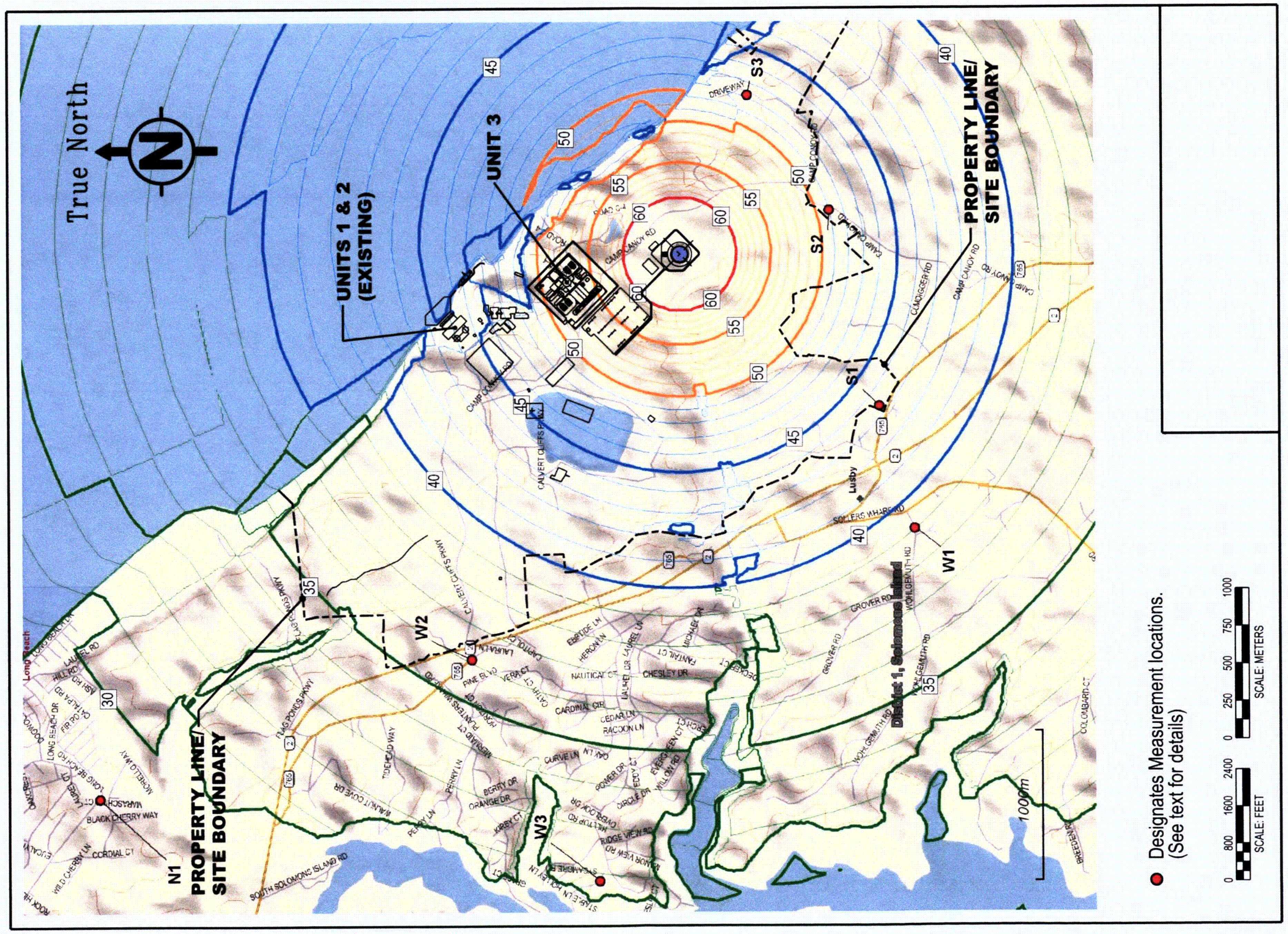

Figure 6.1-1: Existing Thermal Monitoring Stations for CCNPP

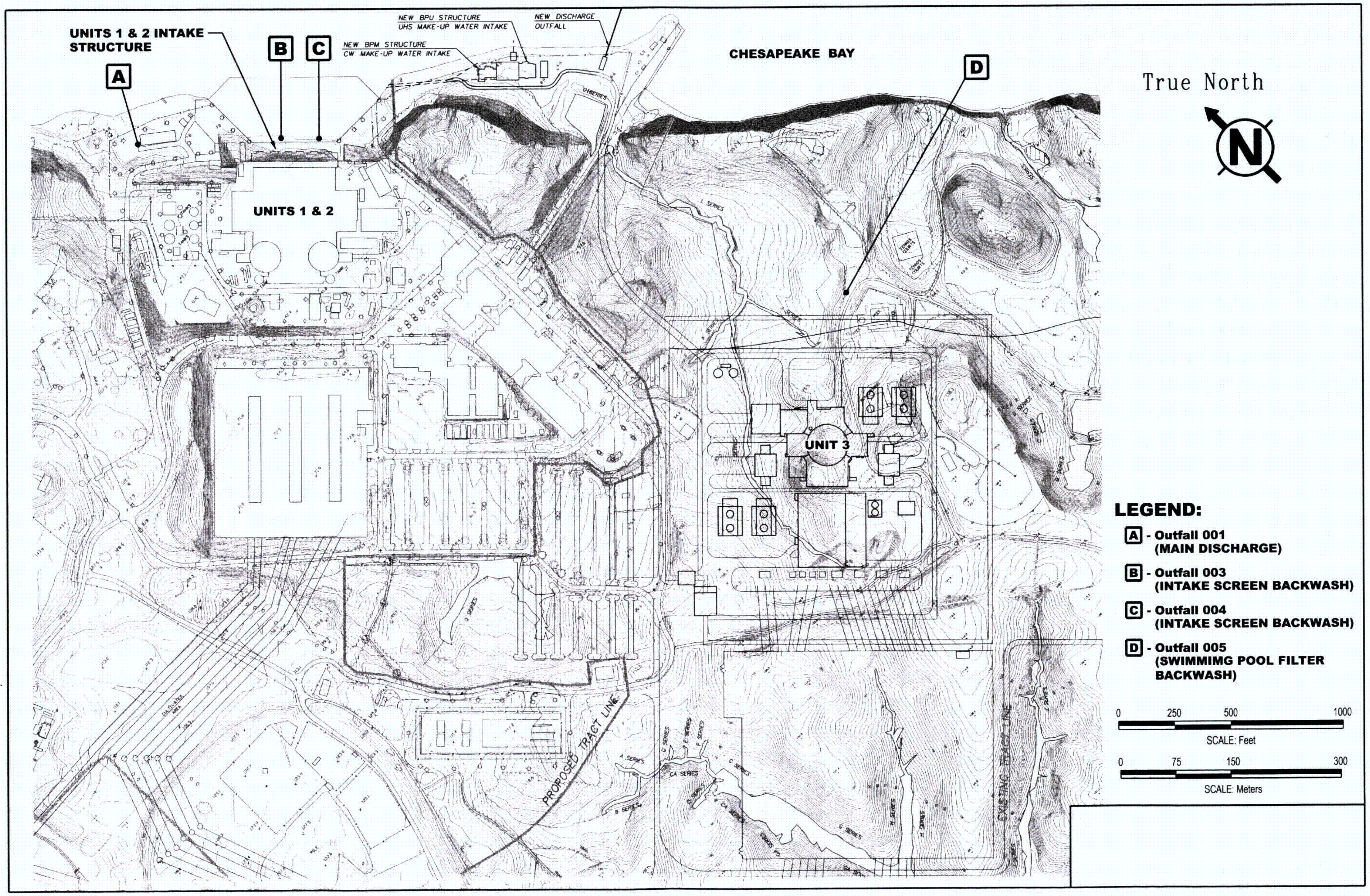

Figure 6.2-1: CCNPP Sampling Locations 0-2 mi (0-3.2 km)

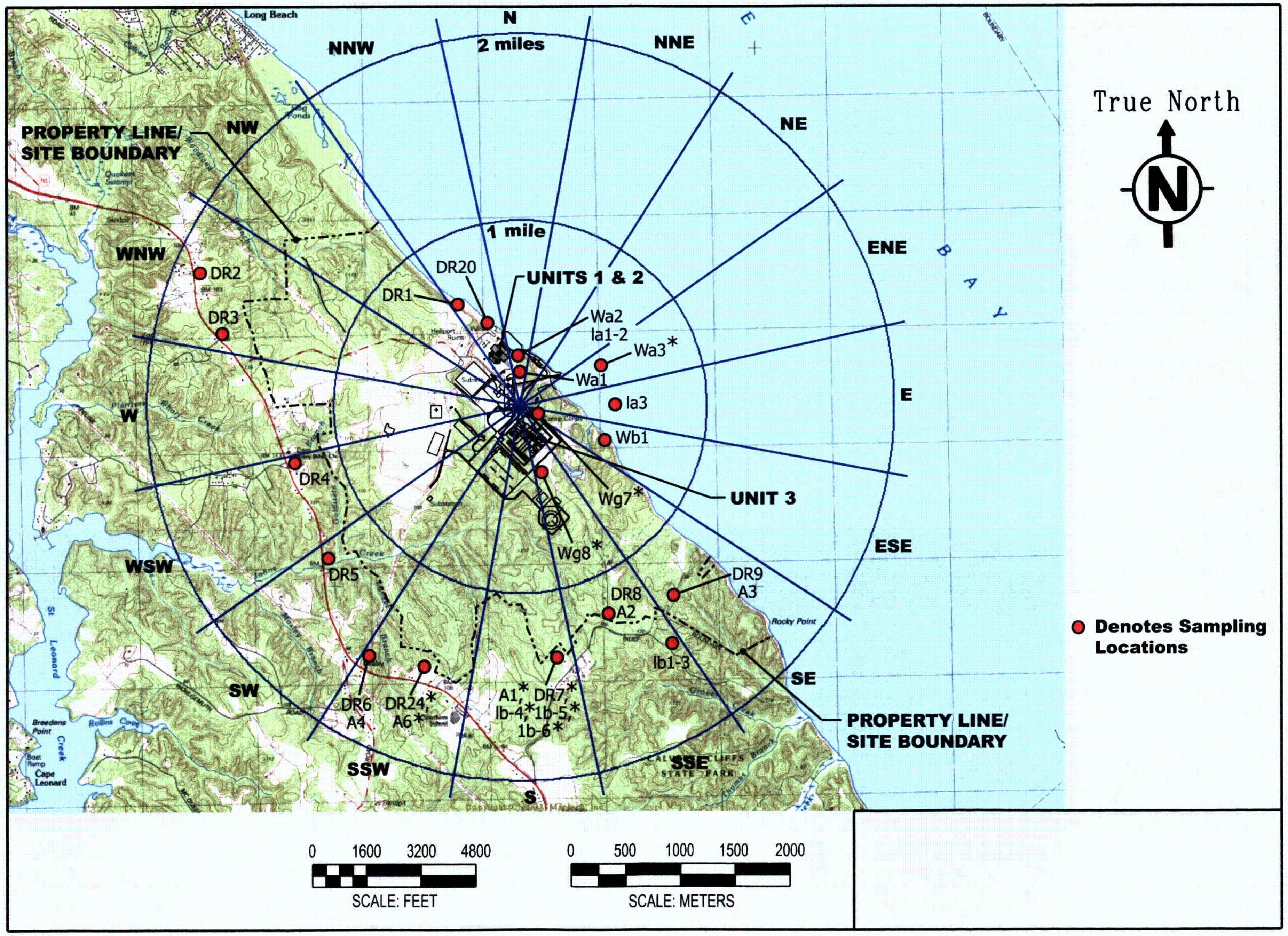

Figure 6.2-3: CCNPP Independent Spent Fuel Storage Installation Sampling Locations

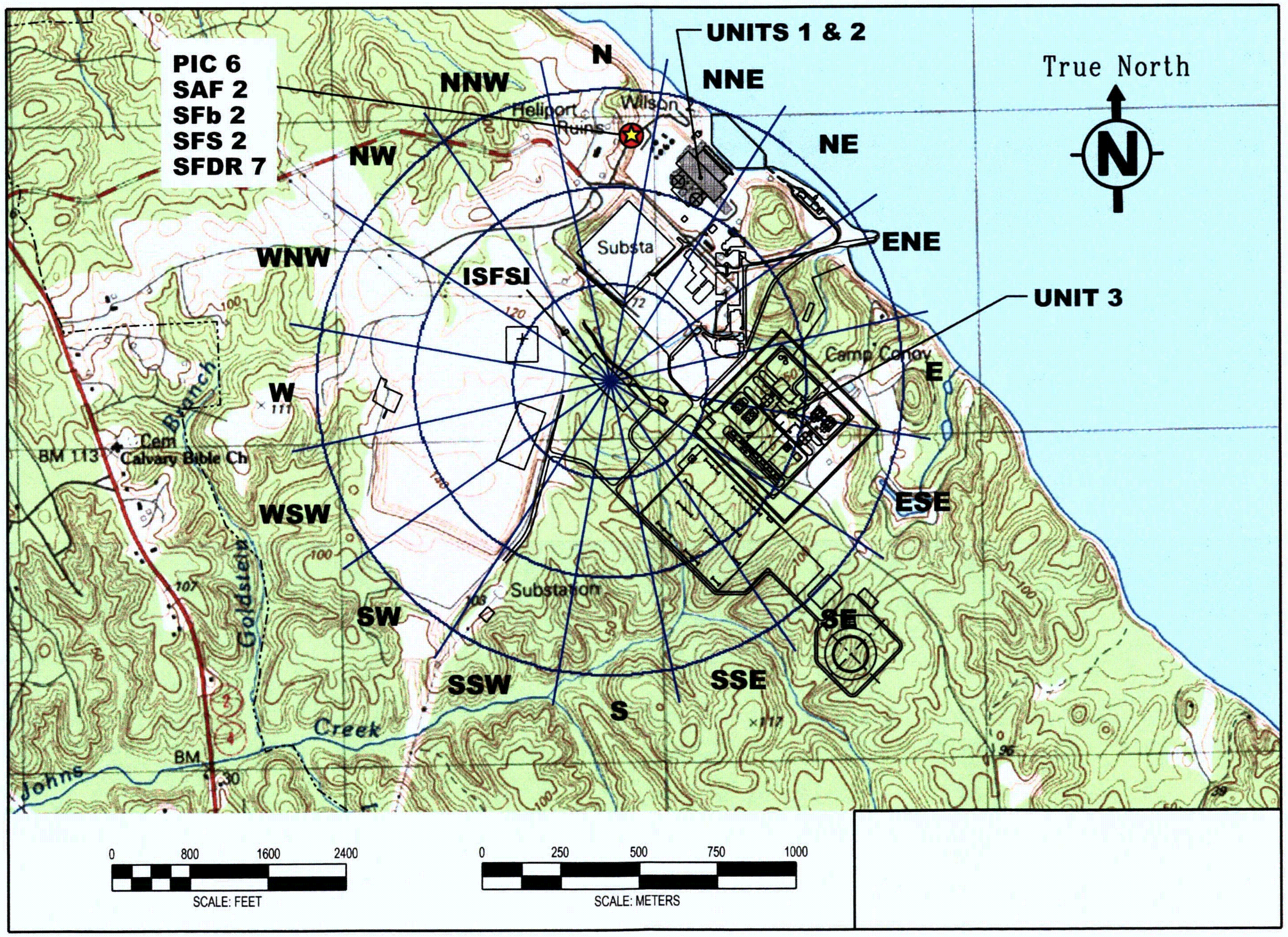

Figure 6.4-1: CCNPP Site Map with Meteorological Tower Location

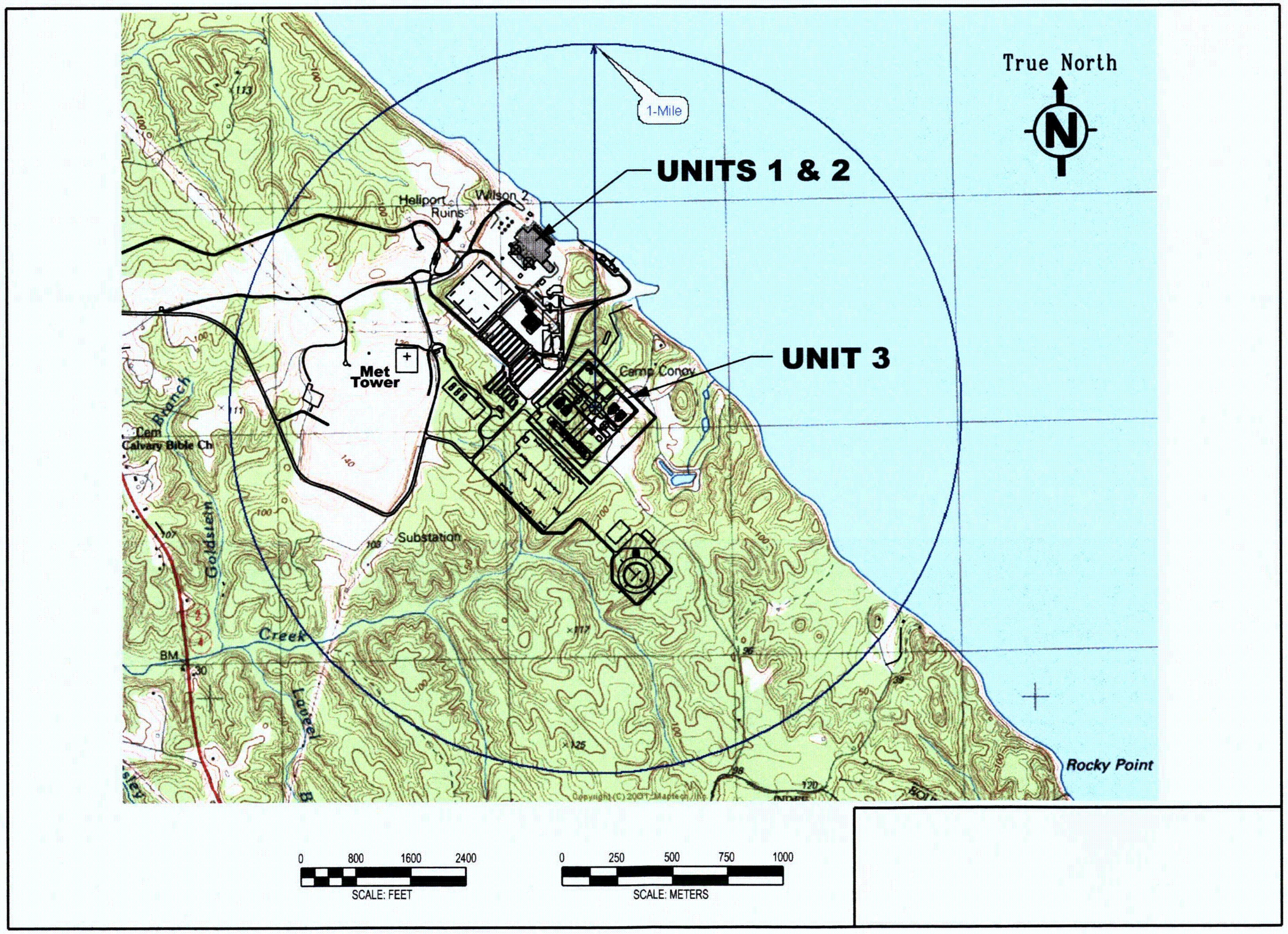

Figure 6.4-2: Detailed Topography Within 5 mi (8 km)