UniStar
Calvert Cliffs Nuclear Power Plant Units 3 and 4
Cooling System Selection
and
Site Layout Study

Prepared for UniStar Nuclear and Constellation Generation Group

By

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List of Abbreviations and Acronyms

ALTA-ACSM	American Land Title Association – American Congress of Surveying and Mapping
ANS	American Nuclear Society
BG&E	Baltimore Gas & Electric
BTA	best technology available
CCNPP	Calvert Cliffs Nuclear Power Plant
CDS	Comprehensive Demonstration Study
CGG	Constellation Generation Group
COLA	Combined Construction Permit and Operating License application
COMAR	Code of Maryland Regulations
CPCN	Certificate of Public Convenience and Necessity
CW	circulating water
CWA	Clean Water Act
CWIS	cooling water intake structure
CZMP	Coastal Zone Management Program
DC	design criteria
EFH	essential fish habitat
EPR	Evolutionary Power Reactors
EPRI	Electric Power Research Institute
ER	Environmental Report
ERGS	Elm Road Generating Station
FF	Farm and Forestry (District)
gpm	gallons per minute
GPS	global positioning satellite
HAPs	habitats of particular concern
IDA	intensively developed area
ISFSI	independent spent fuel system installation
LNG	liquefied natural gas
LWA	limited work authorization
MDE	Maryland Department of Environment
MDNR	Maryland Department of Natural Resources
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Council
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
OCPP	Oak Creek Power Plant
PPRP	Power Plant Research Program
PWR	pressurized water reactor
RCA	Resource Conservation Area
RFMC	Regional Fishery Management Councils
RIS	representative imported species; resident important species
RS	representative species
SAV	submerged aquatic vegetation
SFA	Sustainable Fisheries Act
SNAC	spawning and nursery area of consequence
SSC	system, structure, and component
TDD	Technical Development Document
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
USGS	U.S. Geological Survey
WDNR	Wisconsin Department of Natural Resources

Executive Summary

The purpose of this study was to evaluate the Calvert Cliffs Nuclear Power Plant (CCNPP) site for locating two 1600 MWe U.S. Evolutionary Power Reactors (U.S. EPR) units and to determine the corresponding type of circulating water system for use with the new plant. The evaluations were performed by a team comprised of highly qualified industry experts.

Initial evaluations focused on the choice of open cycle (once-through) and closed cycle circulating water system options for use at the CCNPP site. The analysis of the circulating water system intake and discharge considered the applicable federal and state regulatory requirements, the feasibility of implementing various compliance alternatives, and the risks and impacts to Project economics and schedule based on either closed-cycle cooling or open-cycle cooling. Based upon the analysis conducted, the use of a closed-cycle cooling system is the recommended technology as the once-through (open) cooling option was determined to be not feasible. Selecting this technology minimizes the risks associated with environmental permitting and project schedule.

An evaluation process with an extensive listing of criteria and considerations was developed and used to evaluate layout locations on the Calvert Cliffs site. Criteria were grouped in the following eight categories:

1. Environmental
2. Land Use and Zoning (State, Local)
3. Construction Considerations
4. Construction Facilities
5. Switchyard/Transmission Lines
6. Security
7. Permanent Facility Considerations
8. Impact to Existing Facilities or Structures

Two layout options, located immediately north and south of the existing CCNPP units, presented the more favorable results.

- Northern location - units oriented side by side, south to north, reactor building towards the east, switchyard west, and cooling towers north.

- Southern location - units oriented side by side, north to south, reactor building to the east, switchyard west, and cooling towers south.

The northern location would make better use of land zoned industrial I-1 and would allow for a single site protected area. But this location presents greater construction challenges due to the distance from the existing barge facility and primary laydown, long heavy haul road route, activities crossing under the transmission lines, and impacts that would cause

redesign and relocation of the current entrance and security facilities. The northern location impacts a greater area of wetlands than the southern location.

The southern location is located entirely within the area zoned Rural/Resource Preservation District, where power plants are not permitted as a principal use. Therefore, this location would require exemption from the County Zoning Ordinance or the land must be rezoned (an exemption is preferable). However, the southern location would be more advantageous for construction activities due to the location of the existing barge facility, heavy haul road, batch plant, laydown, and parking facilities. The southern location segregates the construction activities from the operating units and would not disrupt the current traffic flow and maintains the security access facilities. However, the southern location does not allow for a single site protected area that is connected with the existing CCNPP Units 1 and 2 protected area. This would result in a higher life cycle cost for security.

Based on the analysis by the team, it is recommended that the southern location with a closed circulating water system be established as the base case for Calvert Cliffs Units 3 and 4 Combined Construction Permit and Operating License application (COLA). Selection of the southern location is based on locating the entire power block and cooling tower arrangement outside the 1000' wide critical area, which is established under state law to protect the Chesapeake Bay shoreline and associated cliffs. This study assumes that appropriate approvals can be obtained to allow water-critical structures/pipelines to be located within the critical area.

Acknowledgements
The UniStar CCNPP Site Layout Team/Cooling System Expert Working Group

This report presents the results of efforts by the CCNPP Units 3 and 4 Site Layout Team/Cooling Water Systems Working Group, a multidisciplinary team of industry experts led by David W. Murphy, P.E., Bechtel Power Corporation (Bechtel). Members of the team, their affiliations, and contributed expertise are listed below. Biographies of key team members are presented in Appendix J.

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1.0 Introduction

1.1 Background

Constellation Generation Group (Constellation) is embarking on a study with the intent to develop a two-unit nuclear power plant. Constellation is considering the Calvert Cliffs site, along with other candidate sites, for the new plant. As such, Constellation may develop and submit a license application for the addition of two nuclear units at the Calvert Cliffs site in Calvert County, Maryland. The plant would be developed as a project of UniStar Nuclear, a collaboration of Constellation and AREVA with Bechtel as the Architect/Engineer. Development of the new plant would require approval by the U.S. Nuclear Regulatory Commission (NRC) of a construction and operating license application (COLA), including an environmental report (ER), which documents the safety and environmental analyses bases for the facility. With this plan, Constellation is taking an aggressive approach with the following milestones as the driver for the business plan and the decision process for layout and cooling water type selection and recommendation.

Environmental Report (ER) submittal
Design Certification (DC) submittal
COLA submittal
Limited Work Authorization (LWA)

For this study, the proposed units will be referred to as Calvert Cliffs Nuclear Power Plant Units 3 and 4 (CCNPP 3 and 4). References to north, south, and west in the report are based on the existing units as the reference point.

1.2 Purpose

In preparation of the COL, one of the first activities is to develop a layout study to evaluate various layout options and circulating cooling water alternatives, and select those best suited for a site. The purpose of this report is to document Constellation's evaluation of various facility layout options and circulating cooling water alternatives for a two-unit U.S. EPR plant located at the CCNPP site. To accomplish this task, an expert working group was developed. This team includes Constellation, Bechtel, and industry technical specialists. See Appendix J for team members and qualifications.

The team was charged with conducting the necessary analyses and recommending to senior management the circulating water system and layout of major plant facilities that represented the best choice in consideration of all relevant factors, including environmental, constructability, operability, cost, and schedule. Decisions based on the team's recommendations are intended as bases for subsequent engineering, environmental, and geological studies and analyses (e.g., subsurface investigations) necessary to confirm feasibility, basic design parameters, and other information essential for development of a COLA.

2.0 Scope/Basis

The scope of this study is to locate two 1600 MWe net (4592 MWt) U.S. EPR units on the Calvert Cliffs site with the associated circulating cooling water system. The size of the EPR site footprint is based on Framatome drawing NPGM2-102118 for OL-3. Spacing between the reactor building centerlines is 1000' which accommodates the construction activities.

Evaluation of closed-cycle cooling water system options (e.g., cooling tower types) and cooling water intake and discharge conceptual design options beyond that needed for recommendation of circulating water system type is not within the scope of this study.

2.1 Description of Calvert Cliffs Site

The Calvert Cliffs site is approximately 2100 acres on the western shore of the Chesapeake Bay in Calvert County. The Calvert Cliffs property is predominantly occupied by forests with some cleared land. Maryland's Critical Area law and the County Zoning Ordinance require a 100' critical area buffer and a 1000' critical area zone along the Chesapeake Bay shoreline. The CCNPP site includes approximately 2 miles of Chesapeake Bay frontage. This shoreline is mostly extremely steep cliffs with little beach area. South of the Calvert Cliffs units is a recreational area known as Camp Conoy. Camp Conoy contains various cabins, outbuildings, swimming pool, softball field, tennis courts, and fishing pond used by Constellation employees and their families.

The two existing units at Calvert Cliffs are located on a tract containing 976.2 acres, which was acquired from Belle Goldstein (in 1967) and is zoned I-1 (light industrial). An adjacent 29.4 acre tract acquired from Pardoe in 1985 is also zoned I-1. The I-1 district includes the Lake Davies area that was used for approximately 3 million cubic yards of dredging spoil from the construction of the intake canal for the existing units. The remaining land at Calvert Cliffs (1,051.3 acres) is zoned Rural/Resource Preservation District. When the pending comprehensive rewrite of the Zoning Ordinance becomes effective on May 1, 2006, this district will become the Farm & Forestry (FF) district. The FF tracts were acquired from the YMCA in 1968, and from Briscoe, Louis Goldstein, Gibson, Fowler and Raysinger in the 1980s. A chart listing all of the tracts included within the Calvert Cliffs site is attached as Appendix C. A table showing relevant land uses by zoning district is also included in Appendix C.

Calvert County's Flag Ponds Nature Park and Calvert Cliffs State Park border the site on the north and south, respectively. The northerly portion of the site is adjoined on its western border by Maryland Highway 2-4, a designated state-scenic highway. The southern portion of the site adjoins rural residential property to the west, between the site and Highway 2-4, and several residential parcels located on the bayshore.

Site topography, streams, existing CCNPP facilities, and other general site features relevant to this study are shown in figures included in Appendix A.

2.1.1 Site Environmental Characteristics

Environmental characteristics of the CCNPP site and adjacent areas of the Chesapeake Bay that contribute to the bases of this study are highlighted below. Detailed accounts of these characteristics are provided in Appendix H.

- Endangered or Threatened Species – Three species designated as threatened or endangered on the federal or state level are known to occur on the CCNPP site: the Northeastern Beach Tiger Beetle and Puritan Tiger Beetle, which occupy cliff and/or shoreline areas of the site, and the Bald Eagle, which is known to nest in the far southern part of the site.

- Wetlands and Floodplains – Wetlands on the CCNPP site of primary concern consist of small headwater streams in the Patuxent River drainage and associated riparian forest, and minor Chesapeake Bay tributary streams and associated small impoundments. No designated floodplains occur on the site except along the Chesapeake Bay shoreline.

- Cultural Resources – Known historic resources on the CCNPP site consist of a relocated tobacco barn that served as the CCNPP Visitor Center (closed in 2001 due to heightened security measures) and a historical house foundation and chimney, all located immediately north of existing plant facilities; log cabins associated with Camp Conoy, a former Boy Scout camp, located south of existing plant facilities; and tobacco barns located elsewhere on the site. No known archaeological sites are present on the CCNPP site.

- Chesapeake Bay Ecological Resources – Known Chesapeake Bay ecological resources in the immediate vicinity of the CCNPP site include oyster beds south of existing CCNPP plant facilities.

2.2 Description of U.S. EPR

The U.S. EPR is an evolutionary power reactor designed by Framatome ANP, a jointly-owned subsidiary of AREVA and Siemens. This plant is a four-loop design. The primary system design, loop configuration, and main components are similar to those of current operating U.S. PWRs. Construction of the EPR is currently proceeding at the Olkiluoto 3 site in Finland.

Cooling water requirements used for this study were estimated from CCNPP Units 1 and 2 and from the initial U.S. EPR heat balance. On this basis, a once-through cooling water system for a two-unit plant would require an onshore or offshore intake design to accommodate upwards of 5 million gallons per minute (gpm) considering a 10°F temperature rise across the condenser. Cooling water makeup and blowdown requirements for a closed-cycle circulating water system are estimated to be 40,000 gpm and 20,000 gpm per unit, respectively.

2.3 Site Layout Alternatives

This study will consider both an open and closed cooling water system for removal of heat from the turbine cycle. Layout alternatives will include locations north, south, and west of the existing CCNPP Units 1 and 2.

The new U.S. EPR units for the Calvert Cliffs site are located using the Maryland State Plane coordinate system based on USGS reference year 1927 (NAD). This coordinate system was used for the original construction of Units 1 and 2. The location is based on information obtained from Bechtel drawing 6750-C-1 (BG&E No. 61-501E) depicting plant coordinates MD N 219,000.00 and E 960,000 and plant grid coordinates N 10,000.00 and E 10,000.00.

2.4 Methodology

The methodology for the study was developed and implemented by the study team during the course of two working sessions held at Bechtel offices in Frederick, MD on January 5-6 and February 8, 2006; teleconferences; independent analyses, report preparation, and review by team members; and a site walkdown by selected team members on January 26, 2006. See Appendices D and E for documentation of walkdown results and meetings.

The team used an adaptive approach in which detailed methodology for subsequent steps were developed on the basis of investigation results. Following is a summary of key steps used in the methodology. Details of the process are described in Section 4.0.

2.4.1 Evaluation of Cooling System Options

Based on initial discussions by the team, selection of cooling system (once-through versus closed-cycle) was the appropriate starting point for the analysis. Detailed evaluation included consideration of applicable regulations, technological factors, cost, and associated regulatory and schedule risk. Results of the analysis, discussed in Section 3.0, indicated that a closed-cycle system was the appropriate choice for the new plant, a decision which drove the remainder of the evaluations.

2.4.2 Facility Layout Alternatives Evaluation and Selection

Based on the initial conclusions reached by the team, the facility layout evaluations were based on a close-cycle cooling system. Steps in the layout evaluation process are summarized below and described in more detail in Section 4.0 and Appendix B.

1. Identification of Exclusion Criteria – areas of the site that were deemed “off-limits” to development, were identified.

2. Identification of candidate facility layout options based on a closed cooling water system and the exclusion criteria.

3. Initial layout screening to eliminate configurations with obvious construction problems.

4. Evaluation of Remaining Layout Options (2 (north) and 4 (south))

    a. Development and Weighting of Evaluation Criteria
    b. Evaluation and Scoring Process

3.0 Evaluation of Cooling Water System Alternatives

Based on the analysis of the information discussed below, the use of a closed-cycle cooling system is the recommended cooling water system alternative for CCNPP Units 3 and 4. Selecting this technology is likely to minimize the risks associated with environmental permitting, which also would minimize the risk to the Project schedule. Furthermore, open-cycle cooling for CCNPP Units 3 and 4 is not a feasible alternative from an engineering and cost-effectiveness perspective.

In Section 3.1.1, below, applicable federal and state regulatory requirements, the feasibility of implementing various compliance alternatives, and the risks and possible impacts to Project economics and schedule based on the two major compliance alternatives, i.e., open and closed-cycle cooling, are identified and discussed. Also considered are possible impacts and benefits to CCNPP Units 1 and 2 of compliance alternatives for CCNPP Units 3 and 4 under USEPA’s §316(b) Phase II Rule (discussed below in Section 3.1.1.2.c).

Engineering considerations regarding the installation and operation of open-cycle cooling for CCNPP Units 3 and 4 are discussed in Section 3.1.1.6, below. Also discussed in that section is the feasibility of satisfying regulatory requirements for reducing impacts to fish and shellfish through the use of cooling water intake structure (CWIS) technologies.

3.1 Federal and State Cooling Water Intake Structure and Thermal Discharge Regulations

CWIS’ are regulated under §316(b) of the Federal Clean Water Act (CWA) and its implementing regulations, and under Title 26 of the Code of Maryland Regulations (COMAR) 26.08.03.05. The associated thermal discharges are regulated under COMAR 26.08.03.03, which implements CWA §316(a) in the State of Maryland. These regulations, and their applicability to CCNPP, are summarized in Appendix K. Discussed below are implications of these regulations to the choice of cooling water system alternatives for CCNPP Units 3 and 4.

The regulatory analyses presented in this section reflect reasonable interpretations of the federal and state regulations, as those regulations exist today. However, these regulations are not cast in stone. USEPA's regulations that implement §316(b) are under appeal and the Maryland §316(b) regulations predate USEPA's regulations which were promulgated in 2001, 2003, and 2004. Therefore, it is possible that the outcome of the appeal of the federal regulations or future regulatory action by Maryland could affect the validity of these analyses and, therefore, the conclusions and recommendations that were derived from them.

In addition, Maryland is authorized to implement its own regulatory program so long as the state regulations are as stringent as or more stringent than USEPA's regulations. Maryland could implement regulations that would require units such as the proposed CCNPP Units 3 and 4 to operate with closed cooling. Maryland could, although unlikely given past permitting history and its comments during the §316(b) rulemaking, adopt regulations that would prohibit some regulatory options available under USEPA's Rules. Maryland could also impose mandatory studies and assessments beyond those required by USEPA's Rules. Such regulations could adversely impact the Project's economics, and if additional studies were required, the Project's schedule.

3.1.1 §316(b) -- Federal CWIS Regulations

Section 316(b) of the CWA regulates CWISs associated with point source discharges (i.e., discharges regulated under §301 or §306 of the CWA):

> "Any standard pursuant to section 301 or section 306 of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."

USEPA promulgated regulations governing CWISs at new facilities, which include new steam electric generating stations ("Phase I Rule"), and existing steam electric generating stations ("Phase II Rule") pursuant to §316(b) of the CWA. The Phase I Rule was issued in December 2001 and was amended in June 2003. The Phase II Rule was issued in July 2004.

Given USEPA's definition of "existing facility" (see Appendix G) CCNPP Units 3 and 4 should be considered an existing facility and be regulated under the Phase II Rule. However, as discussed below in the Regulatory Uncertainties section, the definition of existing facility is being challenged in a pending appeal of USEPA's Phase II rule. Therefore, regulation of CCNPP Units 3 and 4 under Phase I as well as Phase II is considered.

USEPA's CWIS regulations are implemented in the context of the Agency's overall National Pollutant Discharge Elimination System (NPDES) regulations. These regulations require that the owner(s) and operator of a point source apply for and operate in conformance with an NPDES permit. The regulations also require that the owner(s) and the operator apply for a modification to an existing permit in advance of the discharge of any pollutants from any additional sources at the site. The NPDES regulations do not require that all sources regulated under a single permit be owned by the same entity. Therefore, CCNPP could apply for a modification of the existing NPDES Permit for Units 1 and 2 to accommodate the discharge of pollutants expected from Units 3 and 4.

If the units are regulated under a single permit, there may be substantial advantages associated with achieving compliance for Units 1 and 2 under USEPA's current §316(b) Phase II Rule[1]. This potential strategy is discussed in Section 3.1.1.2.c, below.

3.1.1.1 Phase I Compliance Alternatives

The Phase I Rule provides for two compliance alternatives: Track I (Fast Track) and Track II (Site-Specific Track). Under Track I, a facility with an estuarine cooling water source must:

- Reduce intake flow, at a minimum, to a level commensurate with that which can be attained by a once-through recirculating cooling water system.
- Design and construct each cooling water intake structure to a maximum design intake velocity of 0.5 ft/sec.
- Design and construct the cooling water intake structures such that the total design intake flow over one tidal cycle of ebb and flow is no greater than 1% of the volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level of the estuary.
- Implement technologies and operational measures to minimize impingement mortality and entrainment of threatened or endangered species and other species of fish and shellfish of concern.

As a practical matter, the intake flow reduction requirement of Track I make Track I a closed-cycle CWIS option.

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[1] *Wisconsin's Department of Natural Resources (WDNR) issued a renewed/modified NPDES permit for a facility on Lake Michigan, Oak Creek Power Plant (OCPP), that included the discharges associated with two additional units, referred to as the Elm Road Generating Station (ERGS), to be built on the same site. OCPP/ERGS will use a common intake structure, a modification of OCPP's existing CWIS. WDNR determined that the modification of the existing CWIS to accommodate the new units was regulated under USEPA's Phase II Rule. USEPA Region 5 did not object to the final permit for Oak Creek/Elm Road.*

Under Track II, a facility may install a CWIS that is not closed-cycle; however, it must comply with the following requirements:

- Reduce the level of adverse environmental impact to a level commensurate with that achieved in Track I.
- Design and construct the CWISs such that the total design intake flow over one tidal cycle of ebb and flood is no greater than 1% of the volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level of the estuary.
- Conduct a Comprehensive Demonstration Study (CDS) including a source water biological study, an evaluation of potential CWIS effects, an evaluation of proposed mitigation measures, and a verification monitoring plan.

3.1.1.1a Implications of Phase I Compliance Alternatives for CCNPP Units 3 and 4

There are no known major impediments for compliance under Track I of the Phase I Rule with a closed-cycle cooling system for CCNPP Units 3 and 4.

However, compliance under Track II of the Phase I Rule with a once-through cooling system would be problematic for a number of reasons:

- There are no demonstrated technologies for achieving reductions in entrainment commensurate with closed-cycle cooling (see Section 3.2.2, below).
- The 1% proportional intake flow requirement may be difficult to satisfy with once-through cooling for CCNPP Units 3 and 4. As one point of reference, CCNPP Units 1 and 2, with 2.4 million gpm of intake flow, withdraw 0.7% of the tidal flow in the area of the plant (BG&E, 1970). The ebb tide excursion distance in the vicinity of CCNPP is 5.3 km (Constellation, 2004). Assuming an equal distance (5.3 km) for the flood tide excursion and an average water depth of 15 m, the referenced water column volume, for the extreme case of an offshore intake 5.3 km from shore, would be 1,324 million m^3. Over one tidal cycle of ebb and flood (approximately 12 hours), 1% of that volume would be withdrawn by an intake flow rate of 4.8 million gpm, roughly the once-through cooling water requirement for CCNPP Units 3 and 4.
- There are requirements to develop a plan of study and submit this plan to Maryland for review, to implement the study plan and to present the results of the study in a comprehensive demonstration study. The time necessary to address these requirements would likely be three years, at a minimum. This would have a substantial impact on the Project's schedule.

3.1.1.2 Phase II Compliance Alternatives

The Phase II Rule establishes national numeric performance standards for reducing impingement mortality and entrainment and a series of compliance alternatives, including meeting the numeric performance standards through design and construction technologies or operational measures. The Phase II Rule requires most existing facilities to develop information to demonstrate that the facility meets or will meet the applicable performance standards. The information is referred to as a Comprehensive Demonstration Study.

The first compliance alternative (§125.94(a)(1)) applies to existing facilities that (1) operate with or will operate with a closed-cycle cooling system (§125.94(a)(1)(i)), in which case they are deemed to be in full compliance with the Phase II Rule and do not need to submit a CDS or (2) have an intake with a through screen velocity of 0.5 feet per second or less (§125.94(a)(1)(ii)), in which case the facility is deemed to have met the performance standard for reductions in impingement mortality and only needs to submit a CDS addressing compliance with the standard for reductions in entrainment.

The second compliance alternative (§125.94(a)(2)) addresses those facilities that meet the performance standards with the existing technological, operational, or restoration measures. The third alternative (§125.94(a)(3)) allows a facility to combine the benefits from newly installed technologies, operational measures, and restoration with existing technologies and measures to comply with the requirements:

> "You may demonstrate to the Director that you have selected, and will install and properly operate and maintain, design and construction technologies, operational measures, and/or restoration measures that will, in combination with any existing design and construction technologies, operational measures, and/or restoration measures, meet the performance standards specified in paragraph (b) of this section and/or the restoration requirements in paragraph (c) of this section."

The fourth compliance alternative (§125.94(a)(4)) applies when a facility installs a technology preapproved by USEPA or the state as meeting the national performance standards for a given water body type. The fifth alternative (§125.94(a)(5)) allows a facility to obtain a site-specific determination of best technology available (BTA) based upon a cost-cost test or a cost-benefit test.

The national performance standards are provided in 40 CFR §125.94(b). The standards applicable to facilities with an estuarine source water are as follows.

- Impingement mortality performance standards:

> "If you choose compliance alternatives in paragraphs (a)(2), (a)(3), or (a)(4) of this section, you must reduce impingement mortality for all life

> stages of fish and shellfish by 80 to 95 percent from the calculation baseline."

- Entrainment performance standards:

> "If you choose compliance alternatives in paragraphs (a)(1)(ii), (a)(2), (a)(3), or (a)(4) of this section, you must also reduce entrainment of all life stages of fish and shellfish by 60 to 90 percent from the calculation baseline if: (i) Your facility has a capacity utilization rate of 15 percent or greater, and (ii)(A) Your facility uses cooling water withdrawn from a tidal river, estuary, ocean, or one of the Great Lakes."

Compliance with these performance standards is determined by comparing the impingement mortality and entrainment that would occur at the existing facility assuming a calculation baseline for the facility, and the impingement mortality and entrainment that would occur once the proposed technological and operational measures proposed under compliance alternative were implemented. USEPA defined the calculation baseline as:

> "…an estimate of impingement mortality and entrainment that would occur at your site assuming that: the cooling water system has been designed as a once- through system; the opening of the cooling water intake structure is located at, and the face of the standard 3/8-inch mesh traveling screen is oriented parallel to, the shoreline near the surface of the source water body; and the baseline practices, procedures, and structural configuration are those that your facility would maintain in the absence of any structural or operational controls, including flow or velocity reductions, implemented in whole or in part for the purposes of reducing impingement mortality and entrainment."

3.1.1.2.a Implications of Phase II Compliance Alternatives for CCNPP Units 3 and 4

If CCNPP Units 3 and 4 were to be regulated under Phase II, all four units at CCNPP would be treated as a single facility. In that case, Phase II compliance alternative 1 (closed-cycle for the facility) would no longer be an available alternative for all four units because CCNPP Units 1 and 2 use open-cycle cooling. However, this would not prevent CCNPP Units 3 and 4 from having a closed-cycle cooling system (see the discussion of compliance alternative 3, below).

Phase II compliance alternative 2 (existing facility already meets performance standards) would not be available either. This is because at the time the CDS would be filed (in accordance with the permitting schedule for CCNPP Units 1 and 2), technologies, operational measures, or restoration measures to meet the performance standards for the combined facility would not be in place.

Phase II compliance alternative 4 (preapproved technologies) is not available to CCNPP because neither USEPA nor Maryland, to date, has preapproved any technologies for reducing entrainment in estuarine environments.

Phase II compliance alternatives 3 and 5 would remain available to CCNPP. Under either of these compliance options, CCNPP Units 3 and 4 could use either closed-cycle or once-through cooling systems. However, there would be no clear benefits from requesting a site-specific BTA determination (compliance alternative 5) if CCNPP Units 3 and 4 used closed-cycle cooling, and there would be additional costs involved in obtaining the site-specific BTA determination.

Therefore, under Phase II, three options would be available for the combined facility of CCNPP Units 1-4:

- Closed-cycle cooling for CCNPP Units 3 and 4 and Phase II compliance alternative 3, or
- Once-through cooling for CCNPP Units 3 and 4 and Phase II compliance alternative 3, or
- Once-through cooling for CCNPP Units 3 and 4 and Phase II compliance alternative 5.

For options that use Phase II compliance alternative 3, the facility would have to demonstrate that the national performance standards were met with some combination of technologies, operational measures, and restoration measures. For the option that uses Phase II compliance alternative 5, a cost/benefit (or cost/cost) study would have to be conducted to determine whether CCNPP was entitled to site-specific determination of BTA (that would be less stringent than required by the national performance standards).

If Units 3 and 4 had a separate CWIS, CCNPP could opt to use compliance alternative 1 for Units 3 and 4. This would eliminate the need to submit a CDS for these units. CCNPP would be required to develop a separate compliance strategy for Units 1 and 2 and to submit a CDS for those units. However, as noted in Section 3.1.1.6.1, below, a separate CWIS for CCNPP Units 3 and 4 likely would be cost-prohibitive.

3.1.1.2.b Phase II Compliance Considerations with Once-through Cooling

Based on historical data, it appears that the national performance standard of an 80% reduction in impingement mortality might be satisfied (but only minimally so) with a fish return system like the one in use at CCNPP Units 1 and 2. The historical (1975–1995) average number of finfish and blue crab impinged by CCNPP Units 1 and 2 is 1,931,462 per year (Ringger, 2000). Of those, 351,688 per year were estimated to have been killed by impingement, the rest survived being returned to the Bay via the screen wash discharge trough. Therefore, on average, impingement mortality of fish and shellfish was reduced 82% compared to a calculation baseline condition, i.e., no return of impinged fish and shellfish to the Bay, and therefore no impingement survival. Under the Phase II Rule, Maryland has considerable discretion in establishing how compliance with the numeric performance standards will be measured and determined. For example, Maryland can set a specific reduction standard for a water body within the 80%–95% range established under the Phase II Rule; it does not have to accept only an 80% reduction. Likewise, Maryland can establish that the percent reduction must be achieved for each species as opposed to its being achieved based upon an average of all species or on the average reduction for representative species (RS).

Representative important species (RIS) (which would now be referred to as RS under the Phase II rule) entrained at CCNPP, based on historical data from CCNPP Units 1 and 2 include bay anchovy, naked goby, and spot (ANSP, 1981). The presence of bay anchovy as a key species subject to entrainment imposes additional challenges to reducing entrainment losses because bay anchovy larvae are extremely frail and exhibit low survival rates when impinged (e.g., on fine mesh screens intended to reduce entrainment).

It is very unlikely that any technology that would satisfy the national performance standard for entrainment could be successfully installed and operated for CCNPP Units 3 and 4. A summary of an evaluation of the feasibility of technology alternatives is presented in Section 3.1.1.6.2.b, below. The conclusion of that evaluation (particularly because bay anchovy were present as a key species subject to entrainment) was that no proven technologies currently exist that would reduce entrainment by at least 60% and could be successfully installed and operated at a facility like CCNPP.

Therefore, it is very unlikely that CCNPP, with once-through cooling for CCNPP Units 3 and 4, would be able to comply with §316(b) under Phase II compliance alternative 3 using CWIS technologies only. Another approach would be to schedule extensive outages or flow reductions during summer months to reduce entrainment, but it is assumed that approach would be economically prohibitive and therefore it is not considered a viable option. However, under Phase II compliance alternative 3, CCNPP could use restoration measures to mitigate entrainment losses, and by doing so comply with the Phase II Rule.

Restoration measures have been used successfully at Chalk Point on the Patuxent River to achieve compliance with §316(b) under USEPA's prior best professional judgment regulatory scheme and Maryland's existing regulations. Maryland was generally supportive of USEPA's including restoration as part of the compliance alternatives in the Phase II Rule. However, use of restoration is one of the issues under appeal and a decision is not expected to until August 2006. If restoration measures were to survive the appeal, and CCNPP could demonstrate that it satisfied the prerequisites, use of restoration measures to achieve compliance would be expected to be a low-cost measure, pending review of the results of new entrainment studies.

The other option for complying with the Phase II Rule with once-through cooling for CCNPP Units 3 and 4 is the site-specific determination of BTA after demonstrating that the costs for meeting the performance standards with technologies are significantly greater than the benefits from meeting the performance standards. Based on historical data from CCNPP Units 1 and 2 and cost-benefit analyses for other facilities such as PSEG's Salem Generating Station, it appears almost certain that such a demonstration would be feasible.

If CCNPP could demonstrate that it is entitled to site-specific (i.e., lower) performance standards based on demonstrations that the costs of achieving compliance are significantly greater than (1) the costs USEPA used for a facility like CCNPP or (2) the value of the benefits, then it is possible to substantially reduce compliance costs for CCNPP Units 3 and 4. Using this compliance alternative could result in a determination that there is no technological or operational measure that could be installed without incurring costs significantly greater than the value of the benefits. However, USEPA's Phase II Rule does not define "significantly greater" and the Rule grants considerable discretion to Maryland in making this determination. In addition, the Phase II Rule specifies the types of benefits that must be included and, depending upon the species entrained and impinged (e.g., species designated as threatened or endangered, species that are at risk of being driven to extinction), it is possible that non-use values would have to be included. Such a requirement could result in a very significant increase in the benefit valuation compared to a benefit based solely on impacts to commercial and recreational fisheries and ecological benefits.

Based upon the Maryland regulations, the estimated economic loss due to historical entrainment at CCNPP Units 1 and 2 was only $200 per year (McLean, et.al. 2002). Assuming that CCNPP Units 3 and 4, with a once-through cooling system, would withdraw twice as much cooling water as CCNPP Units 1 and 2 and therefore entrain twice as many organisms, the total economic loss due to entrainment at the facility (Units 1-4) would be less than $1,000 under the existing Maryland regulations. However, USEPA's Phase II Rule provides specific direction on how to conduct the cost-benefit analyses. The Rule specifically identifies the benefits categories to be considered, requires a consideration of the uncertainties associated with the benefits estimates and also requires that non-use benefits be considered, if appropriate, in the estimation. If non-use benefits were determined to be applicable, the results of the cost-benefit analysis may not be favorable to CCNPP.

3.1.1.2.c Phase II Compliance Considerations with Closed-cycle Cooling

Closed-cycle cooling for CCNPP Units 3 and 4 provides a means for satisfying the performance standards for all four units of the CCNPP facility. Since USEPA has defined an existing facility to include additional units that result in an increase in the design capacity of the CWIS (see Appendix G), the calculation baseline (for determining compliance with Phase II performance standards) would include CCNPP Units 3 and 4 and CCNPP Units 1 and 2. The flow for use in estimating the calculation baseline would be the design flow for CCNPP Units 1 and 2 plus the once-through design flow for CCNPP Units 3 and 4.

Reductions in flow and the resulting reductions in entrainment due to the use of a closed-cycle cooling system on CCNPP Units 3 and 4 could be used to determine compliance with the applicable performance standards of a 60% to 90% reduction in entrainment for CCNPP Units 1-4. For example, if the intake flow for CCNPP Units 3 and 4 is twice the intake flow of CCNPP Units 1 and 2, the intake flow of the facility as a whole (with closed-cycle cooling for CCNPP Units 3 and 4) would be one-third the calculation baseline intake flow (once-through cooling for all four units). Assuming entrainment is proportional to intake flow (as USEPA assumes), the facility would demonstrate a 66% reduction in entrainment compared to the calculation baseline, and would satisfy the national performance standards for entrainment. As noted above with respect to the impingement reduction standard, Maryland has the discretion under the Phase II Rule to establish a water body-specific standard within the 60% to 90% range and can also determine how the reduction is determined, e.g., species by species, average of all species, or average of RS.

3.1.2 §316(a) - Federal Thermal Discharge Regulations

Section 316(a) of the CWA is a variance provision for situations where an existing thermal effluent limitation imposed under §301 or §306 is more stringent than necessary to "assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made." In these situations, the regulator may impose a less stringent effluent limitation with respect to the thermal component of the discharge that still will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water. USEPA has not established technology-based effluent limitations for the discharge of heat from steam electric power plants (40 CFR Part 423); therefore, only the state's thermal water quality standards apply.

3.1.3 COMAR 26.08.03.05 – Maryland CWIS Regulations

3.1.3.1 Regulation Summary

The Maryland CWIS regulation implements §316(b) at the state level and defines acceptable levels of entrainment and impingement:

> "The location, design, construction and capacity of cooling water intake structures shall reflect the best technology available (BTA) for minimizing adverse environmental impact." (COMAR 26.08.03.05(A))
>
> "The determination of BTA for minimizing adverse environmental impact shall consider the effect of:
>
> (1) Impingement loss as determined in §D of this regulation; and

> (2) Entrainment loss as determined in §E of this regulation." (COMAR 26.08.03.05(A))

With respect to impingement, the Maryland regulation requires the facility to mitigate impingement loss to the extent that the costs for the mitigation are not greater than the benefits:

> "Dischargers shall install and operate functional modifications to mitigate impingement loss, provided that the additional cost of installation of modifications to intake structures and of operational modifications over a 5-year period does not exceed 5 times the estimated annual value of the impingement loss." (COMAR 26.08.03.05(D)(2))

For entrainment, the facility must determine whether the entrainment loss causes an adverse environmental impact, and must mitigate the entrainment loss if the facility does cause an adverse environmental impact:

> "The discharger shall determine the extent of cooling water entrainment loss on a spawning or nursery area of consequence for RIS..." (COMAR 26.08.03.05(E)(2))

> "If entrainment loss results in significant adverse environmental impact, the discharger shall install and operate functional modifications to mitigate entrainment loss." (COMAR 26.08.03.05(E)(3))

3.1.3.2 Implications of Maryland CWIS Regulations for CCNPP Units 3 and 4

An economic analysis of impingement loss at CCNPP Units 1 and 2 was conducted using impingement data from 1977–1979 (ANSP, 1981). For those years of study, the average annual impingement loss of finfish and blue crab was 260,252 organisms per year with an average annual economic value of $24,289. Under the assumption that CCNPP Units 3 and 4, with a once-through cooling system, would withdraw twice as much cooling water as CCNPP Units 1 and 2 and therefore impinge twice as many organisms, and adjusting to the average annual impingement loss for the period 1975–1995 of 351,688 organisms (see Section 3.1.1.1.d(1)), the projected economic value of impingement loss for CCNPP Units 1-4 would be roughly $99,000 per year. Therefore, the maximum required 5-year cost for mitigating impingement loss at CCNPP Units 1-4 (under Maryland's existing regulations) would be roughly $500,000 (based on historical impingement estimates and dollar values from 1981).

To assess environmental impacts of entrainment at CCNPP Units 1 and 2, a spawning and nursery area of consequence (SNAC) study was conducted in 1980 (Martin Marietta Corporation, Environmental Center, 1980). That study reported reductions, due to entrainment, in the abundance of Atlantic croaker, bay anchovy, winter flounder, and naked goby in the study area of 4.1% to 6.4%. The study area was defined as a 38-mile stretch of Chesapeake Bay adjacent to CCNPP. That level of effect on the local fish populations was not considered large enough to constitute an adverse environmental impact (McLean, et. al., 2002). Assuming closed-cycle cooling for CCNPP Units 3 and 4, the makeup water for which might add less than 5% to the existing intake flow, it is likely that a conclusion of no adverse environmental impact would be reached. Furthermore, in that case, a new SNAC study may not be required.

However, assuming that CCNPP Units 3 and 4 with a once-through cooling system would withdraw twice as much cooling water as CCNPP Units 1 and 2, and therefore entrain twice as many organisms, the projected reduction in abundance of those species in the study area would be 12.3% to 19.2% for CCNPP Units 1-4. This level of reduction in local fish populations likely would be considered an adverse environmental impact. For example, Versar, Inc. (the biological integrator contractor for the Maryland Power Plant Research Program (PPRP) which performs technical reviews of §316(a) and §316(b) permit applications for the State of Maryland) concluded (under contract to the State of New Jersey) that entrainment at Salem Generating Station on the Delaware Bay was causing an adverse environmental impact because it reduced local finfish population abundance by more than 10%. Also, SNAC modeling results for Chalk Point Power Plant of 20% to 30% reductions in bay anchovy population abundance caused PPRP to conclude Chalk Point was causing an adverse environmental impact (McLean, et.al., 2002). Therefore, it seems likely that mitigation for entrainment loss may be required if CCNPP Units 3 and 4 use a once-through cooling system.

3.1.4 COMAR 26.08.03.03 – Maryland Thermal Discharge Regulations

3.1.4.1 Regulation Summary

Maryland state regulations specify three thermal mixing zone criteria for thermal discharges into tidal waters (COMAR 26.08.03.03). Thermal discharges must be controlled so that:

- The 24-hour average of the maximum radial dimension measured from the point of discharge to the boundary of the full capacity 2°C above ambient isotherm (measured during the critical periods) may not exceed ½ of the average ebb tidal excursion.
- The 24-hour average full capacity 2°C above ambient thermal barrier (measured during the critical periods) may not exceed 50% of the accessible cross-section of the receiving water body.
- The 24-hour average area of the bottom touched by waters heated 2°C or more above ambient at full capacity (measured during the critical periods) may not exceed 5% of the bottom beneath the average ebb tidal excursion multiplied by the width of the receiving water body.

If a discharger is unable to meet these requirements, the discharger may request alternate thermal effluent limitations under the CWA §316(a). Alternate effluent limitations will be established only if the discharger demonstrates to the satisfaction of Maryland Department of the Environment (MDE) that the existing thermal effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on the body of water into which the discharge is made. The demonstration must consider the cumulative impact of the thermal discharge together with all other significant impacts on the species affected, including entrainment and impingement impacts.

In determining whether the protection and propagation of the affected species will be assured, the MDE may consider any information considered relevant and including evidence of the absence of the following factors:

- A significant increase in abundance or distribution of nuisance species
- A significant change in biological productivity
- A significant elimination or impairment of economic and recreational resources
- A significant reduction in the successful completion of the life cycle of representative important species

3.1.4.2 Implications of Maryland Thermal Discharge Regulations for CCNPP Units 3 and 4

The existing 2 units at CCNPP are in compliance with the Maryland thermal mixing zone criteria. For CCNPP Units 1 and 2, the full load 2°C isotherm is 1.81 km (less than ½ the ebb tide excursion distance of 5.3 km), the plume length occupies less than half of the estuary cross-section, and the area of affected bottom is 0.5% of the area swept by the average ebb tide (Constellation 2004). A thermal plume study would be needed to determine whether the combined thermal discharge of CCNPP Units 1 through 4 would meet the Maryland thermal mixing zone criteria.

However, at this stage of planning, it should be noted that under the scenario of once-through cooling for CCNPP Units 3 and 4, the combined heat load entering the Bay from CCNPP would be roughly three times the existing heat load from Units 1 and 2. That level of heat load is likely to be a concern to MDE and the Maryland Department of Natural Resources (MDNR) whether or not the thermal plume modeling indicates compliance with the thermal mixing zone criteria. Furthermore, if CCNPP is forced to apply for Alternate Effluent Limitations, CCNPP may not be able to demonstrate the protection and propagation of a balanced, indigenous community. Large portions of the Chesapeake Bay currently exhibit anoxic conditions during summer months. The addition of such a large heat load would be expected to exacerbate those degraded conditions and could jeopardize the protection and propagation of a balanced, indigenous community.

If CCNPP were to attempt to license Units 3 and 4 with a once-through cooling water system, it would be necessary to conduct additional studies to determine if a variance were required and, assuming the mixing zone standards were exceeded, then to support the request for a §316(a) variance. The studies would include: (1) a hydrothermal monitoring program in the Bay to obtain data needed for calibration and verification of a hydrothermal model; (2) a hydrothermal modeling study to depict the location and dimension of the various thermal isopleths over the varying tidal cycles; and (3) a biothermal assessment to determine the effects, if any, of the thermal discharge on the fish, shellfish, and wildlife in and on the Bay. These studies to demonstrate open cycle cooling meets §316(a) would add significant delays to the Project schedule.

3.1.5 Regulatory Uncertainties

The §316(b) Phase II Rule is currently being challenged by the Riverkeeper Network and others; a decision is not expected until August 2006, at the earliest. Among the issues being litigated are (1) the definition of existing facilities, i.e., whether the addition of new generating units at an existing site (such as the CCNPP Units 3 and 4) should be regulated under Phase I or Phase II; (2) if Phase II facilities will be allowed to use restoration measures, either alone or together with technological or operational measures, to meet the Phase II Rule requirements, (3) if the results of a cost-cost analysis can be used as the basis for a site-specific performance standards; and (4) if the results of a cost-benefit analysis can be used as the basis for a site-specific performance standard.

As a result of the litigation, it is possible that the CCNPP Units 3 and 4 will be regulated under the §316(b) Phase I (new facility) Rule. Likewise, if the Riverkeeper Network were to prevail in its challenge to restoration measures in the Phase II Rule as they did in a similar challenge that they successfully brought in the Phase I appeal, CCNPP's ability to use restoration measures to achieve compliance for either Units 1 and 2 or Units 3 and 4 (if regulated under Phase II) would be eliminated. Likewise, if the Riverkeeper Network were to prevail in their challenges to the inclusion of a site-specific compliance alternative based upon the cost-cost test or the cost-benefit test, the ability to petition for a site-specific performance standard may be disallowed as a result of the current appeal of the §316(b) Phase II Rule.

In addition to changes to the federal regulations as a result of the pending appeal, USEPA may issue guidance that could call into question the regulatory interpretations presented above. In August 2004, USEPA issued an outline for a guidance manual it intends to publish on implementing the §316(b) Phase II Rule. At that time, USEPA included the first section of the guidance manual that related to the timing of the compliance with the requirements to submit comprehensive demonstration studies. No other sections have been issued to date. As USEPA issues additional sections of this guidance manual, the Agency's advice may require modifications to some of the regulatory interpretations that formed the basis for the recommendations in this section.

Maryland's current regulations implementing §316(b) were promulgated well before USEPA adopted its §316(b) Phase I or Phase II Rules. In light of the new federal regulatory program, Maryland may decide to revise its existing regulations or reissue entirely new rules. Maryland can decide to incorporate the federal regulations in their entirety in lieu of having a separate state regulatory program. Under the CWA, however, Maryland can develop its own regulatory program so long as the regulations it adopts are as, or more, stringent than the regulations USEPA adopted.

For example, Maryland could determine that new units like CCNPP 3 and 4 should be required to operate with a closed-cycle cooling system, regardless of the outcome of the appeal of the federal Phase II rule. Maryland could also adopt regulations that would preclude the use of restoration measures or that would disallow any site-specific relief from uniform standards based upon a cost-benefit approach. The latter two changes, however, would mark a major departure from the approach contained in Maryland's current regulations and that Maryland has implemented in permits for facilities like Chalk Point. Maryland could also impose additional requirements that would impose other requirements on CCNPP Units 1-4.

At this point, it is not possible to predict the outcome of the appeal of the federal regulations or whether Maryland will issue new or modified regulations and what any such regulations would require. Therefore, it is not possible to predict whether any of these changes would adversely impact either the economics or schedule for this Project. However, during meetings with MDE and DNR, Constellation staff was told that Maryland would most likely adopt the federal regulation as is, rather than developing its own regulations. DNR and MDE also expressed continued support for restoration, should that option survive the legal challenge.

3.2 Engineering and Technology Considerations for Open-Cycle Cooling for CCNPP Units 3 and 4

3.2.1 CWIS Engineering Considerations

The new units are based on two 1600 MWe (4592 MWt) U.S. EPR. The circulating water (CW) system flow rate would be approximately 2.5 million gallons per minute (gpm) for each unit, considering 10^{o}F temperature rise across the condenser. If an onshore intake structure/pumphouse is used, it would be approximately 1200 feet long (to accommodate 24 drum screens and 12 CW pumps), 170 feet wide and 66 feet deep below the site grade for the two-unit structure. The pump house would have 6- 417,000 gpm concrete volute type pumps per Unit (12 total). The intake screen would include 24-60 feet diameter drum screens (two per pump) with the width of the screen panel about 15 feet. Additionally, 72 bar screens (trash racks), 12 feet wide would be required with 4 rakes to clean these screens.

If an offshore structure is used, twelve-12 foot diameter concrete pipes routed at least 3,000 feet into the Chesapeake Bay to reach 35 feet depth would be required. At the offshore end of each pipe there would be one bank of wedge wire screens arranged with interconnecting manifolds to supply about 420,000 gpm. It is expected that twelve 8-foot diameter T-type wedge wire screens would be needed for each bank, as the wire mesh slot will be very small (1.75 mm or smaller). Wire mesh material would need to be copper-nickel for bio-fouling protection. At each screen's outlet, biocide agent supply piping would be necessary to protect intake pipes from bio-fouling. It is expected that a total of 144-8-foot diameter T-screens could be required. The onshore pumphouse structure for this would be approximately 800 feet long, 120 feet wide, and 66 feet deep. The pumphouse is smaller since the drum screens and bar screens are not needed due to the use of the wedge wire screens offshore. The total offshore intake area covered by the wedge wire screens would be approximately 10 acres. The long trench to place the intake pipes would cover approximately 20 acres of the bottom of the Bay.

The discharge structure would consist of:

- A common onshore seal well structure. This structure would be approximately 250 feet long, 80 feet wide, and 50 feet deep.

- Twelve, 12-foot diameter offshore discharge concrete pipes from the seal well. It is expected that the discharge pipe length would be about 2000 feet. All 12 pipes could be placed in a large trench in a cut-and-fill operation and backfilled, and covered with riprap. At the end of each discharge pipe there would be a multiple port diffuser. The diffuser main body would also be 12-foot pipe. On top of the diffuser pipe would be six, 54-in risers that discharge heated effluent to the ambient water. Therefore, there would be 72-54-in riser pipes discharging all 5 million gpm of heated cooling water flow.

- Due to large discharge flow, large separation distance between offshore intakes and offshore distances would be necessary to prevent thermal recirculation from reaching an unacceptable level. The estimated separation distance would be 4,000 feet.

- The offshore diffuser area would be approximately 10 acres at the bottom of the Bay approximately 2,000 feet offshore. The long trench to place the discharge pipes would cover approximately 12 acres of the bottom of the Bay.

Based on the enormous size of the intake and discharge structures and offshore pipes, the once-through cooling system would be cost-prohibitive and therefore, is not considered feasible for the new units at the Calvert Cliffs site.

3.2.2 CWIS Technologies for Reducing Impacts to Fish and Shellfish Due to Open-Cycle Cooling Systems

3.2.2.1 Technology Alternatives

As noted above, the Impingement Mortality performance standard of the Phase II Rule likely can be satisfied at CCNPP with a fish return system associated with the screen wash water discharge system. However, other technologies would have to be considered for reducing entrainment to meet the entrainment performance standard of the Phase II Rule.

In its Technical Development Document (TDD) for the Phase II Rule, USEPA reviewed 12 general types of CWIS technologies for once-through cooling systems that it believed could be used toward meeting the national performance standards (USEPA §316(b) Phase II TDD, Attachment A to Chapter 3):

- Conventional traveling screens (Impingement Mortality and Entrainment)
- Modified vertical traveling screens (Impingement Mortality and Entrainment)
- Inclined single-entry, single-exit traveling screens (Impingement Mortality and Entrainment)
- Fine mesh screens mounted on traveling screens (Impingement Mortality and Entrainment)
- Wedgewire screens (Impingement Mortality and Entrainment)
- Perforated pipes (Impingement only)
- Porous dikes/leaky dams (Impingement only)
- Louver systems (Impingement only)
- Velocity caps (Impingement only)
- Fish barrier nets (Impingement only)
- Aquatic filter barrier systems (Impingement Mortality and Entrainment)
- Sound barriers (Impingement only)

The feasibility of installation and operation of any of these technology types is site-specific. The size and location of CCNPP Units 3 and 4 pose severe challenges to the application of any of these technologies and the ability of entrainment reducing technologies to meet the performance standard under the conditions that exist at this site is questionable. To address the feasibility of these technologies for CCNPP Units 3 and 4, and in the absence of a site-specific evaluation of these technologies for CCNPP Units 3 and 4, the results from a recent site-specific evaluation for Salem Generating Station (Salem), a nuclear power plant located on a mid-Atlantic estuary, were reviewed.

Salem is a two-unit nuclear generating station located on the Delaware Bay with a cooling water withdrawal rate of 2.2 million gpm. Salem has the highest cooling water withdrawal rate of any generating station located on a mid-Atlantic coast estuary that has recently completed a thorough review of fish protection alternatives. Although the cooling water withdrawal rate at Salem is lower than the once-through requirement for CCNPP

Units 3 and 4, results from the Salem review provide important insights into the practicability of CWIS options for CCNPP Units 3 and 4.

3.2.2.2 Feasibility Evaluation of Technology Alternatives

As part of the 1999 NPDES permit renewal application for Salem, PSEG conducted an exhaustive review of the feasibility of fish protection alternatives for the CWIS at Salem (PSEG, 1999). Salem's review of fish protection alternatives was conducted in two steps: the first step was a screening-level evaluation of all available fish protection systems, the second step was a detailed evaluation of candidate systems. The screening-level evaluation considered 1) known biological effectiveness, 2) engineering feasibility, and 3) engineering and/or biological advantages of one alternative over another. Four categories of alternatives were considered in the screening-level evaluation: behavioral barriers (e.g., air bubble curtains), physical barriers (e.g., barrier nets), collection systems (e.g., modified traveling screens), and diversion systems (e.g., modular inclined screens). A total of 34 types of fish protection systems (including all technologies listed above from USEPA's §316(b) TDD) were considered in the screening-level evaluation. On the basis of the screening-level evaluations, 2 types of fish protection systems that address entrainment were selected for detailed evaluation: wedge-wire screens and fine mesh screens.

For wedge-wire screens, a 2 mm slot size was considered to be the smallest practical size for Salem due to heavy detritus and sediment loads in the estuary and the high water withdrawal volumes. EPRI reported a 62% reduction in entrainment with 2 mm wedge-wire screens (EPRI, 1999). To achieve the desired through-slot velocity of 0.5 ft/sec at Salem, 240 wedge-wire screen modules would have been required. Bio-fouling in the estuarine environment would have caused ongoing problems of keeping the screens clean. In an offshore location, the wedge-wire screen modules would have required a complex series of air backflush piping. Furthermore, the high velocity cross-flows needed for screen flushing and biological efficacy would not be assured during slack tide conditions when velocities approach zero. Under any tidal condition it was uncertain whether the necessary high velocity ambient cross-flows would exist given the 2.2 million gpm withdrawal rate. For these reasons, wedge-wire screens were not considered a proven feasible alternative for Salem, and cannot be considered a proven feasible alternative for CCNPP Units 3 and 4.

For fine mesh screens, a 0.5 mm slot size with a 0.5 ft/sec through-screen velocity was considered at Salem. The mortality rate of bay anchovy eggs collected on fine mesh screens was estimated to be 73%, and the mortality rate for bay anchovy larvae was estimated to be between 63% and 100%. Therefore, assuming 100% mortality of entrained bay anchovy, the fine mesh screens would be expected to reduce entrainment losses of bay anchovy eggs by 27%, and to reduce entrainment losses of bay anchovy larvae by between 0% and 37%.

As noted above, bay anchovy are a key species subject to entrainment at CCNPP. Therefore, fine mesh screens likely would not reduce entrainment losses by at least 60% as required by the Phase II national performance standards for entrainment.

The team reviewed preliminary studies by EPRI in 2005 on the potential effectiveness of wedge wire screens and their application at CCNPP. After review of the preliminary study, the ability to balance flow to ensure a maximum slot velocity of 0.5 ft/s and control bio fouling and blockage for an extremely large screen array is highly questionable. The final detailed report is to be issued later by EPRI.

3.3 Summary of Cooling Water System Considerations and Recommendation

USEPA's Phase I and Phase II regulations implementing §316(b) of the CWA, which regulates CWIS, provides for seven compliance options: Track I and Track II under the Phase I Rule (new facilities), and compliance alternatives 1-5 under the Phase II Rule (existing facilities). Given the definitions and guidance provided by USEPA regarding the Phase I and Phase II Rules, CCNPP Units 3 and 4 will be regulated under the Phase II Rule with all four units of CCNPP being considered a single facility.

Of the five compliance alternatives under the Phase II Rule, only two would be applicable to the combined CCNPP facility (Units 1-4). The first is compliance alternative 3, which would require CCNPP to satisfy the national performance standards for impingement mortality and entrainment through the implementation of additional technologies, operational measures, and restoration measures. The second is compliance alternative 5, which would allow CCNPP to obtain a site-specific determination of BTA.

Under compliance alternative 3, CCNPP Units 3 and 4 could use a once-through cooling system or a closed-cycle cooling system. However, no proven technologies exist for use with a once-through cooling system that would satisfy the national performance standard for entrainment and that could be successfully installed and maintained at CCNPP. Furthermore, it is assumed that extensive outages or flow reductions to reduce entrainment during summer months, the most biologically productive season, would be economically prohibitive, and hence would not be viable alternatives. Therefore, in order for CCNPP Units 3 and 4 to use once-through cooling under compliance alternative 3, restoration measures would have to be implemented to mitigate entrainment losses to satisfy the requirements of the Phase II Rule.

Closed-cycle cooling could also be used under Phase II compliance alternative 3. Under this CWIS compliance option, all four units would be considered a single facility, and the reduction in intake flow from the calculation baseline condition (all four units with once-through cooling) to the proposed condition (Units 1 and 2 with once-through cooling and Units 3 and 4 with closed-cycle cooling) would satisfy the performance standard requirements for Units 1 and 2 as well as for Units 3 and 4.

Because the Phase II Rule is currently in litigation, the definitions of "existing facility" and "new facility" may change. Due to the court's ruling in that litigation (expected August 2006), CCNPP Units 3 and 4 may be regulated under Phase I. In that case, CCNPP Units 3 and 4 could comply with §316(b) through Track I (Fast Track) by installing closed-cycle cooling. In that case, CCNPP Units 1 and 2 might choose to rely on Phase II compliance alternative 5 (site specific BTA) or compliance alternative 3 with restoration.

Therefore, under §316(b) of the CWA, CCNPP Units 3 and 4 have four practical CWIS compliance options, each with somewhat different permitting and scheduling risks:

- Closed –cycle cooling under Phase I, Track I
- Closed-cycle cooling under Phase II compliance alternative 3
- Once-through cooling and restoration under Phase II compliance alternative 3
- Once-through cooling and site-specific BTA under Phase II compliance alternative 5.

All options are likely to require CCNPP to conduct a thermal plume study for submittal to the State of Maryland to demonstrate compliance with the state's thermal mixing zone criteria. For the two once-through cooling options, the thermal plume study may trigger the requirement for alternative thermal effluent limitations. In that case, CCNPP would be at some risk of not being able to demonstrate that the additional heat load (from once-through cooling of CCNPP Units 3 and 4) to the Chesapeake Bay assures the protection and propagation of a balanced, indigenous community (as required by Maryland law). Furthermore, the state may require CCNPP to conduct an impact assessment for entrainment losses (under COMAR 26.08.03.05). The results of that assessment may demonstrate that the combined entrainment losses for Units 1-4 with once-through cooling cause an adverse environmental impact to local fish populations. In that case, CCNPP would be required to mitigate the entrainment losses. Furthermore for the open-cycle cooling system alternative, the environmental studies required for regulatory compliance could detrimentally affect Project schedule. A minimum of three years likely would be required to develop study plans, review the plans with Maryland, implement the studies, and submit the required reports.

For the two closed-cycle cooling options, it is unlikely that concerns over the thermal mixing zone or environmental impacts due to entrainment will be raised (based on historic determinations regarding CCNPP Units 1 and 2 by the State of Maryland). Using a closed cooling design for the Project would provide the highest degree of certainty (but would not guarantee) that regulatory approvals would be received in a time frame that would support the proposed schedule for the Project.

In addition to federal and state regulatory considerations regarding open-cycle cooling, engineering considerations suggest it would not be a viable alternative. The enormous size of the intake and discharge structures and offshore pipes for an open-cycle cooling system for CCNPP Units 3 and 4 likely would be cost-prohibitive for the Calvert Cliffs site.

For the foregoing reasons, the recommended CWIS compliance option for CCNPP Units 3 and 4 is once-through cooling with makeup water withdrawn from the existing intake structure. This option would allow CCNPP Units 1-4 to apply for a §316(b) permit as a single combined facility under Phase II Compliance Option 3. To address the risk that Maryland may require CCNPP Units 3 and 4 to be regulated under Phase I (as the result of the court ruling in the Phase II litigation or for other reasons), it is further recommended that the CWIS for Units 3 and 4 be designed with a maximum intake velocity of 0.5 fps and include additional fish protection (e.g., fine mesh screens or wedgewire screens). This CWIS configuration would satisfy the requirements of Phase I or Phase II. Therefore, if CCNPP Units 3 and 4 are forced to comply with the Phase I Rule, the Project would not be significantly impacted in terms of costs or schedule.

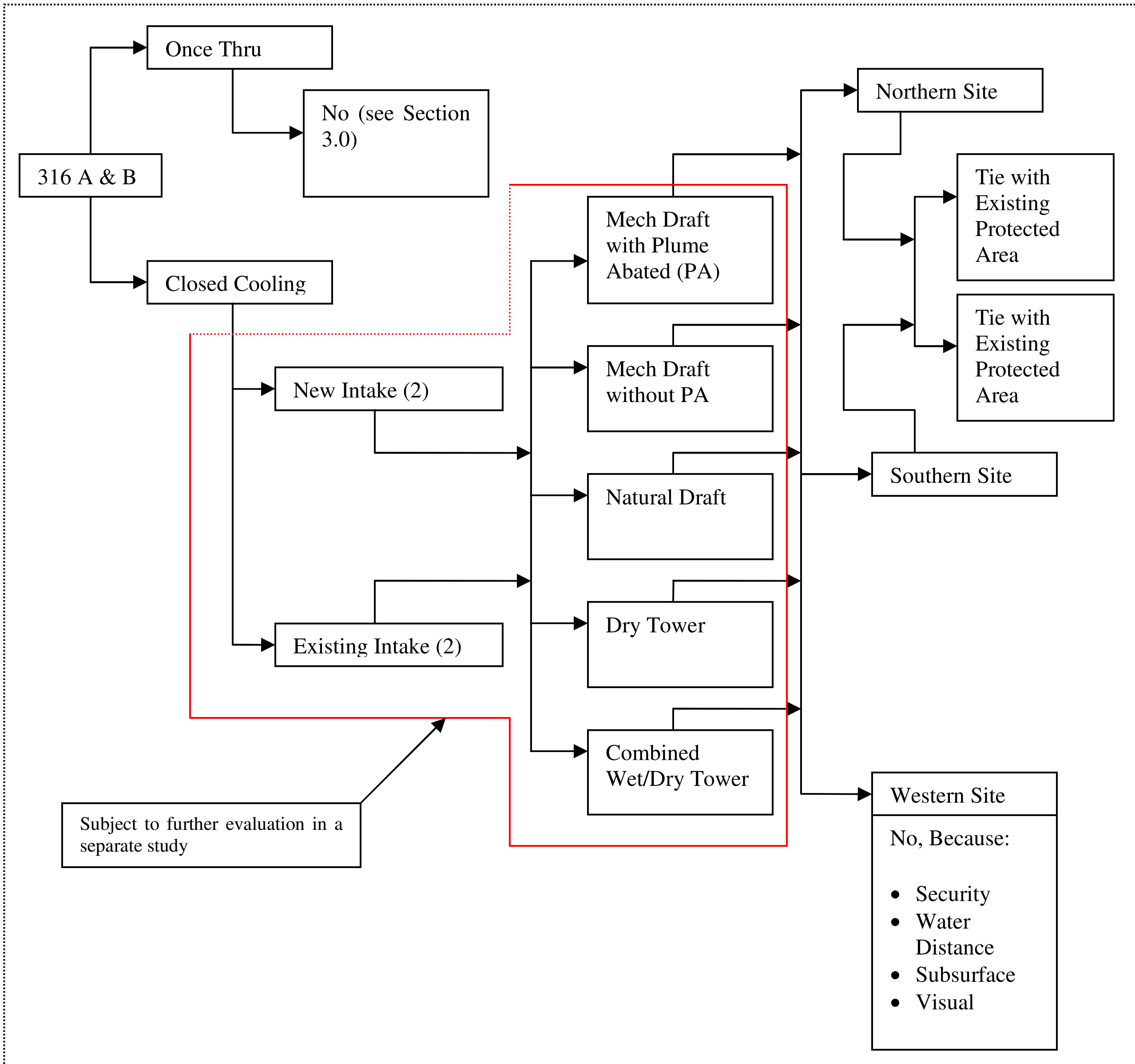
Other environmental issues associated with once-through cooling that were not addressed in this evaluation of cooling water system alternatives include:

- aesthetics (i.e., the visual impacts of the cooling towers [which is more exacerbated if natural draft cooling towers were used], themselves, and/or the cooling tower plume)
- noise (which is more exacerbated if mechanical draft cooling towers are used)
- air emissions from the cooling towers (e.g., salt drift).

These issues will be addressed in a separate report that evaluates cooling tower alternatives.

4.0 Site Layout Selection Process and Evaluation

During the layout evaluation process, the first decision point was based on the regulation associated with 316(a,b). Collectively it was determined by the industry experts that pursuing the once-through cooling water system was technically not feasible and of a high risk. Therefore, this study is pursuing the closed cooling water system for the layout location. The following process flow map was prepared by the study team for guidance in conducting the site layout study.



Using the evaluation process and the collective experience of the team members (Appendix E, January 5, 6, 2006), the following layout configurations and cooling water system resulted for more detailed evaluation.

1. Northern site with closed cooling water system.
2. Southern site with closed cooling water system.

A third option, location west of CCNPP Units 1 and 2, was eliminated at this stage because of uncertain foundation conditions associated with Lake Davies. The evaluation process at this stage also accounted for a potential regulatory benefit of using the existing

Units 1 and 2 intake as source for the Units 3 and 4 makeup (see Section 3.0 and Appendix G).

4.1 Exclusion Criteria

For the layout evaluation, the team established that neither the power block nor the cooling towers would be located within the following areas:

Exclusion Criteria

1. Lake Davies
2. 1500' radius from bald eagle nest
3. Cemetery located near southern property line
4. Reserved transmission corridors and within 300' of existing transmission lines
5. Nearby offsite/onsite pipelines or other hazards

Lake Davies

Located west of the existing units is Lake Davies. Lake Davies served as the landfill for the dredging spoils from the original intake/discharge canal construction. An estimated 3 million cubic yards of material were disposed of in this area. This area represents unknown subsurface conditions and would require excavation and backfill with suitable fill material. Further evaluation is deemed a high risk due to inadequate soil conditions. It is unknown whether sufficient quality backfill is available. This area would also require significant piping lengths to and from the bay for the closed cooling water makeup and discharge.

Therefore, locating two EPR units west of the existing Calvert Cliffs units is being discounted in this layout study.

Bald Eagle

An area of 1500 feet from the bald eagle nest is reserved as an exclusion zone for construction activity and location of the nuclear plant facilities. The bald eagle nest is located in the southern most corner of the Calvert Cliffs property (see figures in Appendix A) and is not impacted by the proposed southern layout location. See Appendix H for further detailed discussion of the bald eagle.

Cemetery

A small cemetery of 3 graves was found located at the end of Road M-1 in the southern portion of the property. This location is not impacted by the proposed southern layout location. See Appendix I for further discussion of cultural sites.

Reserved Transmission Corridors

The CCNPP site has 500 kv transmission lines going north across the property from the existing switchyard. For locating the cooling towers, a 300' setback distance was applied for the northern options due to the influence of drift on the transmission lines. This set-back is outside of the 550' transmission line easement.

Nearby Offsite or Onsite Pipelines or Other Hazards

Although this criterion was established as a generic exclusion criterion potentially applicable for other facility layout evaluations, the team determined there are no nearby offsite or onsite hazardous pipelines that impact layout selection for this study. A modified American Land Title Association – American Congress of Surveying and Mapping (ALTA-ACSM) survey will be performed to verify the absence of onsite hazardous pipelines. See discussion of the Cove Point LNG facility as it relates to Option 4 in section 4.3.2.2(a).

4.2 Proposed Layouts

Based on a closed cooling water system and the exclusion criteria listed above, the following 4 proposed plant layout options were developed for further evaluation.

1. Option 1 – North, units oriented side by side, east to west, reactor building north, switchyard south, and cooling towers north.

2. Option 2 – North, units oriented side by side, south to north, reactor building towards the east, switchyard west, and cooling towers north.

3. Option 3 – North, units oriented side by side, east to west, reactor building towards the south, switchyard north, and cooling towers north.

4. Option 4 – South, units oriented side by side, north to south, reactor building towards the east, switchyard west, and cooling towers south.

See Appendix A for figures of Options 1 through 4 and mechanical draft, natural draft, and hybrid type cooling towers configurations for Options 2 and 4.

4.2.1 Initial Layout Screening

Prior to a detailed layout evaluation process, an initial screening was performed of the 4 site layouts. Based on this initial screening, Options 1 and 3 were eliminated from further evaluation as described below:

Option 1

This option consists of locating the new units on the north side of the existing units. The reactor buildings and turbine buildings of the two units would be side by side, east to west, along with the switchyard to the south and the cooling towers to the north. This arrangement of reactor buildings and turbine buildings of Units 3 and 4 in an east-to-west configuration presents significant construction challenges. With this arrangement, the eastern-most unit would be constructed first with an approximate 1-year lag for the next unit. This arrangement would cause all construction to pass over the western-most unit to get to the eastern unit on the bay side. This arrangement would result in a more complex circulating water piping or box culvert layout with routing between the unit and the bay, between the units, and west of Unit 4. Connection with the existing protected area would create a very large protected area that would contain the switchyard for the new units.

Significant amount of grubbing, clearing, and cut and fill would be required for this option. Most of the property north of the main access road is heavily forested outside of the cleared land around the visitors center and security access point. A significant amount of cut and fill would be required to create a plant grade at approximate Elevation 75 feet (considered to approximate the existing switchyard grade) and fill in the ravines and valleys on each side of fire road A-2 and the large valley at the north end of the property in the Fowler Tract. A large wetland is identified in the northern section of the property and is also detrimental to this option (See Appendix H).

Construction on the north would require separating the construction activities and site from the operating plant. This would require relocation of the main access road and security access point. The following facilities would also require demolition and/or relocation:

1. Security access facility
2. Cell phone tower
3. Visitor center
4. Educational center
5. Chimneys
6. Transformers
7. PUP facility
8. Dog training facility
9. Historical tobacco barns

This option would require extending the existing switchyard south and reconfiguring the transmission lines south to the new bay to allow for space on the north end to connect with the new switchyard.

<u>Option 3</u>

Option 3 is a similar configuration as Option 1 except that the reactor buildings are south and the switchyard is located on the north side of the turbine buildings resulting in a longer transition to the existing switchyard. The constructability issues are the same as described in Option 1 above due to the reactor buildings and turbine buildings of the two units being located side by side, east to west. This configuration would facilitate a better transition to the existing protected area due to the reactor buildings and safeguards buildings being located south next to the existing protected area.

Based on the above discussion, Options 1 and 3 were screened from further detailed evaluation. Options 2 and 4 was further evaluated in detail using a rigorous process.

4.3 Evaluation of Options 2 and 4

4.3.1 Evaluation Methodology and Process

The layout for a new U.S. EPR power block and permanent facilities involved consideration and integration of various issues. The following considerations are generic in nature and each was reviewed by the team for applicability to the Calvert Cliffs site. Each siting decision generally has both positive and negative effects on multiple issues and was considered in the total context of plant siting. Evaluation criteria were developed based on the following eight categories:

1. Environmental
2. Land Use and Zoning (State, Local)
3. Construction Considerations
4. Construction Facilities
5. Switchyard/Transmission Lines
6. Security
7. Permanent Facility Considerations
8. Impact to Existing Facilities or Structures

Detailed criteria evaluated for each category included:

1. Environmental

- Visual/aesthetic impact of power block
- Wetlands/marshes
- Endangered or threatened species (animal or plants)
- Flood plains
- Environmentally sensitive areas
- Historic/cultural sites
- Impacts on source receiving water body and associated ecological resources

See Appendix H for detail discussion of environmental issues and Appendix I for cultural sites.

2. Land Use and Zoning (State, Local)

- Critical Areas
- Subdivision
- Certificate of Public Convenience and Necessity (CPCN) considerations
- Coastal Zone Management Act Consistency
- Impact on Easements

3. Construction Considerations

- Standoff distance from the existing unit security fence, supervision of crane operations, exclusion areas
- Evacuation of construction forces and existing unit personnel
- Foundation integrity - undercutting
- Dewatering effects; impacts on groundwater levels
- Slope stability
- Rock blasting
- Dredging, erosion, turbidity effects
- Construction dust and equipment exhaust
- Construction noise, vibrations, electromagnetic disturbance
- Construction accident hazards
- Crane failures; heavy load drops, boom swings
- New unit SSCs installed in proximity to existing unit SSCs
- Impacts on the site meteorological tower(s)
- Hazardous construction materials; potential missiles greater than existing plant design basis
- Hazardous onsite material storage and lines
- Construction flooding events (ruptured lines, site drainage interruptions, flooding of excavations, etc.)

- Normal operation, maintenance, and outage activities for the existing unit; delivery, receiving traffic patterns; sally ports
- Plumes from the existing and new units, diesel generators, offgas, etc.
- New and spent fuel handling and transport for the new and existing units
- Missile impacts from existing unit on new unit
- Impacts of existing unit normal operations and accidents on the new unit
- Restrictions on decommissioning activities for the existing unit while the new unit is in operation
- Excavation
- Timeline for construction
- Steep slope areas
- Areas subject to liquefaction
- Permanent drainage corridors and ponds
- Construction drainage corridors and ponds
- Construction laydown and parking areas for the existing unit (or alternate areas identified)
- Reserved transmission corridors
- Nearby offsite or onsite pipelines or other hazardous items (Included as exclusion criteria earlier in section)
- Spacing between the 2 unit EPRs is based on the construction crane orientation and lift paths. See Appendix F for the crane plan provided by Framatome.

4. Construction Facilities

- Safety
- Batch plant
- Laydown areas
- Construction office locations

- Construction parking areas and access roads
- Barge facility (existing)
- Heavy haul roads (slow grades, no transmission lines to cross under, short as possible, large turn radius for crawlers, direct access power block areas)
- Warehousing/staging/fuel location

5. Switchyard

Locate the switchyard considering:

- Location in front of the main startup transformers
- Location adjacent to the existing switchyard to allow for expansion and interconnection
- Location convenient to the transmission line corridor for existing and new transmission lines
- Sizing depends on the transmission voltage and phase spacing, the bus arrangement, the number of outgoing and incoming transmission lines, the number of interconnections with the existing switchyard, and the number of bays required for future expansion.

6. Security

Identify applicable security restrictions:

- Separate the existing and new units to allow for security during construction
- Defend the design basis threat
- Use of common security force and area
- Protection of the existing unit's security barrier during construction of the new unit
- Relocation of security boundary after the new unit is completed
- Impacts on existing security monitoring and detection systems, lighting, lines of sight
- Minimum standoffs from existing unit security fence, exclusion areas

In developing a layout for both the north and south locations, consideration was given to connecting with the existing protected area. This configuration would make for a single protected area and activities and maintenance personnel would be able to flow between the existing units and the new units.

7. Permanent Facility Considerations

- Review the EPR low trajectory turbine missile ejection zone for impacts on the existing unit.
- Confirm acceptable minimum distance to onsite and near site hazardous facilities (pipelines, barge accidents, etc.)
- Locate accident release points within the ½ mile exclusion radius of the EPR
- Identify access routes, sally ports, openings for normal operations, maintenance, and outage activities
- Identify access routes for future replacement of major components
- Offgas tower dispersion
- Tie-ins to existing unit SSCs
- If necessary, consider rotating individual power block structures (would require coordination with Framatome)
- Cooling tower fog and drift (HVAC opening, transmission line icing, tank vent freezing, stair and grating icing, onsite road icing)
- Need for blowdown cooling and holdup prior to discharge
- Pipe/canal routing to/from the condenser
- Installation schedule based on construction access requirements.
- Consider need for new water intake and discharge structures to minimize existing unit impacts
- Use of common plant resources
- Impacts of new unit normal operations and accidents on the existing unit

8. Impact to Existing Facilities or Structures

- Cultural structures
- Existing structures
- Areas reserved for future facilities to support existing unit operations

4.3.2 Discussion of Options 2 and 4

The following sections describe the main advantages and disadvantages of Layout Options 2 and 4 with respect to criteria identified in the previous section.

4.3.2.1 Northern Location - Option 2

This option consists of locating the two units on the north side of the existing units. The reactor buildings and turbine buildings of the two units are oriented side by side, south to north, reactor building towards the east, switchyard west, and cooling towers north. The power blocks are entirely within the I-1 zoning district. Depending on the cooling tower scheme, a portion of the cooling towers and circulating water system may extend over the Rural/Resource Preservation District into the Fowler tract.

With the arrangement of reactor buildings and turbine buildings of Units 3 and 4 south to north, better construction access, circulating water system layout, and security separation between the units is provided. With this arrangement, construction materials and activities can flow from the west for both units without crossing over each other. Routing of the circulating water system piping or box culverts between the switchyard and the turbine buildings provides a simpler layout for construction.

North options would require extending the existing switchyard south and reconfiguring the transmission lines south to the new bay to allow for space on the north end to connect with the new switchyard. Even though the cooling towers are located greater than 300 feet from the transmission lines under this option, there is the potential for plume and drift effects on the main transmission lines running north from Units 1 and 2.

Due to the north location being adjacent to the existing protected area, special compensatory actions may be necessary during construction. Also, since the height of the site for the new plant is greater than the existing plant, the possibility exists that a blast wall may be necessary along the construction road as it passes the diesel generator buildings. These considerations may also cause the power blocks to be located further north, thus creating more separation between the existing protected area and the construction zone.

Significant amount of grubbing, clearing, and cut and fill is anticipated for this option. Most of the property north of the main access road is heavily forested outside of the cleared land around the visitor center and security access point. A significant amount of cut and fill would be required to create a plant grade at approximate Elevation 75 feet and fill in the ravines and valleys on each side of fire road A-2 and the large valley at the north end of the property in the Fowler Tract. A large wetland is identified in the northern section of the property.

Construction on the north would require separating the construction activities and site from the operating plant. This would require demolition and/or relocation of the main access road and security access point. The following facilities would also require demolition and/or relocation:

1. Cell phone tower
2. Visitor center
3. Educational center
4. Chimneys
5. Transformers
6. PUP facility
7. Dog training facility
8. Historical tobacco barns

4.3.2.2 Southern Location - Option 4

This option consists of locating the new units on the south side of the existing units in the Camp Conoy area outside of the 1000' critical zone. The reactor buildings and turbine buildings of the two units are oriented side by side, north to south, reactor building towards the east, switchyard west, and cooling towers south. This option provides better construction access, circulating water system layout, and security separation. With this arrangement, construction materials and activities can flow from the west for both units without crossing over each other. Based on the site topography, site preparation would involve lower amount of excavation for this location. Natural valleys exist on the southern side for location of the power block.

For the southern option the existing switchyard would be expanded south and the transition made from the Unit 3/4 switchyard to the existing switchyard. No reconfiguring of the outgoing transmission lines would be required. With the southern option, the cooling towers are significantly further from the transmission lines and, therefore, would not be affected by the drift and plume.

Less grubbing, clearing, and cut and fill are anticipated for Option 4. Proposed locations for the batch plant, laydown, and parking areas are either clear fields or lightly forested areas. The Lake Davies area is proposed for the laydown yard. Areas around Camp Conoy are also clear fields. Wetlands in the southern location consist primarily of the Camp Conoy fishing pond and 3 water retention ponds that lead from the fishing pond to the Chesapeake Bay.

Construction to the south provides for a natural separation of the construction activities and site from the operating plant. No demolition and/or relocation of the main access road and security access point would be required. The facilities that would require demolition and/or relocation include Camp Conoy and its associated cabins, outbuildings, and recreational facilities.

4.3.2.2(a) Cove Point Liquefied Natural Gas Facility

A preliminary evaluation of effects from the Cove Point Liquefied Natural Gas (LNG) Facility on the southern layout location was conducted. The Cove Point terminal resumed importation of liquefied natural gas in 2003. This facility is relatively close to the Calvert Cliffs Units 1 and 2 and would be slightly closer to additional units located south of the existing units. Due to the location of Cove Point, any accidental release of LNG will have some impact on the safety of the proposed EPR plant.

The previous evaluation was based on a maximum hazard distance that would have a 3 psi overpressure criterion. The maximum hazard distance with the 850,000 barrel LNG tank will be 0.22 miles. Since the tank will be located approximately 3 miles from the proposed site for expansion at Calvert Cliffs, the hazard distance will not stretch closer than approximately 2.75 miles from the plant.

Regarding shipping vessels, the Coast Guard has committed to establish approach and docking procedures that keep vessels outside the 3.4 mile exclusionary range from CCNPP. The proposed southern location is located farther inland than Calvert Cliffs Units 1 and 2 to stay outside the 1000' critical area from the shore. Since the southern location is farther inland, the 3.4 mile exclusionary zone from CCNPP would be maintained.

4.3.3 Scoring Process

A weighted scoring process was developed to evaluate the criteria in the eight categories above. Fifteen (15) team members from the February 8, 2006 (see Appendix E) meeting anonymously scored the weighting factors, the responses were averaged, and presented to the team for consensus. The weighted results were,

Category	Weight
1. Environmental	20%
2. Land Use & Zoning	20%
3. Construction Considerations	20%
4. Construction Facilities	10%
5. Switchyard	5%
6. Security	10%
7. Permanent Facility Considerations	10%
8. Impact to Existing Facilities	5%

The eight categories and corresponding criteria were reviewed by the team members in detail for Options 2 and 4 by the subject matter expert. Thirteen team members then scored the categories for which they felt sufficiently knowledgeable. These values were averaged and then multiplied by the weighted value and summed to determine an overall score for Options 2 and 4. The results are as follows:

Table 4.3.3-1
Scoring Summary - CCNPP Units 3 and 4 Site Layout Study

Criteria	Weight %	Options			
		2		4	
		Score	Subtotal	Score	Subtotal
Environmental	20	4.08	0.82	5.77	1.15
Land Use & Zoning (State, Local)	20	3.85	0.77	5.62	1.12
Construction Considerations	20	4.00	0.80	6.64	1.33
Construction Facilities	10	3.55	0.35	7.18	0.72
Switch Yard/Transmission Line	5	4.60	0.23	6.10	0.31
Security	10	4.08	0.41	4.31	0.43
Permanent Facility Considerations	10	4.15	0.42	5.45	0.55
Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**3.98**		**5.88**

Methodology, results, and sensitivity analysis details can be found in Appendix B. Sensitivity analysis conducted for the weighting and scoring to determine impact to overall score and the relationship to each other indicates that the overall score varies only slightly.

5.0 Conclusion

From the analysis of CWA Section 316(a,b) and related cooling water system issues, the use of once-through cooling for the circulating water system is not a feasible option for a proposed nuclear power plant at the CCNPP site. Therefore, a closed cooling water system is determined to be the best option considering the business model associated with the licensing, construction, and commissioning of a new nuclear plant at the CCNPP site.

Layout Options 2 (northern location) and 4 (southern location) were down-selected as the most desirable options to evaluate in detail.

Based on detailed evaluation and scoring, Option 4 scores significantly higher than Option 2. Sensitivity analysis conducted for the weighting and scoring to determine impact to overall score and the relationship to each other indicates that the overall score varies only slightly and in no cases did the overall conclusion change.

Option 2 would make better use of land currently zoned I-1, but would present a greater impact to land within the 1000' critical area. Option 2 would present greater construction challenges, including a longer distance from the barge area and construction facilities. Option 2 would require all construction activities to cross under the transmission lines. This option would also cause for greater redesign of the current entrance and security facilities for the existing plant. Option 2 would allow for a single site protected area connected with the existing protected area for CCNPP Units 1 and 2.

Option 4 is located entirely within the Rural/Resource Preservation District which would result in the need for an exemption from the current zoning. However, the power block and cooling towers for Option 4 could be located entirely outside the 1000' critical area. Option 4 would result in better flow for construction activities and makes better use of the barge location, heavy haul road, batch plant, laydown, and parking facilities. Option 4 would not disrupt the current traffic entrance and flow for the operating plant and would maintain the existing security facilities. Option 4 would better segregate the construction traffic and activities from the operating plant traffic and activities. However, Option 4 would require a separate protected area due the distance and location from the protected area for CCNPP Units 1 and 2.

Therefore, Option 4 is the recommended layout option for the base case to conduct further site investigations and studies.

6.0 Risk and Contingency for Option 4 – Southern Location

The team identified the following risks associated with the recommended southern location:

1. Unfavorable litigation 316(b)
2. Unfavorable zoning
3. Construction within the critical area
4. Residences south of the site
5. Use of existing intake
6. Limited cooling tower options
7. Salt drift impact on vegetation in the critical area
8. NRC construction security requirements
9. ISFSI proximity
10. Storm water management
11. Additional barge dredging
12. Inadequate subsurface conditions

Rating the probability from 1 (highly unlikely) to 5 (high) and the consequences from 1 (low) to 5 (high) and taking the product yields the following exposure. This evaluation shows the focus where a contingency plan should be developed.

Table 6-1
Risk Evaluation for South Option

Risk	Probability	Consequence	Exposure (PxC)
1. Unfavorable litigation 316(b)	2	2	4
2. Unfavorable zoning	2	4	8
3. Construction within the critical area	2	3	6
4. Residences to south	3	2	6
5. Use of existing intake	3	2	6
6. Limited cooling tower options	3	1	3
7. Salt drift impact on vegetation within the critical area	5	2	10
8. NRC constr. Security req.	4	1	4
9. ISFSI proximity	5	2	10
10. Storm water management	5	1	5
11. Additional barge dredging	5	2	10
12. Inadequate subsurface cond.	1	2	2

Probability: 1(highly unlikely) - 5 (high)
Consequence: 1 (low) - 5 (high)

A contingency plan was developed for the items that had an exposure rating of 6 or higher.

Table 6-2
Contingency Plan

Issue	Indications	Methods of Detection	Actions Required	Parts/Services Needed	Impact to Schedule
Additional barge dredging required	Area is shallow and requires dredging for steam generator and reactor head delivery	TBD	Obtain permitting process information on dredging being performed in 2006. Verify quantity and schedule for work in 2006 for applying to later dredging activities.	Dredging contractor	Obtain permits and schedule work to meet delivery schedule of large components
Salt drift affect vegetation within the critical area	Similar condition and cooling tower arrangement at Brandon Shores plant	TBD	Review conditions at Brandon Shores. Establish mitigation plan.	Evaluate as part of detailed site engineering.	TBD
ISFSI proximity	Southern location and construction area near ISFSI	TBD	Review ISFSI security plan and take mitigating measures as necessary	Evaluate as part of detailed site engineering.	Conduct review and put mitigating measures in place prior to construction
Unfavorable zoning	Southern location is in the rural resource preservation district	TBD	Obtain zoning text amendment	County zoning amendment submitted by Constellation legal.	Amendment approved by County. Unfavorable zoning could re-emerge in CPCN process.
Construction within the critical area	Power block and cooling towers will be outside the critical area. Intake/discharge or piping to the existing intake may be in the RCA	TBD	Verify that water critical systems and structures will be in the intensely developed area rather than the RCA (completed). Develop feasibility study for the intake and discharge systems and structures. Prepare recommendation for review with internal stakeholders.	Evaluate as part of detailed site engineering.	TBD
Location of residences south of southern location.	Power blocks are located 3000' – 4000' feet from the nearest residence.	TBD	Communication with community. Review / evaluate noise and plume abatement options.	N/A	TBD

Issue	Indications	Methods of Detection	Actions Required	Parts/Services Needed	Impact to Schedule
Use of existing intake for supply and/or discharge.	Option exists to use the existing Units 1 and 2 intake.	TBD	Develop feasibility study and recommendation to internal stakeholders.	Evaluate as part of detailed site engineering.	TBD

7.0 Recommendation

Based on the analysis of the siting team, it is recommended to establish the south location, Option 4 with a closed circulating water system as the base case for the CCNPP Units 3 and 4 COLA. Selection of the south option is based on locating the entire power block and cooling tower arrangement outside the 1000' critical area. The study assumes that appropriate approvals can be obtained to allow water-critical structures/pipelines to be located within the critical area. Water-critical structures/pipelines may be located within the intensely developed area, which has previously been designated for impact within the 1000’ critical area.

See figures 3a, 3b, and 3c (Appendix A) for the recommended location dimensions and reactor building centerline coordinates. Figure 8 of Appendix A includes a rendering drawing showing two U.S. EPR Units with a hybrid cooling tower arrangement (as an example) located at the recommended southern location.

UniStar
Calvert Cliffs Nuclear Power Plant Units 3 and 4
Cooling System Selection
and
Site Layout Study

Appendix A

Figures

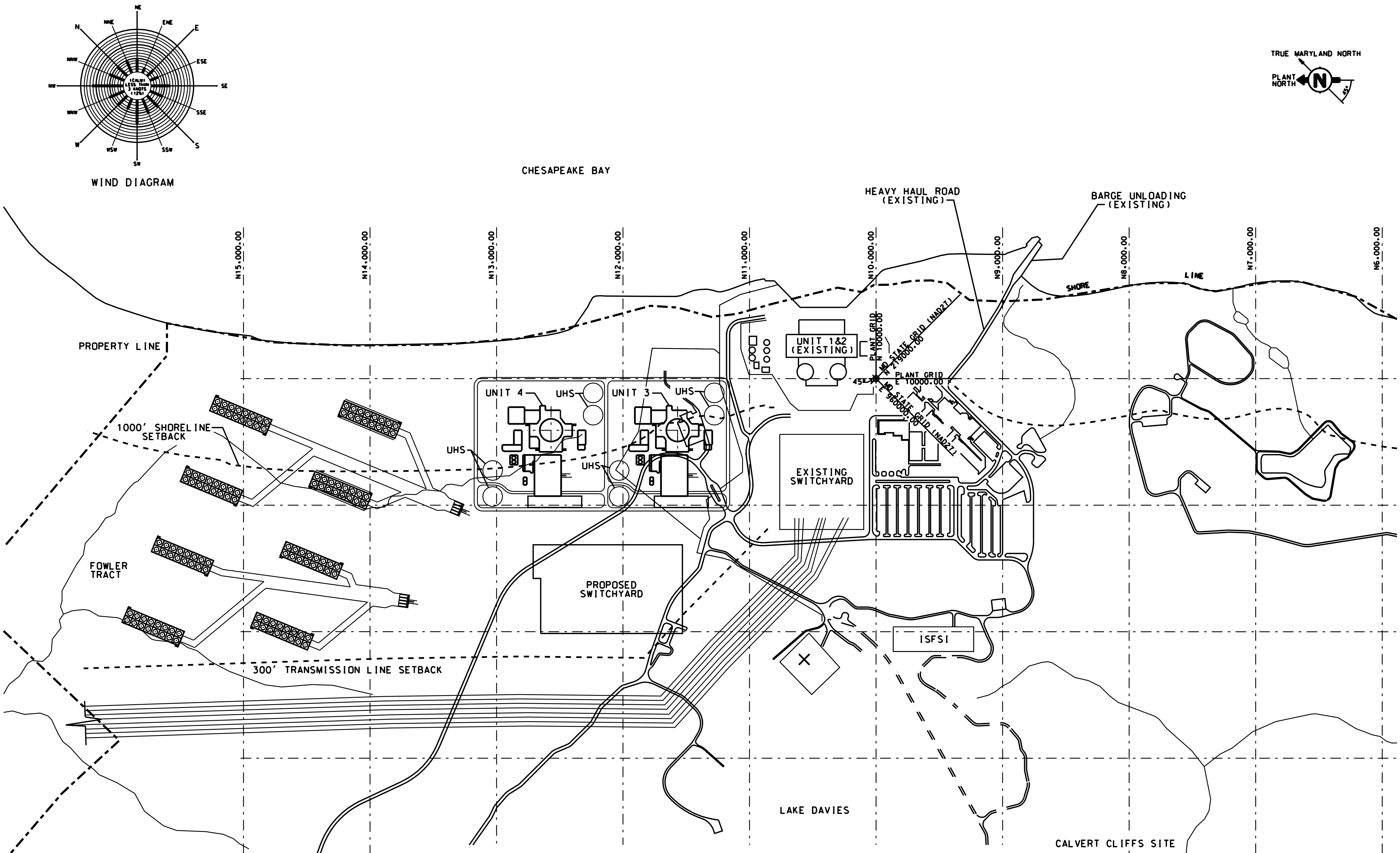


Figure 2a - Units 3 and 4 Siting Plan, Option 2a

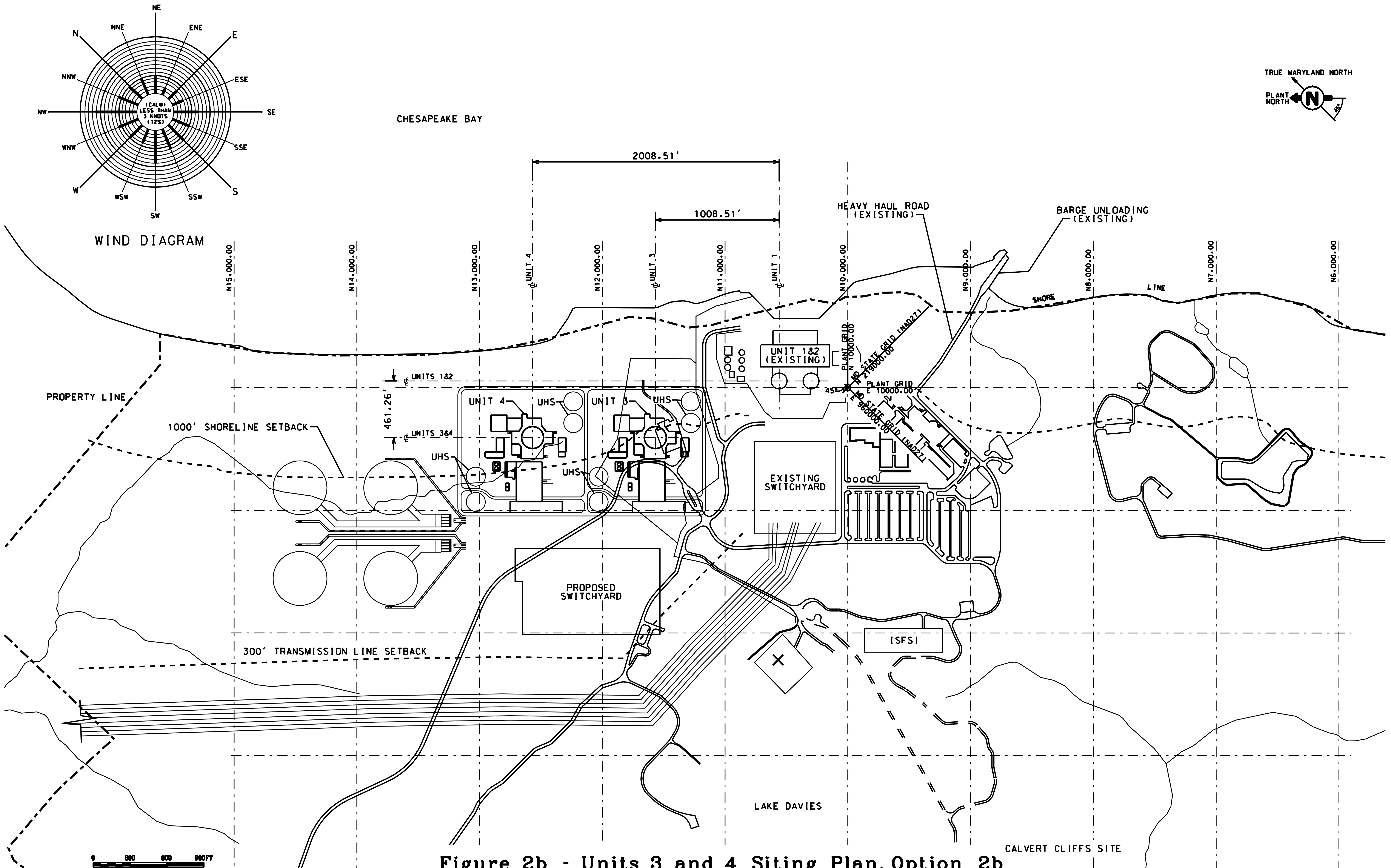


Figure 2b - Units 3 and 4 Siting Plan, Option 2b

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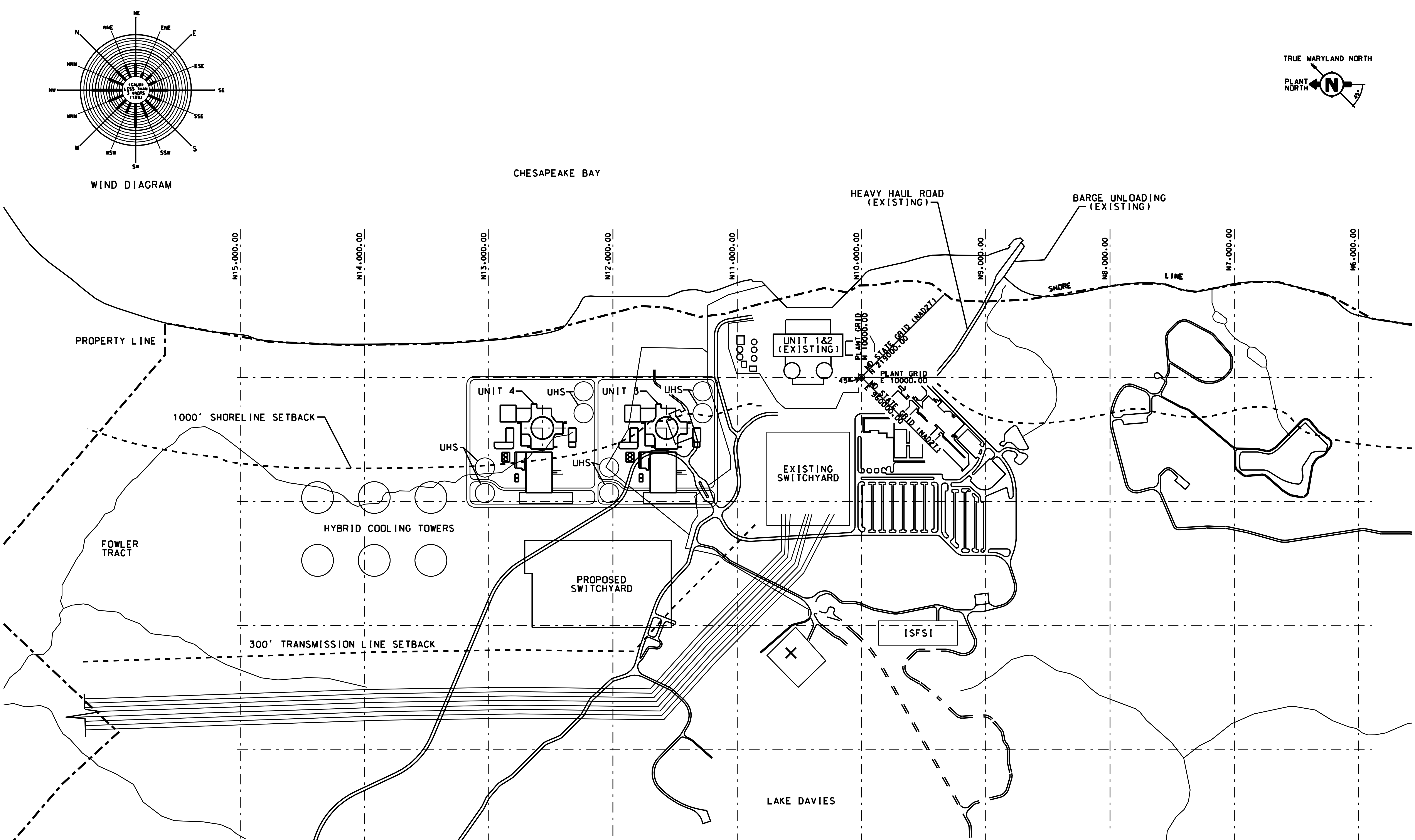

Figure 2c - Units 3 and 4 Siting Plan, Option 2c

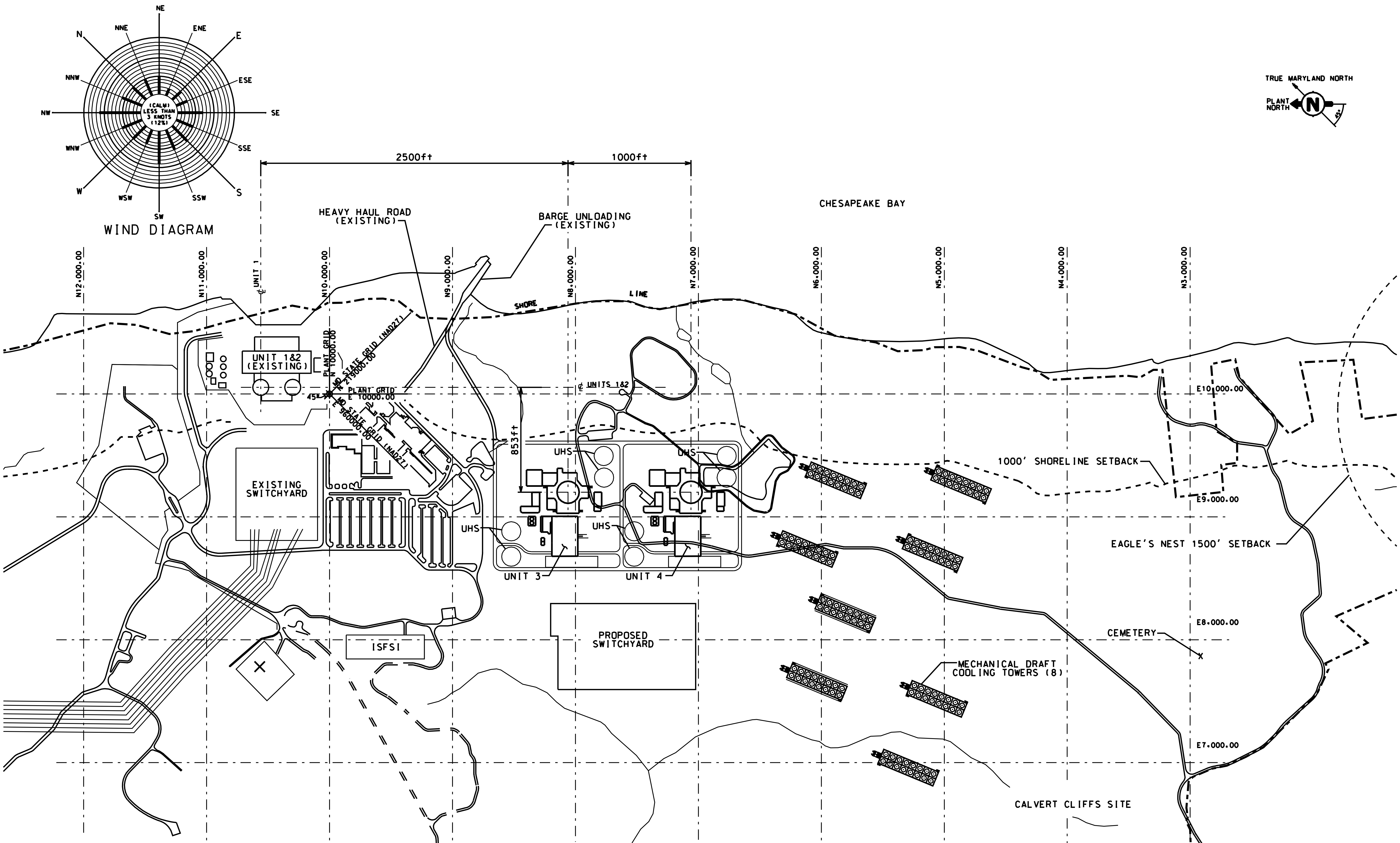

Figure 3a - Units 3 and 4 Siting Plan, Option 4a

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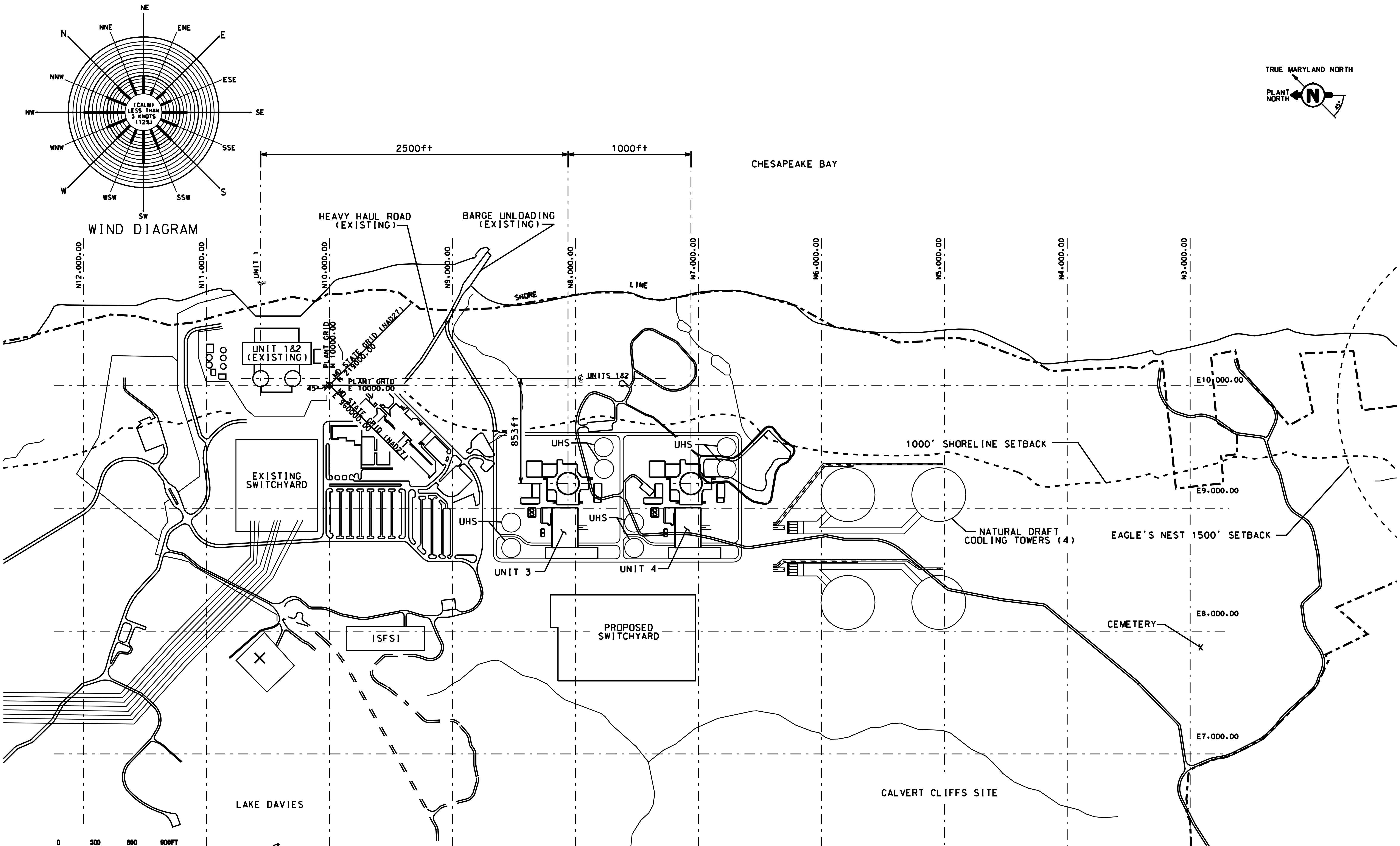

Figure 3b - Units 3 and 4 Siting Plan, Option 4b

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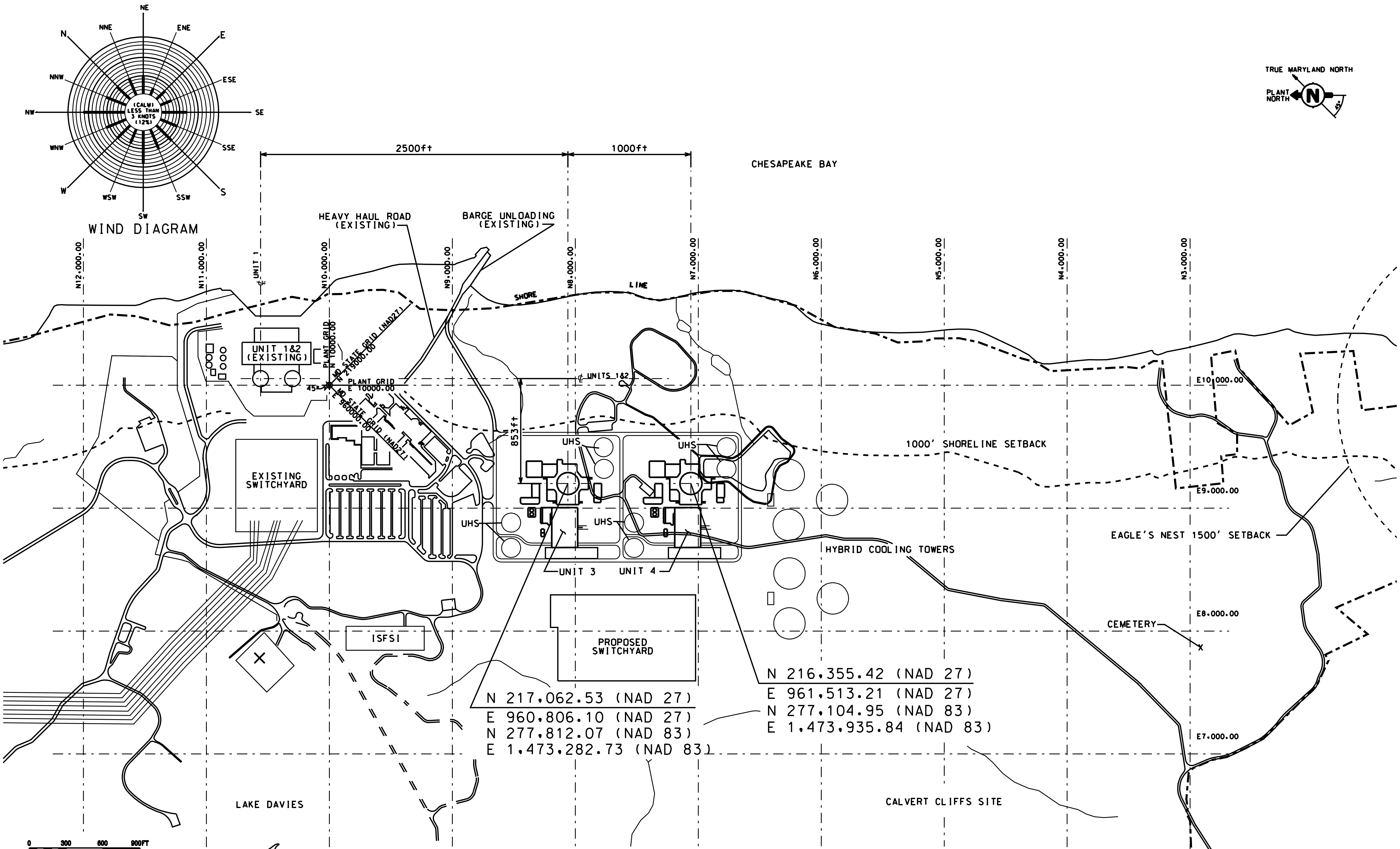

Figure 3c - Units 3 and 4 Siting Plan, Option 4c

CONFIDENTIAL, PROPRIETARY BUSINESS INFORMATION

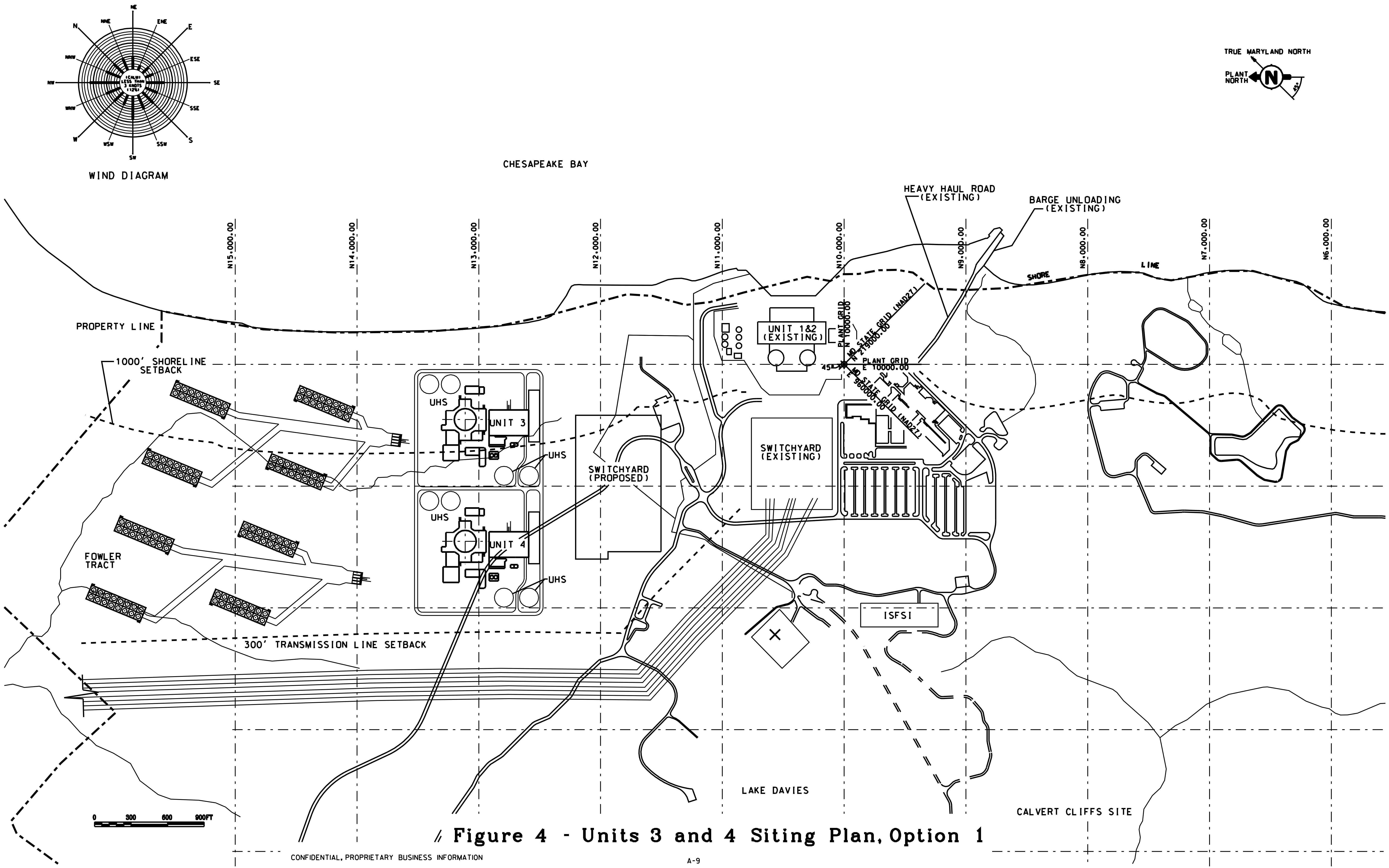

Figure 4 - Units 3 and 4 Siting Plan, Option 1

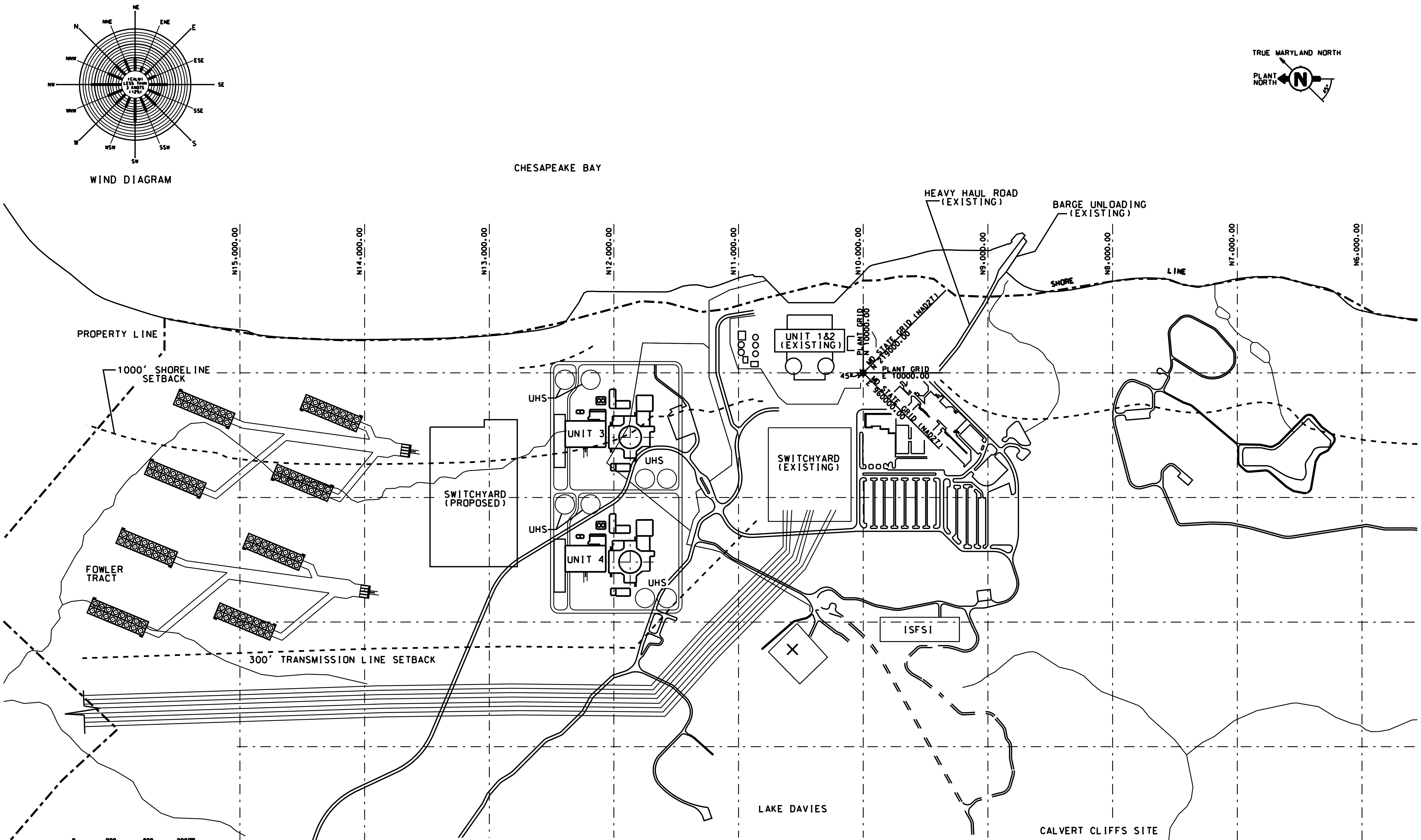

Figure 5 - Units 3 and 4 Siting Plan, Option 3

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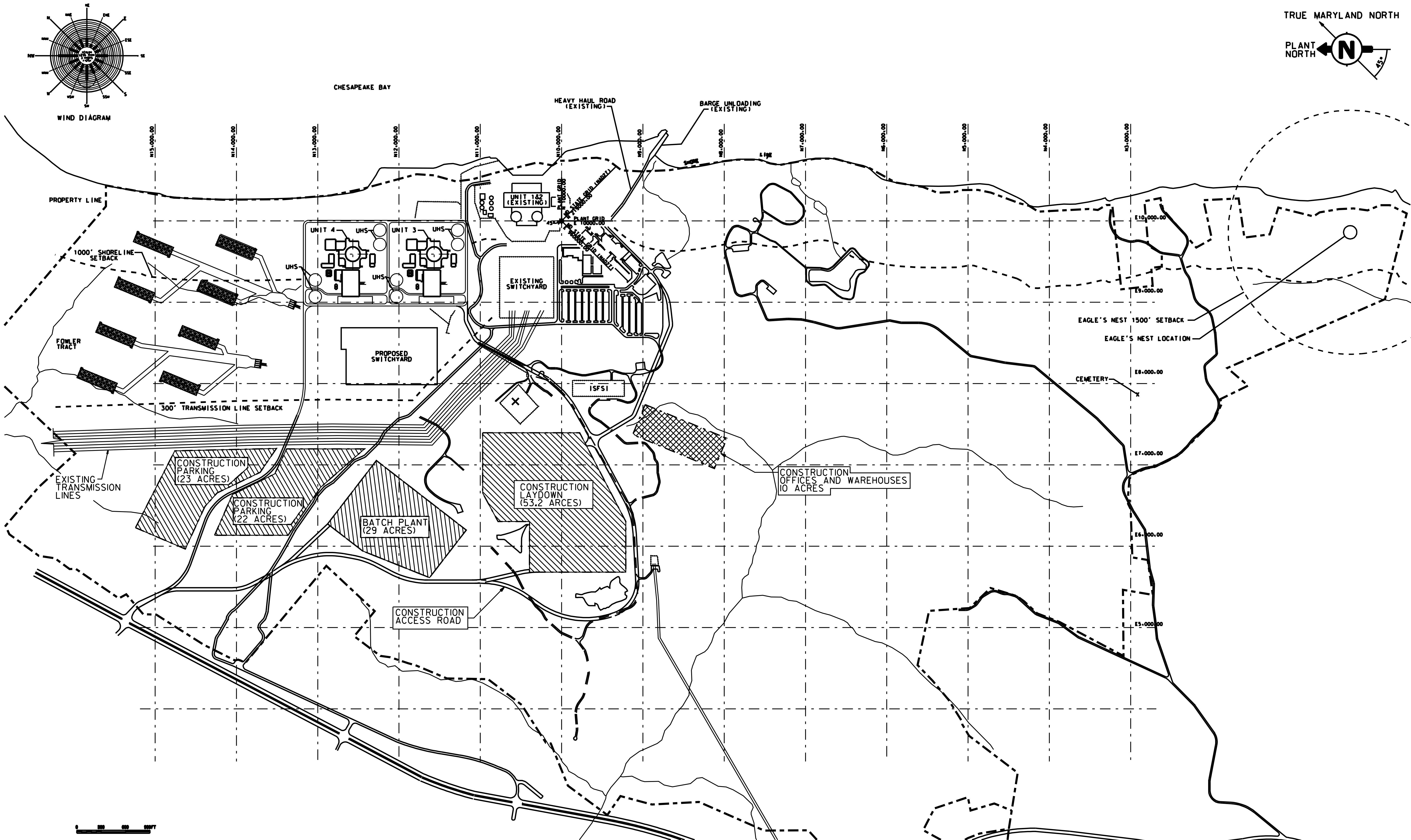

Figure 6 - Units 3 and 4 Siting Plan
Option 2a with Plan for Batch Plant, Laydown Area, and Parking

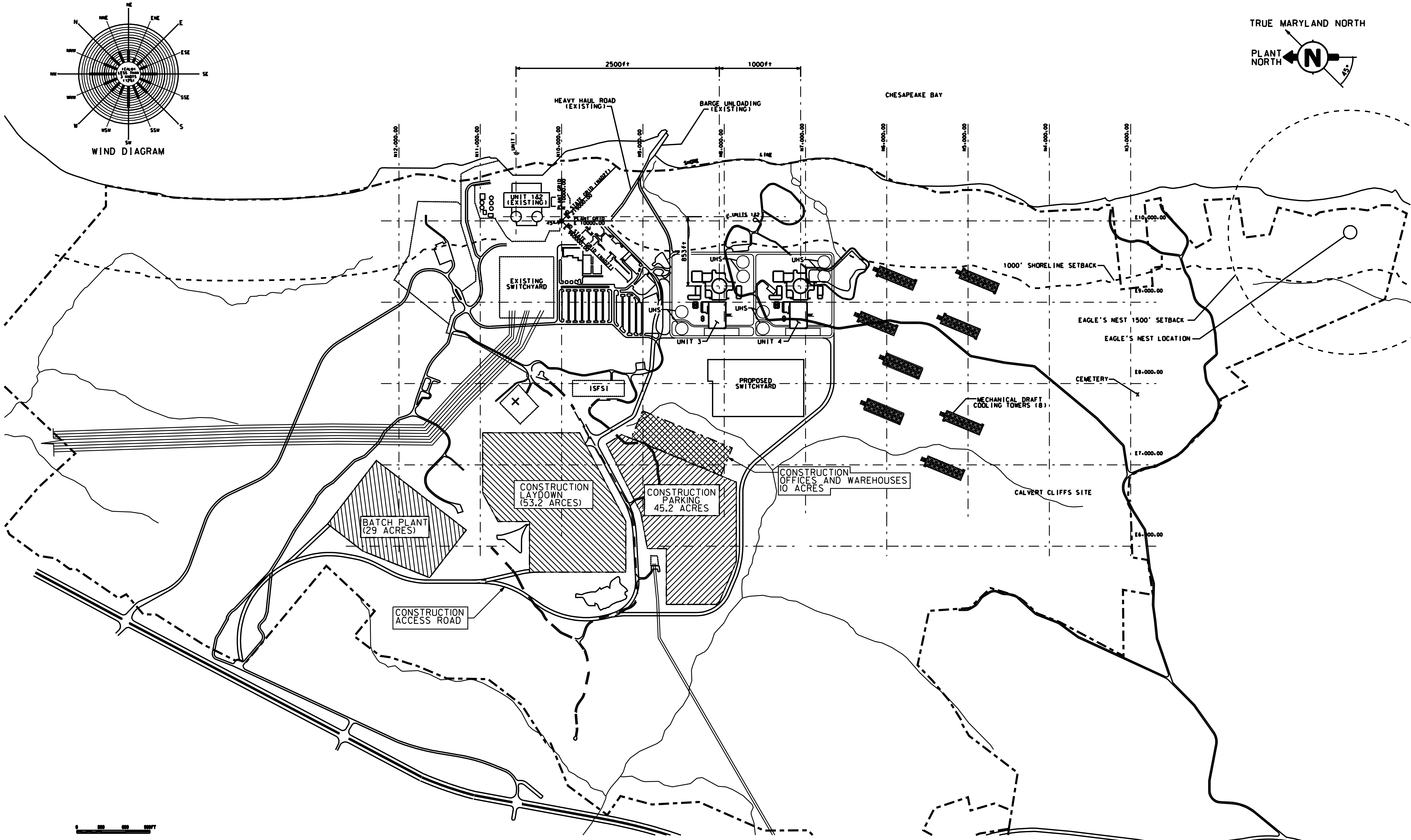

Figure 7 - Units 3 and 4 Siting Plan
Option 4a with Plan for Batch Plant, Laydown Area, and Parking

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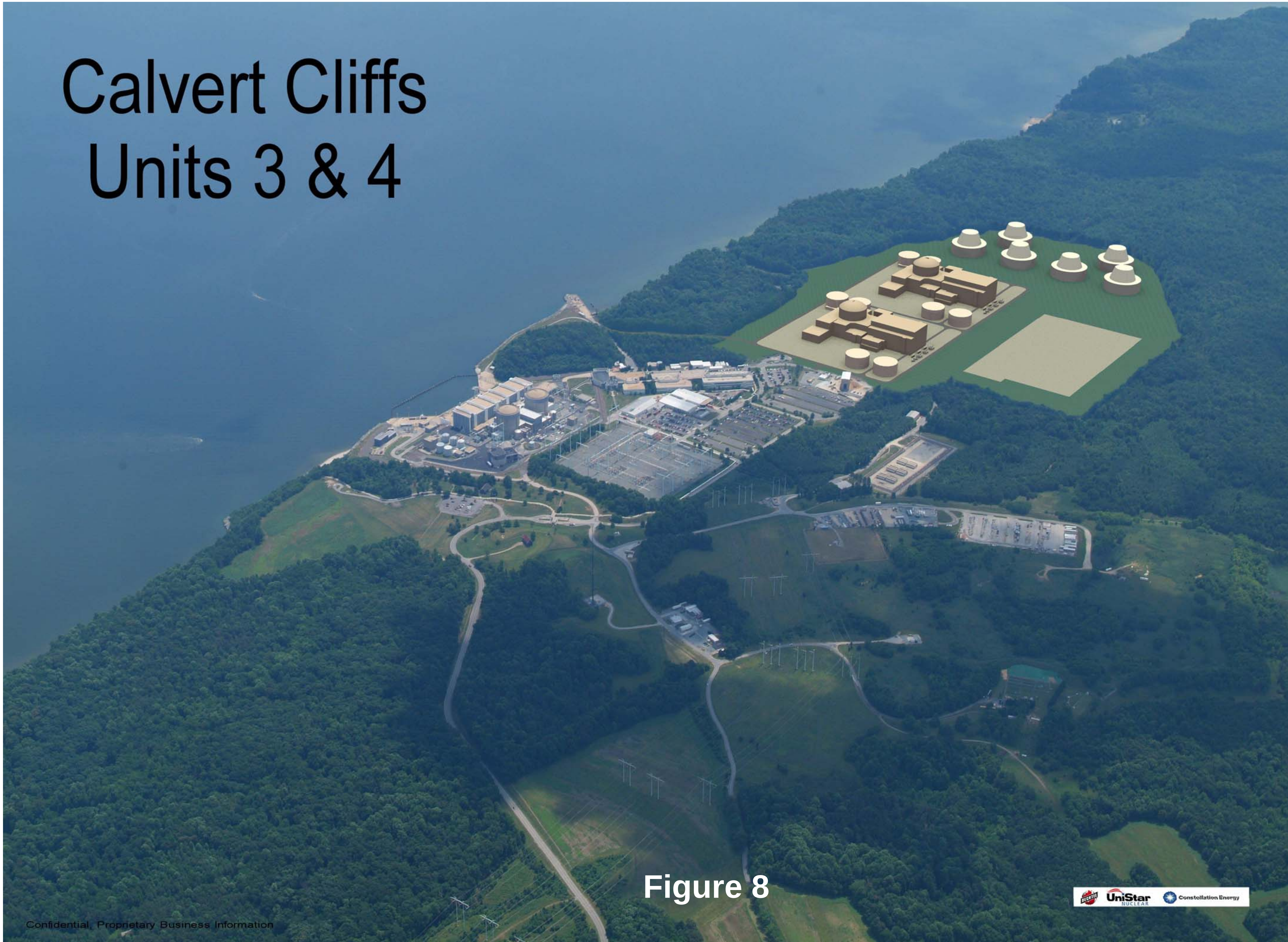

Calvert Cliffs
Units 3 & 4
UniStar Nuclear
Constellation Energy
Confidential, Proprietary Business Information

Figure 8

UniStar
Calvert Cliffs Nuclear Power Plant Units 3 and 4
Cooling System Selection
and
Site Layout Study

Appendix B

CCNPP Units 3 and 4 Site Evaluation Process/ Sensitivity Analysis

Methodology

The two Options (2 and 4) selected for further evaluation were evaluated for suitability based on the following Categories:

1. Environmental
2. Land Use and State/Local Zoning
3. Construction Considerations
4. Construction Facilities
5. Switchyard/Transmission Line
6. Security
7. Permanent Facility Considerations
8. Impact to Existing Facility Structures

Each of the above criteria was expanded to additional considerations as indicated in the checklist (Table B-1). In the meeting on February 8, 2006 among the engineers from Bechtel, Constellation, and industry experts (see Appendix E for list of attendees), this checklist was evaluated by assigning weighting to each of the criteria. First, each individual in the meeting assigned a weight to each criterion based on the description and discussion of each criterion and sub-criterion associated with it. Then, an average weight was calculated based on input from everyone. This average weight for each criterion was discussed to reach a consensus (see Table B-2 for this information).

After assigning the weight to each of the criteria, the two Options were evaluated based on suitability considering each of the sub-criterion. Each sub-criterion was considered by the team members for its applicability to the two Options selected for further evaluation. Then each criterion was ranked based on the impact of sub-criteria within the criterion. The criterion was ranked for each Option from 1 to 9 (absolute scale) based on least desirable (1) to most desirable (9). Individuals not knowledgeable in certain category had the option to skip that category. The average for such category accounted for this consideration. Similar to the weighting, the input from everyone in the meeting was averaged and a consensus was obtained for the Average Value of each category.

Result

Based on the weight and ranking of each category, a total score for each of the two Options was determined (see Table B-2). The result of this evaluation indicates that Option 4 (South Location) is more suitable for consideration.

Sensitivity Evaluation

In order to validate that assigning the weighting to the categories and scoring the Options for each of the categories is not significantly affected by variation in the weights and scoring, a sensitivity evaluation is performed of the data colleted from individual team members.

Weighting Sensitivity Evaluation

In this evaluation, the maximum and the minimum weighting assigned by the team members to the following four top weighted categories were assigned to the associated category and the total score for Options 2 and 4 were calculated:

1. Environmental
2. Land Use and Zoning
3. Construction Considerations
4. Construction Facilities

The scores assigned to each of the categories were kept unchanged from the normal case.

The evaluation and results are tabulated in Table B-3. From the summary charts of the evaluation it is evident that the resulting scores for the two Options are not significantly affected by the variation in the assigned weighting for the top four categories.

Scoring Sensitivity Evaluation

In this evaluation, the maximum scoring assigned by team members for the top four categories described above was applied to Option 2 and minimum scoring applied to Option 4. The weights for each criterion remained unchanged from normal case.

The evaluation and results are tabulated in Table B-4. From the summary charts of the evaluation it is evident that the resulting scores for the two Options considered are not significantly affected by the variation in the assigned scoring for the four categories.

Table B-1
CCNPP Units 3 and 4 Site Layout Checklist

No.	Criteria	Option 2 – N Plus	Option 2 – N Neutral	Option 2 – N Minus	Option 4 – S Plus	Option 4 – S Neutral	Option 4 – S Minus	Comment/Value
1.00	Environmental							
1.01	Visual / Aesthetic impact of Power Block							
1.02	Wetlands / Marshes							
1.03	Endangered or Threatened species (Animals & Plants)							
1.04	Flood plains							
1.05	Environmentally sensitive areas							
1.06	Historic sites / Cultural Sites							
1.07	Receiving water body impacts							
	Section 1 Score							
2.00	Land Use and Zoning (State, Local)							
2.01	Critical Areas							
2.02	Sub-Division							
2.03	CPCN (Certificate of Public Convenience and Necessity) Considerations							
2.04	Coastal Zone Management Act Consistency							
2.05	Impact on Easements							
2.06	Other areas							
	Section 2 Score							
3.00	Construction Considerations							
3.01	Standoff distance from the existing unit security fence, supervision of crane operations, exclusion areas							
3.02	Evacuation of construction forces and existing unit personnel							
3.03	Foundation integrity - undercutting							
3.04	Dewatering effects; impacts on groundwater levels							
3.05	Slope stability							
3.06	Rock blasting							
3.07	Dredging, erosion, turbidity effects							
3.08	Construction dust and equipment exhaust							
3.09	Construction noise, vibrations, electromagnetic disturbance							
3.10	Construction accident hazards							
3.11	Crane failures; heavy load drops, boom swings							
3.12	New unit SSCs installed in proximity to existing unit SSCs							

No.	Criteria	Option 2 – N			Option 4 – S			Comment/Value
		Plus	Neutral	Minus	Plus	Neutral	Minus	
3.13	Impacts on the site meteorological tower(s)							
3.14	Hazardous construction materials; potential missiles greater than existing plant design basis							
3.15	Hazardous onsite material storage and lines							
3.16	Construction flooding events (ruptured lines, site drainage interruptions, flooding of excavations, etc.)							
3.17	Normal operation, maintenance, and outage activities for the existing unit; delivery, receiving traffic patterns; sallie-ports							
3.18	Plumes from the existing and new units, diesel generators, offgas, etc.							
3.19	New and spent fuel handling and transport for the new and existing units							
3.20	Missile impacts from existing unit on new unit							
3.21	Impacts of existing unit normal operations and accidents on the new unit							
3.22	Impacts of new unit normal operations and accidents on the existing unit							
3.23	Restrictions on decommissioning activities for the existing unit while the new unit is in operation							
3.24	Excavation							
3.25	Timeline for Construction							
3.26	Steep slope areas							
3.27	Areas subject to liquefaction							
3.28	Permanent drainage corridors and ponds							
3.29	Construction drainage corridors and ponds							
3.30	Construction laydown and parking areas for the existing unit (or alternate areas identified)							
3.31	Reserved transmission corridors							
3.32	Nearby offsite or onsite pipelines, other hazardous items							
	Section 3 Score							
4.00	Construction Facilities							
4.01	Safety							
4.02	Batch plant							
4.03	Laydown areas							
4.04	Construction office locations							
4.05	Construction parking areas and access roads							
4.06	Barge facility (existing)							

No.	Criteria	Option 2 – N			Option 4 – S			Comment/Value
		Plus	Neutral	Minus	Plus	Neutral	Minus	
4.07	Heavy haul roads (slow grades, no transmission lines to cross under, short as possible, large turn radius for crawlers, direct access power block areas)							
4.08	Warehousing /Staging/Fuel							
	Section 4 Score							
5.00	Switchyard/Transmission Lines							
5.01	Location in front of the main startup transformers							
5.02	Location adjacent to the existing switchyard to allow for expansion and interconnection.							
5.03	Location convenient to the transmission line corridor for existing and new transmission lines							
5.04	Sizing depends on the transmission voltage and phase spacing, the bus arrangement, the number of outgoing and incoming transmission lines, the number of interconnections with the existing switchyard, and the number of bays required for future expansion.							
	Section 5 Score							
6.00	Security							
6.01	Separate the existing and new units to allow for security during construction							
6.02	Defend the design basis threat							
6.03	Use of common security force and area							
6.04	Protection of the existing unit's security barrier during construction of the new unit							
6.05	Relocation of security boundary after the new unit is completed							
6.06	Impacts on existing security monitoring and detection systems, lighting, lines of sight							
6.07	Minimum standoffs from existing unit security fence, exclusion areas							
	Section 6 Score							
7.00	Permanent facility considerations							
7.01	Review the EPR low trajectory turbine missile ejection zone for impacts on the existing unit.							
7.02	Confirm acceptable minimum distance to onsite and near site hazardous facilities (pipelines, barge accidents, etc.)							
7.03	Locate accident release points within the ½ mile exclusion radius of the EPR.							

No.	Criteria	Option 2 – N			Option 4 – S			Comment/Value
		Plus	Neutral	Minus	Plus	Neutral	Minus	
7.04	Identify access routes, sallie-ports, openings for normal operations, maintenance, and outage activities							
7.05	Identify access routes for future replacement of major components							
7.06	Offgas tower dispersion							
7.07	Tie-ins to existing unit SSCs							
7.08	If necessary, consider rotating individual power block structures (would require coordination with Framatome)							
7.09	Cooling tower fog and drift (HVAC opening, transmission line icing, tank vent freezing, stair and grating icing, onsite road icing)							
7.10	Need for blowdown cooling and holdup prior to discharge							
7.11	Installation schedule based on construction access requirements							
7.12	Consider need for new water intake and discharge structures to minimize existing unit impacts							
7.13	Use of Common Plant resources							
	Section 7 Score							
8.00	Impact to existing facilities or structures							
8.01	Cultural structures							
8.02	Existing structures							
8.03	Areas reserved for future facilities to support existing unit operations							
	Section 8 Score							

Table B-2
Scoring Summary – CCNPP Units 3 and 4 Site Layout Study

North Option - Units oriented side by side south to north, reactor building towards the east, switchyard west, and cooling tower north
South Option - Units oriented side by side north to south, reactor building to the east, switchyard west, and cooling tower South

Criteria	Weight % (total is 100%)	Options			
		North		South	
		Score	Sub Total	Score	Sub Total
1. Environmental	20	4.08	0.82	5.77	1.15
2. Land Use & Zoning (State, Local)	20	3.85	0.77	5.62	1.12
3. Construction Considerations	20	4.00	0.80	6.64	1.33
4. Construction Facilities	10	3.55	0.35	7.18	0.72
5. Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
6. Security	10	4.08	0.41	4.31	0.43
7. Permanent Facility Considerations	10	4.15	0.42	5.45	0.55
8. Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**3.98**		**5.88**

Individual Weighting Input and Evaluation

Criteria	Weight (total is 100%)	1	2	3	4	5	6	7	8	9
1. Environmental		25	15	20	30	25	20	15	20	25
2. Land Use & Zoning (State, Local)		25	15	25	20	25	20	15	20	25
3. Construction Considerations		20	25	20	30	25	20	20	15	15
4. Construction Facilities		5	25	15	5	10	5	15	10	10
5. Switch Yard / Transmission Line		5	5	8	5	5	5	10	5	5
6. Security		10	10	7	10	5	15	15	10	5
7. Permanent Facility Considerations		5	3	3	0	3	10	5	15	10
8. Impact to Existing Facility Structures		5	2	2	0	2	5	5	5	5
Totals		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Criteria	Weight (total is 100%)	10	11	12	13	14	15	Subtotals	Average	High	Low
1. Environmental		20	20	20	20	10	20	305	20.33	30	10
2. Land Use & Zoning (State, Local)		15	20	20	20	30	20	315	21.00	30	15
3. Construction Considerations		25	15	20	15	30	15	310	20.67	30	15
4. Construction Facilities		5	10	10	10	10	10	155	10.33	25	5
5. Switch Yard / Transmission Line		5	5	10	5	5	10	93	6.20	10	5
6. Security		5	10	10	5	5	5	127	8.47	15	5
7. Permanent Facility Considerations		20	15	5	20	10	15	139	9.27	20	0
8. Impact to Existing Facility Structures		5	5	5	5	0	5	56	3.73	5	0
Totals		**100**	**100**	**100**	**100**	**100**	**100**	**1500**	**100**		

Individual Scoring of Option 2

Option 2 – North Criteria	Weight (total is 100%)	1	2	3	4	5	6	7	8	9
1. Environmental		5	5	4	4	4	4	3	4	4
2. Land Use & Zoning (State, Local)		3	5	3	2	4	6	4	3	3
3. Construction Considerations		4	5		3	4	4	4	5	
4. Construction Facilities		4	5		4	2	4	4	4	
5. Switch Yard / Transmission Line		5	5			4	5	5	6	
6. Security		5	5		6	4	5	6	5	
7. Permanent Facility Considerations		5	5		6	4	6	5	4	
8. Impact to Existing Facility Structures		5	5		4	4	4	5	5	
Totals		**36**	**40**	**7**	**29**	**30**	**38**	**36**	**36**	**7**

Criteria	Weight (total is 100%)	10	11	12	13	14	15	Subtotals	Average	High	Low
1. Environmental		3	4	4	5			53	4.08	5	3
2. Land Use & Zoning (State, Local)		5	4	4	4			50	3.85	6	2
3. Construction Considerations		4	3	4	4			44	4.00	5	3
4. Construction Facilities		1	4	4	3			39	3.55	5	1
5. Switch Yard / Transmission Line		5	4	3	4			46	4.60	6	3
6. Security		3	7	3	4			53	4.08	7	3
7. Permanent Facility Considerations		5	4	4	6			54	4.15	6	4
8. Impact to Existing Facility Structures		4	4	4	4			48	3.69	5	4
Totals		**30**	**34**	**30**	**34**	**0**	**0**	**387**	**31.99**		

Individual Scoring of Option 4

Option 4 – South Criteria	Weight (total is 100%)	1	2	3	4	5	6	7	8	9
1. Environmental		5	7	7	3	6	6	4	6	8
2. Land Use & Zoning (State, Local)		7	7	5	4	6	4	6	7	6
3. Construction Considerations		7	7		2	7	7	6	5	
4. Construction Facilities		6	7		6	8	7	7	5	
5. Switch Yard / Transmission Line		8	7			6	6	6	4	
6. Security		5	5		4	7	5	4	5	
7. Permanent Facility Considerations		5	7		4	7	4	5	6	
8. Impact to Existing Facility Structures		5	5		6	6	6	5	6	
Totals		**48**	**52**	**12**	**29**	**53**	**45**	**43**	**44**	**14**

Criteria	Weight (total is 100%)	10	11	12	13	14	15	Subtotals	Average	High	Low
1. Environmental		6	6	6	5			75	5.77	8	3
2. Land Use & Zoning (State, Local)		4	6	5	6			73	5.62	7	4
3. Construction Considerations		6	9	8	9			73	6.64	9	5
4. Construction Facilities		8	9	7	9			79	7.18	9	5
5. Switch Yard / Transmission Line		5	6	7	6			61	6.10	8	4
6. Security		6	4	5	6			56	4.31	7	4
7. Permanent Facility Considerations		6	6	6	4			60	5.45	7	4
8. Impact to Existing Facility Structures		4	6	5	6			60	5.45	6	4
Totals		**45**	**52**	**49**	**51**	**0**	**0**	**537**	**46.52**		

Table B-3
Sensitivity Evaluation – Weighting
Maximum Weight Applied to Environmental

Criteria	Weight % (total is 100%)	Options			
		2		4	
		Score	Sub Total	Score	Sub Total
Environmental	30	4.08	1.22	5.77	1.73
Land Use & Zoning (State, Local)	17	3.85	0.65	5.62	0.95
Construction Considerations	17	4.00	0.68	6.64	1.13
Construction Facilities	9	3.55	0.32	7.18	0.65
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	9	4.08	0.37	4.31	0.39
Permanent Facility Considerations	9	4.15	0.37	5.45	0.49
Impact to Existing Facility Structures	4	3.69	0.15	5.45	0.22
Totals	**100**		**3.99**		**5.86**

Maximum Weight applied to Land Use and Zoning

Criteria	Weight % (total is 100%)	Options			
		2		4	
		Score	Sub Total	Score	Sub Total
Environmental	17	4.08	0.69	5.77	0.98
Land Use & Zoning (State, Local)	30	3.85	1.15	5.62	1.68
Construction Considerations	17	4.00	0.68	6.64	1.13
Construction Facilities	9	3.55	0.32	7.18	0.65
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	9	4.08	0.37	4.31	0.39
Permanent Facility Considerations	9	4.15	0.37	5.45	0.49
Impact to Existing Facility Structures	4	3.69	0.15	5.45	0.22
Totals	**100**		**3.96**		**5.84**

Maximum Weight applied to Construction Considerations

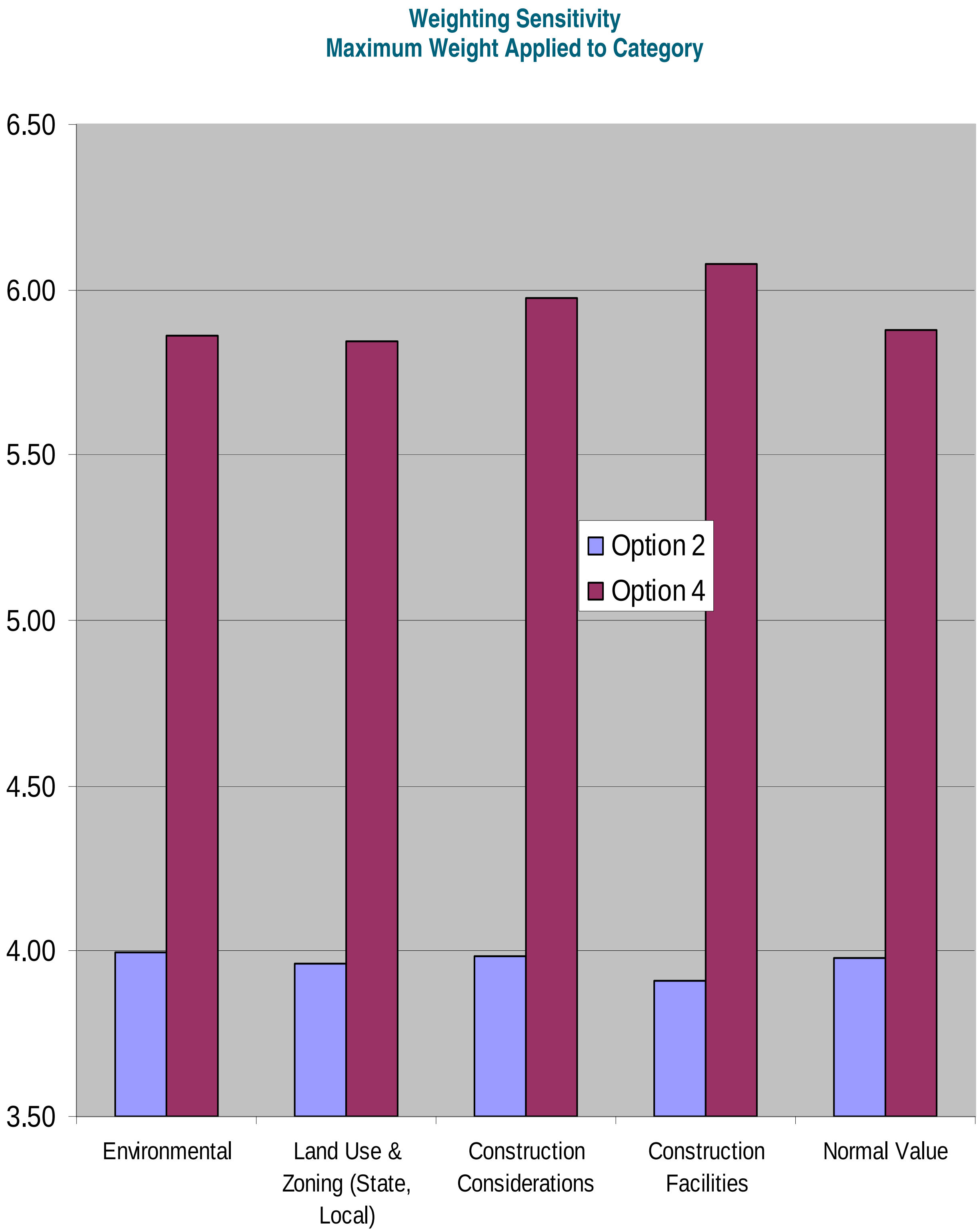
Criteria	Weight % (total is 100%)	Options 2 Score	Options 2 Sub Total	Options 4 Score	Options 4 Sub Total
Environmental	17	4.08	0.69	5.77	0.98
Land Use & Zoning (State, Local)	17	3.85	0.65	5.62	0.95
Construction Considerations	30	4.00	1.20	6.64	1.99
Construction Facilities	9	3.55	0.32	7.18	0.65
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	9	4.08	0.37	4.31	0.39
Permanent Facility Considerations	9	4.15	0.37	5.45	0.49
Impact to Existing Facility Structures	4	3.69	0.15	5.45	0.22
Totals	**100**		**3.98**		**5.97**

Maximum Weight applied to Construction Facility

Criteria	Weight % (total is 100%)	Options 2 Score	Options 2 Sub Total	Options 4 Score	Options 4 Sub Total
Environmental	16	4.08	0.65	5.77	0.92
Land Use & Zoning (State, Local)	16	3.85	0.62	5.62	0.90
Construction Considerations	16	4.00	0.64	6.64	1.06
Construction Facilities	25	3.55	0.89	7.18	1.80
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	9	4.08	0.37	4.31	0.39
Permanent Facility Considerations	9	4.15	0.37	5.45	0.49
Impact to Existing Facility Structures	4	3.69	0.15	5.45	0.22
Totals	**100**		**3.91**		**6.08**

Summary Sensitivity Evaluation for Maximum Weight

Case	Option 2	Option 4
Environmental	3.99	5.86
Land Use & Zoning (State, Local)	3.96	5.84
Construction Considerations	3.98	5.97
Construction Facilities	3.91	6.08
Normal Value	3.98	5.88


Weighting Sensitivity
Maximum Weight Applied to Category
6.50
6.00
5.50
5.00
4.50
4.00
3.50
Option 2
Option 4
Environmental
Land Use & Zoning (State, Local)
Construction Considerations
Construction Facilities
Normal Value

Scoring Summary
CCNPP Units 3 and 4 Site Layout Study

Sensitivity Evaluation – Weighting
Minimum Weight Applied to Environmental

Criteria	Weight % (total is 100%)	Options			
		2		4	
		Score	Sub Total	Score	Sub Total
Environmental	10	4.08	0.41	5.77	0.58
Land Use & Zoning (State, Local)	23	3.85	0.88	5.62	1.29
Construction Considerations	23	4.00	0.92	6.64	1.53
Construction Facilities	11	3.55	0.39	7.18	0.79
Switch Yard / Transmission Line	6	4.60	0.28	6.10	0.37
Security	11	4.08	0.45	4.31	0.47
Permanent Facility Considerations	11	4.15	0.46	5.45	0.60
Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**3.97**		**5.90**

Minimum Weight applied to Land Use and Zoning

Criteria	Weight % (total is 100%)	Options			
		2		4	
		Score	Sub Total	Score	Sub Total
Environmental	22	4.08	0.90	5.77	1.27
Land Use & Zoning (State, Local)	15	3.85	0.58	5.62	0.84
Construction Considerations	22	4.00	0.88	6.64	1.46
Construction Facilities	11	3.55	0.39	7.18	0.79
Switch Yard / Transmission Line	6	4.60	0.28	6.10	0.37
Security	10	4.08	0.41	4.31	0.43
Permanent Facility Considerations	10	4.15	0.42	5.45	0.55
Impact to Existing Facility Structures	4	3.69	0.15	5.45	0.22
Totals	**100**		**3.99**		**5.92**

Minimum Weight applied to Construction Considerations

Criteria	Weight % (total is 100%)	Options 2 Score	Options 2 Sub Total	Options 4 Score	Options 4 Sub Total
Environmental	22	4.08	0.90	5.77	1.27
Land Use & Zoning (State, Local)	22	3.85	0.85	5.62	1.24
Construction Considerations	15	4.00	0.60	6.64	1.00
Construction Facilities	10	3.55	0.35	7.18	0.72
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	10	4.08	0.41	4.31	0.43
Permanent Facility Considerations	11	4.15	0.46	5.45	0.60
Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**3.98**		**5.83**

Minimum Weight applied to Construction Facility

Criteria	Weight % (total is 100%)	Options 2 Score	Options 2 Sub Total	Options 4 Score	Options 4 Sub Total
Environmental	21	4.08	0.86	5.77	1.21
Land Use & Zoning (State, Local)	21	3.85	0.81	5.62	1.18
Construction Considerations	21	4.00	0.84	6.64	1.39
Construction Facilities	5	3.55	0.18	7.18	0.36
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	11	4.08	0.45	4.31	0.47
Permanent Facility Considerations	11	4.15	0.46	5.45	0.60
Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**4.00**		**5.80**

Summary Sensitivity Evaluation for Maximum Weight

Case	Option 2	Option 4
Environmental	3.97	5.90
Land Use & Zoning	3.99	5.92
Construction Considerations	3.98	5.83
Construction Facilities	4.00	5.80
Normal Value	3.98	5.88

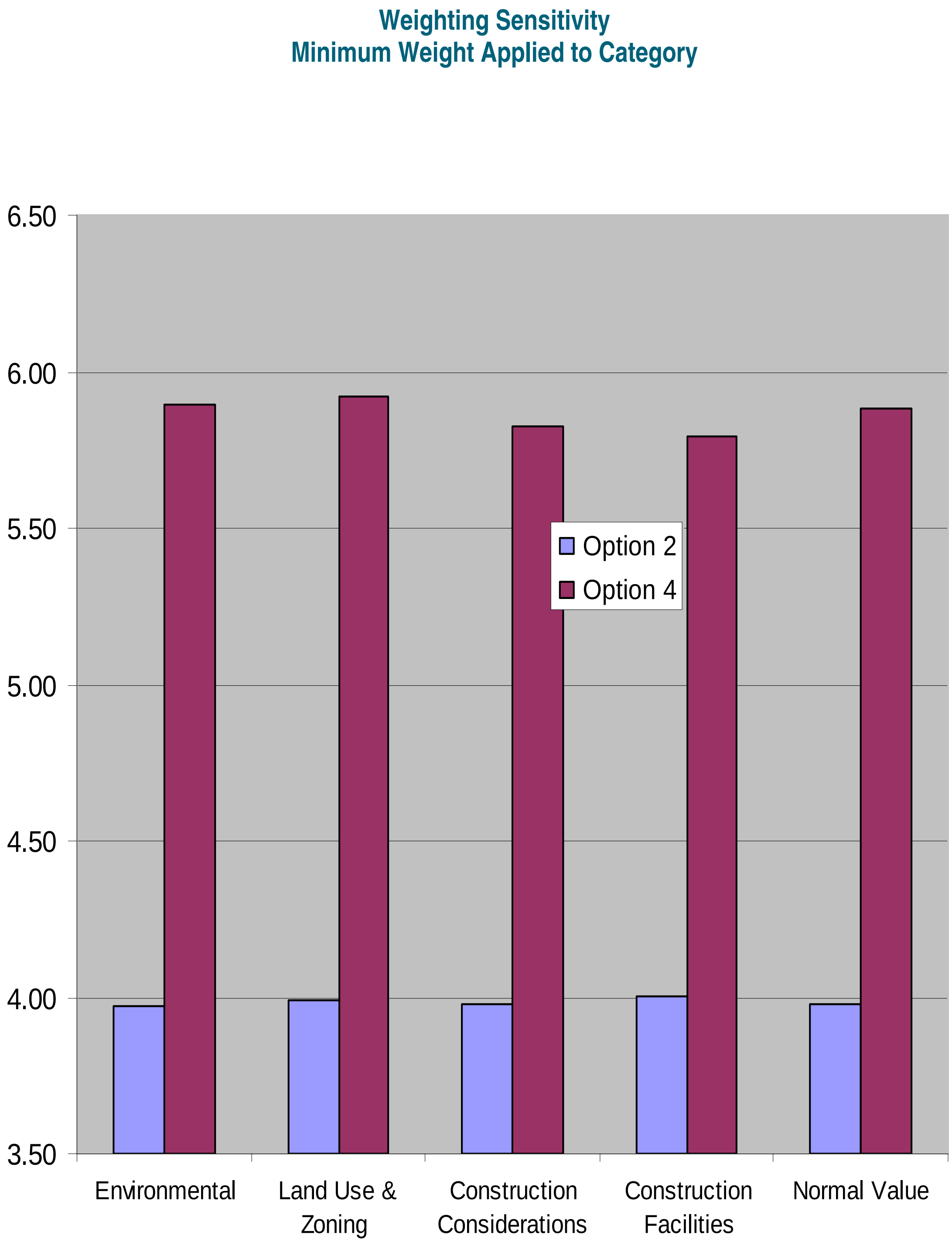

Weighting Sensitivity
Minimum Weight Applied to Category
6.50
6.00
5.50
5.00
4.50
4.00
3.50
Option 2
Option 4
Environmental
Land Use & Zoning
Construction Considerations
Construction Facilities
Normal Value

Table B-4
Sensitivity Evaluation – Scoring
Maximum Score Applied to Option 2 and Minimum Score Applied to Option 4 for Environmental

Criteria	Weight % (total is 100%)	Options			
		2		4	
		Score	Sub Total	Score	Sub Total
Environmental	20	5.00	1.00	3.00	0.60
Land Use & Zoning (State, Local)	20	3.85	0.77	5.62	1.12
Construction Considerations	20	4.00	0.80	6.64	1.33
Construction Facilities	10	3.55	0.35	7.18	0.72
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	10	4.08	0.41	4.31	0.43
Permanent Facility Considerations	10	4.15	0.42	5.45	0.55
Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**4.16**		**5.32**

Sensitivity Evaluation – Scoring
Maximum Score applied to Option 2 and Minimum Score Applied to Option 4 for Land Use and Zoning

Criteria	Weight % (total is 100%)	Options			
		2		4	
		Score	Sub Total	Score	Sub Total
Environmental	20	4.08	0.82	5.77	1.15
Land Use & Zoning (State, Local)	20	6.00	1.20	3.00	0.60
Construction Considerations	20	4.00	0.80	6.64	1.33
Construction Facilities	10	3.55	0.35	7.18	0.72
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	10	4.08	0.41	4.31	0.43
Permanent Facility Considerations	10	4.15	0.42	5.45	0.55
Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**4.41**		**5.35**

Sensitivity Evaluation – Scoring
Maximum Score applied to Option 2 and Minimum Score Applied to Option 4 for Construction Considerations

Criteria	Weight % (total is 100%)	Options			
		2		4	
		Score	Sub Total	Score	Sub Total
Environmental	20	4.08	0.82	5.77	1.15
Land Use & Zoning (State, Local)	20	3.85	0.77	5.62	1.12
Construction Considerations	20	5.00	1.00	5.00	1.00
Construction Facilities	10	3.55	0.36	7.18	0.72
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	10	4.08	0.41	4.31	0.43
Permanent Facility Considerations	10	4.15	0.42	5.45	0.55
Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**4.18**		**5.55**

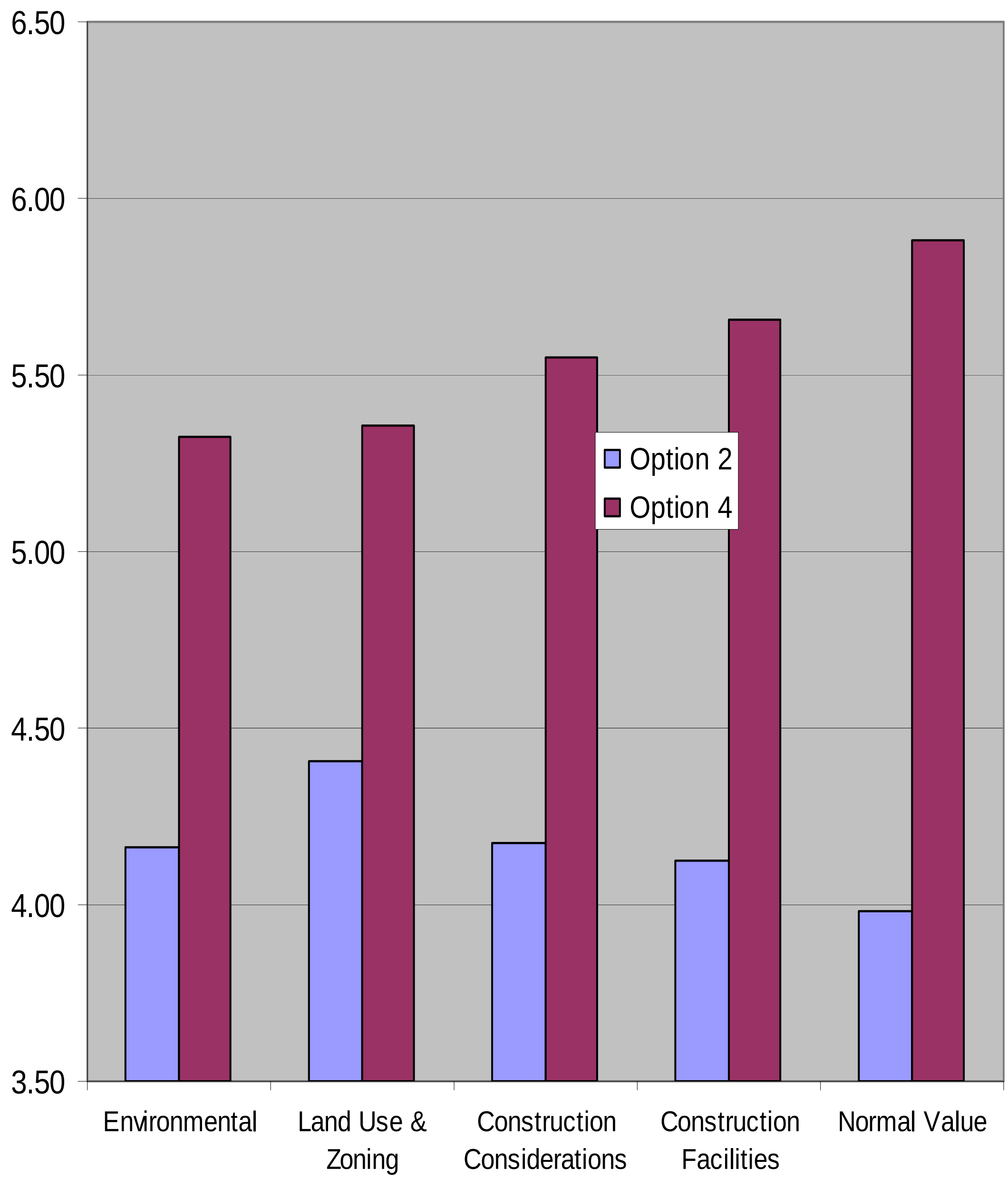
Sensitivity Evaluation – Scoring
Maximum Score applied to Option 2 and Minimum Score Applied to Option 4 for Construction Facilities

Criteria	Weight % (total is 100%)	Options			
		2		4	
		Score	Sub Total	Score	Sub Total
Environmental	20	4.08	0.82	5.77	1.15
Land Use & Zoning	20	3.85	0.77	5.62	1.12
Construction Considerations	20	4.00	0.80	6.64	1.33
Construction Facilities	10	5.00	0.50	5.00	0.50
Switch Yard / Transmission Line	5	4.60	0.23	6.10	0.31
Security	10	4.08	0.41	4.31	0.43
Permanent Facility Considerations	10	4.15	0.42	5.45	0.55
Impact to Existing Facility Structures	5	3.69	0.18	5.45	0.27
Totals	**100**		**4.12**		**5.66**

Summary Sensitivity Evaluation for Score

Case	Option 2	Option 4
Environmental	4.16	5.32
Land Use & Zoning	4.41	5.35
Construction Considerations	4.18	5.55
Construction Facilities	4.12	5.66
Normal Value	3.98	5.88

Scoring Sensitivity
Maximum Score Applied to Option 2 and Minimum Score Applied to Option 4



UniStar
Calvert Cliffs Nuclear Power Plant Units 3 and 4
Cooling System Selection
and
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Appendix C

Property and Zoning Information

CCNPP Related Land Uses by Zoning District

	I-1 District	I-1 District	Rural/ Resource Preservation District	Farm and Forestry District
	Current	Rewrite	Current	Rewrite
Commercial Power Generating Facility	P	P*	X	X*
Accessory Building or Use	P	P	P	P
Target Range	SC	SC	SC	SC
Public Utility Lines & Accessory Structures	P	P	P	P
Heliport	S	S	S	S
Temporary Structure Incidental to Construction (non-residential)	C	C	C	C
Tower, Commercial on Private Property (no height restriction)	SC	SC	SC	SC
Tower, Commercial on Private Property, less than 75 feet	C	C	SC	SC
Antenna, Commercial on Private Property	C	C	C	C
Satellite Dish Antenna; Ground Mounted, greater than 3' in diameter	C	C	C	C
Satellite Dish Antenna; Roof Mounted, greater than 3' in diameter	C	C	SC	SC
Satellite Dish Antenna; Ground or Roof Mounted, less than 3' in diameter	P	P	P	P

P Permitted Use
C Permitted Use if it meets certain conditions
S Permitted Use subject to special exception from the Board of Appeals
SC Permitted Use subject to special exception if it meets certain conditions
X Use is not permitted
* Status of this use in the Comprehensive Rewrite requires verification

Parcel	Grantor	Year Acq'd	Acres Acq'd	Grantee	Year Sold	Acres Sold	Net Acreage Left	Tax ID	SDAT Acreage
1	Belle Goldstein	1967	986.2	Maryland/Wayson Land Holdings*	1984/ 2002	8.8/1.2	976.2	01-000578	962.0
3	YMCA	1968	150.4				150.4	01-000586	150.4
5	Briscoe	1982	68.6				68.6	01-002562	68.6
6	Louis Goldstein	1984	289.3				289.3	01-001116	291.8
2	Gibson	1984	414.4	Calvert County Commis.	1999	25.6	388.8	01-008625	388.8
7	Pardoe	1985	29.4				29.4	01-239996	29.4
4	Fowler	1986	167.1	Wayson Land Holdings*	2002	15.4	151.7	01-007769	166.0
6	Raysinger	1988	2.5				2.5	01-001116	**
	Total		**2,107.9**			**41.0**	**2,056.9**		**2,057.0**

* BGE sold 8.8 acres of the Belle Goldstein tract to the State of Maryland in 1984. CCNPP sold 1.2 acres of the Belle Goldstein tract and 15.4 acres of the Fowler tract to Wayson Land Holdings in 2002. SDAT got the latter transaction backwards. It deducted 15.4 acres from the Belle Goldstein tract and 1.1 acres from the Fowler tract.

** SDAT has combined the Louis Goldstein tract and the Raysinger tract into a single tax parcel.

UniStar
Calvert Cliffs Nuclear Power Plant Units 3 and 4
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Appendix D

Walkdown Results

Walkdown Report

Location: Calvert Cliffs Nuclear Plant Site

Date: January 26, 2006

Participants: David Murphy, Bechtel
Chuck Dicey, Bechtel
Mark Hunter, Constellation
Tom Roberts, Constellation

Purpose: Walkdown Calvert Cliffs site to gather information for evaluating potential locations for Units 3 and 4.

Observations:

Southern side of property

1. Ponds downstream of Camp Conoy Lake are man-made water impoundment structures. Berms were formed on the bay side to create pooling and slow run-off to the bay.

2. Bald eagle nest is at the southern most location on the Calvert Cliffs property past current residential construction. Mark Hunter has provided GPS coordinates for the location.

3. The cemetery of 3 graves is located near the southern property line at the end of fire road M-1 (near node point N-3 on drawing 61502, sht 001).

4. The land just west of the Camp Conoy provides for moderately deep natural valleys for locating the power block.

5. Areas around Camp Conoy would require grading for locating the cooling towers.

6. Southern area works well with the nearby location of the barge ramp and heavy haul road. The existing heavy haul road is adjacent with the proposed site location.

7. The natural valley between the steep cliffs where the Camp Conoy tennis courts are located provides for an excellent area for locating an intake and discharge structure with the makeup and discharge lines routed through this valley to the circulating water system.

Northern side of property

1. Large ravines exist on both sides of fire road A-2 with a large deep valley at the northern most location on the property. This valley is located mostly within the Fowler tract. Most of the areas requiring significant fill would be used for the cooling tower locations and construction facilities.

2. Significant grubbing, clearing, and grading are required for the northern location.

3. At the proposed power block location, the land is mostly cleared, but would require significant grading to get to a grade elevation of approx. 75' as the natural elevation is 90'–100'.

4. A northern location would require demolition or relocation of the visitor center, educational center, tobacco barns, restored chimneys, security checkpoint and associated transformers, some of the main access road, cell phone tower, Procedure Upgrade Project trailers, and dog training facility.

Heavy Haul Road

The heavy haul road has 3 potential routes for a northern location. The first being through the existing Unit 1 and 2 protected area. This route contains a constricting Sallie-port, various 90° turns, runs just west of the Units 1 and 2 reactor buildings and would have a significant grade to traverse to get to the north location.

The second route would use the road just west of the existing switchyard and the third would use the road by the ISFSI. Both the second and third routes would be in excess of a mile in length. All routes require crossing under the transmission lines to get to a northern location.

For a southern site, the haul route is approximately a half mile with limited impact to the operating plant, and would not cross under any transmission lines.

Existing Intake and Discharge Structure

The existing intake and discharge structures were reviewed. There is the potential to connect to the existing intake for supplying makeup to both the northern and southern locations. The challenge is to locate the intake building either inside the protected area or outside and transition intake lines into the intake channel. Blowdown from the circulating water system could be returned to the intake channel from the southern location (would require additional feasibility studies) or tied into the existing discharge structure from a northern location. The difficulty would be integrating the change with the operating units.

UniStar
Calvert Cliffs Nuclear Power Plant Units 3 and 4
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Appendix E

Documentation of Meetings

January 5 and 6, 2006 Attendance

Attendees:

Name	Company	January 5	January 6
David Murphy	Bechtel	✓	✓
Ed Sherow	Bechtel	✓	*
Frank Lopez	Bechtel	✓	✓
Steve Routh	Bechtel	✓	✓
Hector Cruz	Bechtel	✓	Did not attend
Yifan Zheng	Bechtel	✓	Did not attend
Chuck Dicey	Bechtel	Did not attend	✓
Mark Hunter	Constellation	✓	✓
Tom Roberts	Constellation	✓	✓
Greg DeCamp	Constellation	✓	✓
Mike Milbrandt	Constellation	✓	✓
Jim Burkman	Constellation	✓	✓
Carla Logan	Constellation	✓	✓
Fred Jacobs	AKRF	✓	✓
Doug Heimbuch	AKRF	✓	✓
Maureen Heimbuch	AKRF	Via teleconference	Did not attend
David Bailey	EPRI	✓	Did not attend
Jay Hixson	Morgan State	✓	Did not attend
Barry Knisley	Randolph - Macon	✓	Did not attend
Brenda Nuse	Constellation	✓	Did not attend
Ken Johnson	Constellation	✓	Did not attend
Dick Ransom	Constellation	Did not attend	Did not attend
Dave Tomlinson	Constellation	✓	Did not attend
Karen Patterson	TT/NUS	✓	✓
Ned Taft	Alden	Via teleconference	Did not attend
Bruce Bradford	TT/NUS	✓	✓

Calvert Cliffs Siting Study Meeting Notes
January 5 and 6, 2006

January 5, 2006

Scope Items for Consideration

1. Schedule

2. Impact to existing site

3. Zoning Issues

4. Beetles – Tiger

   - Two species (Northeastern Beach and Puritan), both have active adults from June 15 to August, both have minimal impacts due to salt deposition.

   - Northeastern Beach: (a) located at Flag Ponds & Western Shores, also used to be at Cove Point, (b) eggs/larvae are in beach sand

   - Puritan (a) located at Scientist Cliffs, Calvert Cliffs State Park, Cove Point, etc and south of Barge Dock, (beetles are able to use a narrow beach area with High Cliffs), (b) Eggs/larvae are laid in a sand/soft material layer in the cliffs. The beetles need a "bare" or exposed cliff face for access soil to lay their eggs.

5. Environmental Approvals (know order/precedence/pre-requisites)

6. Eagle Nest (s) Location

7. Noise

8. Life Cycle Costs and NOT Initial Capital Cost will govern decisions

9. Cultural Resources (old tobacco barn, foundation and chimney, camp conoy)

10. Use of Fresh water and source (water to run the plant plus possible Ultimate Heat Sink)

11. Develop a plan to allow investigation of plants and vegetation to be implemented in the spring.

Other Discussion Topics and Considerations

1. Offshore screens for *Once Through* would require many modules with small screens that would provide fouling problems.

2. *Once Through* cooling would have thermal impacts that are seen as high risk

3. Need to define and/or minimize interaction with future U1/U2 changes (i.e. know relationship to future U1/U2 changes such as power upgrade).

4. Cooling Option and impacts of 316A & B. Phase I (New Facility) with Track 1 (closed cycle) and track 2 (Once through). Phase II (Existing Facilities).

5. Intake Options: Use existing U1/U2 intake to feed the new units so total site would be 50% cooling tower. This would help U1/U2 also. Need to have velocity of feed to new units to be < 0.5 ft/sec.

6. Initiate a Flight Study for impacts and restraints

7. Perform Study to locate Oyster bed south of the plant

8. Develop Matrix of options for Cooling System. Matrix to included various options, +/- items. Must consider type of system, type of towers, plumes and deposition of material, impact on T-Lines, etc.

9. Obtain or perform a study for existing site background noise data.

10. Site with 2 units to be arranged to have a common switchyard that would then tie into the existing U1/U2 switchyard for interface with the grid.

11. Efforts and process developed for the Calvert Site selection will become the standard for other plants.

12. Site selection will address both 1 unit and 2 unit options.

13. The 1000 foot zone critical area is a Maryland State requirement enforced by Calvert County. There is also a sensitive zone that is the first 100 feet. Potential to encroach the 1000 foot, but leave at least 300 feet.

14. Site has sections zoned as industrial and buffer. Goal is to use industrial area first and then buffer area if needed. Working to get state to approve a Certificate of Public Convenience and Necessity (CPCN) that will give flexibility for changing zoning, height and other restrictions.

15. Constructability and crane access and usage will be addressed.

Location Considerations

North Side

Plus Items	Negative Items
Area is designated as industrial	Water intake and discharge could impact cliffs and will have to go past sand bar (1.0 miles in length). High Cliffs
No oyster bed area	Flag Pond Nature Park is in relative close proximity to immediate north
Good access to tie into existing intake area and discharge area	Shore intake not possible without dredging and high maintenance. Concern on impact to U1/2 discharge pipe
Minimal impact due to Tiger Beetles to be addressed	Will need to be within 1000 ft exclusion area and will need to use part of "Fowler" property
Open fields for soil borings	Higher elevation and much earthwork to be done

South Side

Plus Items	Negative Items
Shoreline intake and discharge can use "valley area" and not impact cliffs	Old Oyster bar (may not be active) will need survey and may need to be re-seeded
Offshore area is OK with respect to recirc of discharge.	
Minimal impact due to Tiger Beetles to be addressed	

West Side

Plus Items	Negative Items

January 6, 2006

Site Critical Items

1. Have space for 2 Units and ability to tie the 2 new units together

2. Stay 300 feet from the Bay (100 foot sensitive zone plus 200 feet of the critical zone)

3. Do not place the nuclear island on Lake Davies

4. Maintain 1500 feet separation from Bald Eagle Nest, also address any nest in the Flag Pond Area

Site Objectives/Desires Wants

1. Low Regulatory risk
2. Minimal environmental impact
3. Positive public viewpoint
4. Acceptable Capital/Life cycle cost
5. Streamlined schedule
6. DOE Funding
7. Licensing benefit to Units 1 and 2
8. Common security

Cooling Tower Options and Considerations

1. Once through cooling is not viable due to 316 A & B regulations and impacts. These impacts include:

    a. No known or pre-approved technology to meet 95% entrainment requirements

    b. Large thermal plume to be added to existing plume

    c. Flow greater than 1% of Tidal flow

    d. Use of existing intake for once through would have fouling of wedge wire screens and high maintenance

    e. Long schedule to perform multiple studies with uncertain results

2. Mechanical towers using wet technology with salt drift of 80% within 300 feet to be considered

3. Natural Draft towers with salt drift of 80% within 1 mile to be considered

4. Visual impact of cooling towers to be considered.

5. Intake for make-up to consider both new and existing intake structure.

6. Particulate emissions to be considered

7. Tower size impact on selected site to be considered

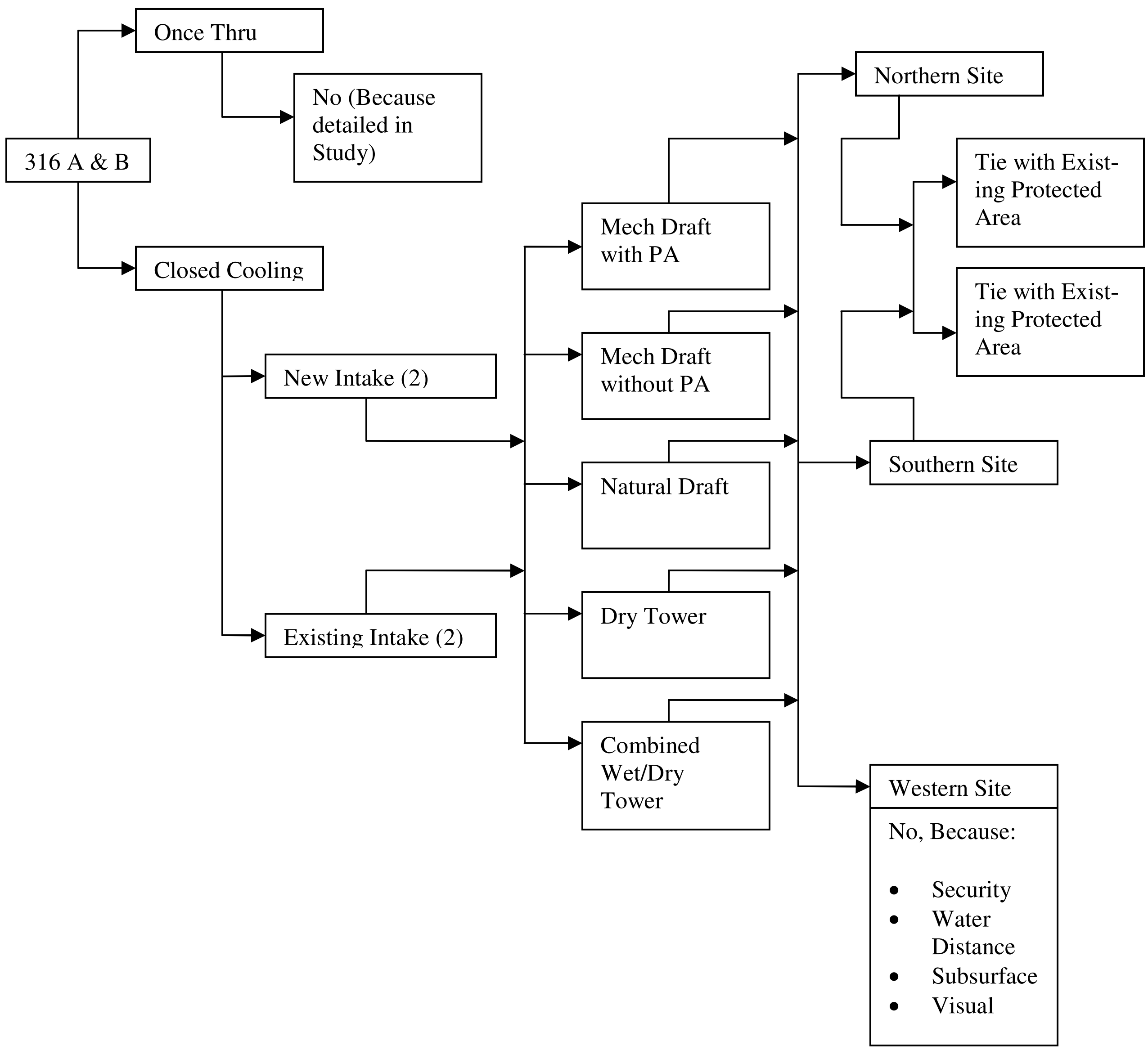
<u>Site Location Options</u>

The following site options are to be included and addressed in the Site Layout Study Report:

1. North of existing units with mechanical towers and use of a new intake structure
2. North of existing units with mechanical towers and use of existing intake structure
3. North of existing units with natural draft towers and use of a new intake structure
4. North of existing units with natural draft towers and use of existing intake structure
5. South of existing units with mechanical towers and use of a new intake structure
6. South of existing units with mechanical towers and use of existing intake structure
7. South of existing units with natural draft towers and use of a new intake structure
8. South of existing units with natural draft towers and use of existing intake structure

Site Selection Logic Tree

The following logic tree was discussed and will be used in the site selection



Notes/Basis for Logic Tree:

1. New Plant will be for 2 each EPR Units
2. Phase I/II decision to affect compliance regulations

Calvert Cliffs Unit 3 & 4 Site Layout Study Report Outline

The study will include the following sections: (Note, study outline issued to all parties on 1/10/06)

Executive Summary

Acknowledgements

Introduction

Purpose

Scope/Basis

Known information

Site Layout Evaluation (group by type of consideration reviewed)

Key Layout Drivers

- 316A&B
  - Technical
  - Regulatory
  - Integration (D Heimbuck (AKRF) Carla Logan D Bailey (EPRI), N Taft (Alden))
  - Bay Ecology (J Hixson)
    - Oyster Beds
- Environmental Items
  - Endangered Species (G DeCamp)
    - Tiger Beetles (B. Kinsley)
    - Bald Eagle (G DeCamp)
- Security items
- Land Use/Zoning
  - Zoning (J Burkman)
  - Chesapeake Bay Buffer Zone (100 foot and 1000 foot zones) (J Burkman)
- Cooling Tower Considerations (D Murphy, H Cruz)

- Constructability Items
  - Crane Use Plans
  - Barge Access
- North/South/West Sites (D Murphy, B Nuse

Matrix of Sites/Cooling Options

Discussion of Options

Conclusion

Recommendation

Appendices

- Drawings
- Walkdown Results
- Pictures
- Meeting Notes
- Individuals Contacted and Discussion Summary
- List of Recommended Field Studies
- Bibliography/References

Schedule

Issue Outline: 1/10

Input: 1/20

First Draft: 2/1

Review First Draft: 2/2 to 2/8

Review Meeting to finalize: 2/8

Issue Final 2/10

Senior Management Presentation: 2/13 to 2/17

Available for use with external stack holders starting 2/20

Start Field Activities: 3/27

Action Items – Calvert Cliff Siting Study

Date: January 5 and 6, 2005

Meeting with Constellation-UniStar, and Bechtel (BPC) to review Calvert Cliffs Siting Study

Action Items

	Action Item Description Actions Performed	Responsible Party - Company	Due Date/ Status
1.	Perform a Bathometric Study to determine water levels and bottom of bay	Carla Logan	1/17/06 Open
2.	Obtain MDNR report for location of Eagle(s) nest. Southern nest coordinates provided and will be part of study	Mark Hunter	1/17/06 Complete
3.	Obtain or create a map/drawing of site wetlands and restricted areas. Greg DeCamp has ordered the drawing	Jim Burkman	1/17/06 Ongoing
4.	Obtain location of proposed gas line There is no gas line	Mark Hunter/ Jim Burkman	1/12/06 Complete
5.	Define items/data needed from Framatome (OL3) for site Layout. Include any Plant Data Requirements Data requested has been received, ongoing as new needs arise (using Dave Marcelli per item 6)	David Murphy	1/12/06 Ongoing
6.	Establish FANP contact for requests for information (Joe Savage or Dave Marcelli ?) Dave Marcelli is contact.	Mike Milbrandt	1/12/06 Complete
7.	Check into ability/technology to provide picture overlays and identify costs	David Murphy	1/27/06 Open
8.	Identify and provide information for visual permits, guides and zoning information Information provided and will be part of study	Mark Hunter	1/20/06 Complete
9.	Define number and potential locations for monitoring wells. Coordinate with Unit 1&2 for location of and potential use of Unit 1&2 monitoring wells.	David Murphy/ Mark Hunter	1/27/06 Open
10.	Obtain copy or confirm existence of paperwork to allow “minor disturbances” on the overall site from a permit aspect.	Jim Burkman	1/27/06 Open
11.	Establish Automation Plan for interface between Constellation, Bechtel and Others Being worked with IMS integration with Areva	Dave Murphy/ Ed Sherow	2/24/06 Open

Conference Call Attendance

Attendees:

Name	Company	January 17 Conference Call	January 24 Conference call
David Murphy	Bechtel	✓	✓
Ed Sherow	Bechtel	Not on call	Not on call
Frank Lopez	Bechtel	✓	Not on call
Mark Hunter	Constellation	✓	✓
Tom Roberts	Constellation	✓	✓
Greg DeCamp	Constellation	✓	✓
Mike Milbrandt	Constellation	✓	✓
Jim Burkman	Constellation	✓	✓
Carla Logan	Constellation	✓	✓
Fred Jacobs	AKRF	✓	✓
Doug Heimbuch	AKRF	✓	✓
David Bailey	EPRI	Not on call	Not on call
Jay Hixson	Morgan State	Not on call	✓
Barry Knisley	Randolph - Macon	Not on call	Not on call
Brenda Nuse	Constellation	✓	✓
Ken Johnson	Constellation	✓	✓
Dick Ransom	Constellation	✓	✓
Karen Patterson	TT/NUS	Not on call	Not on call
Ned Taft	Alden	Not on call	✓
Bruce Bradford	TT/NUS	✓	Not on call

February 8, 2006 Attendance

Attendees:

Name	Company	February 8
Shawn Hughes	Constellation	Attended
Mike Milbrandt	Constellation	Attended
Tom Roberts	Constellation	Attended
Mark Hunter	Constellation	Attended
Greg DeCamp	Constellation	Attended
Ken Johnson	Constellation	Attended
Dick Ransom	Constellation	Attended
Jim Burkman	Constellation	Attended
Carla Logan	Constellation	Did not attend
Brenda Nuse	Constellation	Attended
Fred Jacobs	AKRF	Did not attend
Doug Heimbuch	AKRF	Attended
David Bailey	EPRI	Did not attend
Jay Hixson	Morgan State	Attended
Barry Knisley	Randolph - Macon	Attended
Ned Taft	Alden	Did not attend
Frank Lopez	Bechtel	Attended P/T
David Murphy	Bechtel	Attended
Ed Sherow	Bechtel	Attended
Chuck Dicey	Bechtel	Attended P/T
Shankar Rao	Bechtel	Attended

Action Items – Calvert Cliff Siting Study

Date: February 8, 2006

Meeting with Constellation-UniStar, and Bechtel (BPC) to review Calvert Cliffs Siting Study

Action Items

Action Item Description Actions Performed	Responsible Party - Company	Due Date/ Status
1. Develop generic checklist template for other sites	D. Murphy	3/31/06
2. Revise wording of items on checklists to be a "criteria" on the generic checklist	D. Murphy	3/31/06
3. Validate there is no impact or define any impacts for transmission line and/or "remote" grid substations impacted by project (Needed to support CPCN and ER)	T Roberts	2/17/06
4. Intensively developed area (IDA) coordinates to be provided	J Burkman	2/14/06
5. Show IDA and Zoning boundaries on Layout drawings	D Murphy	2/15/06
6. Add resume/CV of each team member supporting the Study Report	ALL	2/14/06
7. Provide Template for Resume/CV input	D Murphy	2/9/06
8. Rework Option 4 to get towers out of critical area	D. Murphy	2/14/06
9. Review and revise wording in sections that you authored to reflect items from meeting. Use appendix for details and put more summary level in body of report with reference to appendix. a. Include critical review of references and bibliography. b. Highlight what items we control and what items are outside of our control c. Remove Appendix G on Recommended Field Studies, unless study is required specifically for South location and not just part of COL/ER	ALL Doug Heimbuch	2/10/06 2/14/06
10. Develop summary of construction impacts as part of report	D. Murphy	2/24/06
11. Complete Artistic rendering	D. Murphy	2/14/06
12. Develop Cost Summary List for Options	T Roberts D Murphy	2/15/06

Schedule of Near Term Activities

2/10 – Input from team on report
2/14 – Input from Doug on report
2/15 – Dry Run for Constellation Meeting Presentation (1:00 pm in Annapolis)
2/17 – Constellation Management Meeting
2/20 – Input to NRC on Core Bore locations based on Study
2/24 – Issue final study report
2/28 – Meeting with GEA on Cooling Towers
3/?? – NRC Meeting to review Core Boring Data
??/?? – Meeting with External Stakeholders
3/27 – Commence Core Borings at site.

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Calvert Cliffs Nuclear Power Plant Units 3 and 4
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Appendix F

Crane Plan for OL-3 and Framatome

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Appendix G

Overview of Federal and State Cooling Water Intake Structure and Thermal Discharge Regulations

G.1 Regulatory Overview

Cooling water intake structures ("CWIS") are regulated under §316(b) of the Federal Clean Water Act ("CWA") and its implementing regulations, and under Title 26 of the Code of Maryland Regulations ("COMAR") 26.08.03.05. The associated thermal discharges are regulated under COMAR 26.08.03.03, which implements CWA §316(a) in the State of Maryland.

G.2 §316(b) -- Federal CWIS Regulation

Section 316(b) regulates CWISs associated with point source discharges (i.e., discharges regulated under §301 or §306 of the CWA):

> "Any standard pursuant to section 301 or section 306 of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."

USEPA promulgated regulations governing CWISs at new facilities, which include new steam electric generating stations ("Phase I Rule"), and existing ("Phase II Rule") steam electric generating stations pursuant to §316(b) of the CWA. The Phase I Rule was issued in December 2001 and was amended in June 2003. The Phase II Rule was issued in July 2004.

G.2.1 New Facility: Phase I Rule

G.2.1.1 Definition of *New Source*

USEPA at 40 CFR §125.83 defines a new facility that would be regulated under the Phase I Rule as:

> "any building, structure, facility, or installation that meets the definition of a "new source" or "new discharger" in 40 CFR 122.2 *and* 122.29(b)(1), (2), and (4) *and* is a greenfield or stand-alone facility; commences construction after January 17, 2002; and uses either a newly constructed cooling water intake structure, or an existing cooling water intake structure whose design capacity is increased to accommodate the intake of additional cooling water. *New facilities include only "greenfield" and "stand-alone facilities."* A greenfield facility is a facility that is constructed at a site at which no other source is located, or that totally replaces the process or production equipment at an existing facility (See 40 CFR 122.29(b)(1)(i) and (ii)). A stand-alone facility is a new, separate facility

> that is constructed on property where an existing facility is located and whose processes are substantially independent of the existing facility at the same site. New facility does not include new units that are added to a facility for purposes of the same general industrial operation." [emphasis added]

Therefore, in order for a facility to meet the definition of "new facility," it must meet *all* of the requirements of the first sentence of the definition from the Phase I Rule:

> (1) it must be a "new source" or "new discharger[1]" within the meaning of both 40 CFR §122.2 and §122.29(b)(1), (2) and (4);
>
> (2) it must be a "greenfield" or a "stand-alone" facility, as defined in 40 CFR §125.83;
>
> (3) construction must have commenced after January 17, 2002; and
>
> (4) it must use a new CWIS or an existing CWIS whose design capacity is increased to accommodate the intake of additional cooling water.

USEPA's regulations at 40 CFR §122.2 define "new source" as:

> "any building, structure, facility, or installation from which there is or may be a "discharge of pollutants," the construction of which commenced: (a) [a]fter the promulgation of standards of performance under section 306 of CWA which are applicable to such source…"

and 40 CFR §122.29(b)(1) provides criteria for determining what constitutes a "new source":

> "(1) a source is a "new source" if it meets the definition in §122.2, *and* (i) [i]t is constructed at a site at which no other source is located; *or* (ii) [i]t totally replaces the process or production equipment that causes the discharge of pollutants at an existing source; *or* (iii)[i]ts processes are substantially independent of an existing source at the same site. In determining whether these processes are substantially independent, the Director shall consider such factors as the extent to which the new facility is inte-

[1] *"New discharger" definition applies to buildings, facilities, etc. which are in existence but which had not been discharging as of August 1979 and which had not never received a final NPDES permit for discharges from the site.*

> grated with the existing plant; and the extent to which the new facility is engaged in the same general type of activity as the existing source." [emphasis added]

USEPA defined "greenfield" facility (40 CFR §125.83) as

> "…a facility that is constructed at a site at which no other source is located, or that totally replaces the process or production equipment at an existing facility (see 40 CFR 122.29(b)(1)(i)(ii))."

USEPA defined "stand-alone" facility (40 CFR §125.83) as

> "…a new separate facility that is constructed on property where an existing source is located and whose processes are substantially independent of the existing facility at the same site (see 40 CFR 122.29(b)(1)(iii))."

G.2.1.2 Applicability of Phase I to CCNPP Units 3&4

CCNPP Units 3&4 do not meet any of the criteria in 40 CFR §122.29(b)(1) for determining when a facility is a "new source." Subsection (b)(1)(i) does not apply because CCNPP Units 3&4 would be built at the site of the existing CCNPP Units 1&2, an existing source. Subsection (b)(1)(ii) does not apply because the CCNPP Units 3&4 would not replace the processes or production equipment that causes the discharge of pollutants at CCNPP Units 1&2; CCNPP Units 1&2 will continue to operate after Units 3&4 are built. In addition, CCNPP Units 3&4 will be engaged in the same specific type of activity as the existing CCNPP units. Also, 40 CFR §122.29(b)(1)(iii) does not apply because the operations of Units 3&4 and Units 1&2 will not be substantially independent; they will share switching and transmission facilities; and they likely will share some discharge pipes. CCNPP Units 3&4 are not "new sources" within the meaning of that term in 40 CFR §122.2 based upon the criteria in 40 CFR §122.29(b)(1), (2) or (4)[2].

Furthermore, CCNPP Units 3&4 are not "greenfield" or "stand-alone" facilities. Finally, USEPA's definition of new facility specifically excludes new units used for the same general industrial operation.

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[2] *Subsection (b)(2) is a further clarification on facilities that are deemed to be "new sources" under subsection (b)(1). Subsection (b)(4) provides clarification on how to determine whether construction has commenced for purposes of the "new source" definition in 40 CFR §122.2. Neither is relevant for purposes of CCNPP Units 3&4.*

In summary, CCNPP Units 3&4 do not fit within the definition of "new source" when it is considered in light of the criteria in 40 CFR §122.29(b)(1), (2) and (4). CCNPP Units 3&4 are neither "greenfield" nor "stand-alone" facilities. The units are being constructed at the existing CCNPP site; CCNPP Units 1&2 are an operating steam electric generating plant that will continue to operate after Units 3&4 are built and in operation. Not meeting either of these requirements is sufficient for CCNPP Units 3&4 to be excluded from the definition of "new facility" and therefore from regulation under the Phase I Rule.

However, the criteria for determining existing facilities and new facilities are being challenged in court (as discussed in the report). Although the current regulatory language clearly indicates that CCNPP Units 3&4 would not be deemed a new facility, the decision of the court may change that.

G.2.2 Existing Facility: Phase II Rule

G.2.2.1 Definition of *Existing Facility*

The Phase II regulations applicable to existing steam electric generating stations defines existing facility as:

> "…any facility that commenced construction as described in 40 CFR 122.29(b)(4) on or before January 17, 2002; and any modification of, or any addition of a unit at such a facility that does not meet the definition of a new facility at §125.83."

The preamble to the Phase II Rule (69 Fed. Reg. 41579) clarifies the key focus for determining what constitutes an existing facility. USEPA states:

> "…modifications or additions to the cooling water intake structure (or even the total replacement of an existing cooling water intake structure with a new one) does not convert an otherwise unchanged existing facility into a new facility, regardless of the purpose of such changes (e.g., to comply with today's rule or to increase capacity). *Rather, the determination as to whether a facility is new or existing focuses on the power-generating point source itself, i.e., whether it is a greenfield facility or a stand-alone facility.* This focus on the point source discharger is consistent with section 316(b), which by its express terms applies only to point sources." (emphasis added)

USEPA goes on to provide examples of existing facilities for purposes of the Phase II Rule. The Preamble continues at 69 Fed. Reg. 41579 (col. 2) and states:

> "For example, the following facility modifications or additions would result in a facility being characterized as an existing facility under today's rule:
>
> – An existing power generating facility undergoes a modification of its process short of total replacement of the process and concurrently increases the design capacity of its existing cooling water intake structures;
>
> – *An existing power generating facility builds a new process at its site for purposes of the same industrial operation and concurrently increases the design capacity of its existing cooling water intake structures;…"* [emphasis added]

USEPA went on to explain the approach taken in the Phase I Rule and how it relates to the Phase II Rule [emphasis added]:

> "In the preamble to the Phase I rule, …[US]EPA noted that it had generally deferred regulation of new sources constructed on a site at which an existing source is located until the Agency had completed analysis of its survey data on existing facilities. 66 FR 65286. Accordingly, the Phase I rule treated almost all changes to existing facilities for purposes of the same industrial operation as existing facilities. *These included the addition of new generating units at the same site, even where they required an increase in cooling water intake structure design capacity or the construction of a new cooling water intake structure,* as well as the complete demolition of an existing facility and its replacement with a new facility, so long as it did not increase the design capacity of the cooling water intake structure… As the preamble explained: "The definition of a new facility in the final rule applies to a facility that is repowered only if the existing facility has been demolished and another facility is constructed in its place, and modifies the existing cooling water intake structure to increase the design intake capacity." " 69 Fed Reg. 41579 (cols. 2 and 3)

In a footnote to the last sentence above, USEPA clarified its position by stating:

> "Because they are part of the same ''industrial operation,'' such units are not ''stand-alone'' facilities for purposes of the ''new facility'' definition. As the fifth sentence of the definition of ''new facility'' explains, they are categorically treated as ''existing facilities'' regardless of any other considerations unless they completely replace an existing facility and its cooling water design intake capacity is increased. Accordingly, there is thus no

> need to make a determination whether they are ''substantially independent'' of the existing facility at the same site under the fourth sentence of the definition in order to determine whether they are ''existing'' or ''new facilities.'' The fifth sentence alone controls this question."

The addition of this footnote, which was numbered as "2a" is being cited in the challenges to USEPA's definition of "existing facility" in appeal of the Phase II Rule pending before the Second Circuit Court of Appeals. Environmental groups are challenging USEPA's application of the "substantial independence" test under 40 CFR §122.29(b) in the Phase II Rule. A decision is not expected until August 2006.

> USEPA also provided:
>
> "In particular, new units that are added to a facility for purposes of the same general industrial operation should be treated as existing facilities because limitations associated with an existing site make it inappropriate to subject such units to new facility requirements. These limitations include space, existing location on a waterbody, location in already congested areas which could affect (if Phase 1 requirements were applied) visibility impairment, highway and airport safety issues, noise abatement issues, salt drift and corrosion problems and additional energy requirements. Moreover, power generation facilities should not be discouraged from making any upgrade, modification, or repowering that would increase energy efficiency or supply out of concern that they would be considered a new facility for purposes of section 316(b). Additional benefits will be realized in terms of reducing industrial sprawl if incremental power generation is not discouraged at existing power generation sites. These considerations counsel in favor of treating new units locating at existing sites as existing rather than new facilities. [US]EPA also noted when it promulgated the Phase I rule (*see* 66 FR 65286) that it is not feasible for the permit authority to judge whether the facility could have been located elsewhere for the purpose of determining whether the facility is subject to the new facility rules."

G.2.2.2 Applicability of Phase II to CCNPP Units 3&4

Given the definition of "existing facility" and USEPA's clarifications, CCNPP Units 3&4 should be considered an existing facility and be regulated under the Phase II Rule. CCNPP Units 1&2 clearly commenced construction prior to January 17, 2002, (under any definition of commencement of construction), CCNPP Units 3&4 are additional units at the facility and CCNPP Units 3&4 do not satisfy the definition of a "new facility".

G.2.3 COMAR 26.08.03.05 -- Maryland CWIS Regulation

The Maryland CWIS regulation implements §316(b) at the state level and defines acceptable levels of entrainment and impingement:

> "The location, design, construction and capacity of cooling water intake structures shall reflect the best technology available (BTA) for minimizing adverse environmental impact." (COMAR 26.08.03.05(A))
>
> "The determination of BTA for minimizing adverse environmental impact shall consider the effect of:
>
> (1) Impingement loss as determined in §D of this regulation; and
>
> (2) Entrainment loss as determined in §E of this regulation." (COMAR 26.08.03.05(A))

With respect to impingement, the Maryland regulation requires the facility to mitigate impingement loss to the extent that the costs for the mitigation are not greater than the benefits:

> "Dischargers shall install and operate functional modifications to mitigate impingement loss, provided that the additional cost of installation of modifications to intake structures and of operation modifications over a 5-year period does not exceed 5 times the estimated annual value of the impingement loss." (COMAR 26.08.03.05(D)(2))

For entrainment, the facility must determine whether the entrainment loss causes an adverse environmental impact, and must mitigate the entrainment loss if the facility does cause an adverse environmental impact:

> "The discharger shall determine the extent of cooling water entrainment loss on a spawning or nursery area of consequence for RIS..." (COMAR 26.08.03.05(E)(2))
>
> "If entrainment loss results in significant adverse environmental impact, the discharger shall install and operate functional modifications to mitigate entrainment loss." (COMAR 26.08.03.05(E)(3))

G.2.4 COMAR 26.08.03.03 -- Maryland Thermal Discharge Regulation

Maryland state regulations specify three thermal mixing zone criteria for thermal discharges into tidal waters (COMAR 26.08.03.03). Thermal discharges must be controlled so that:

- The 24-hour average of the maximum radial dimension measured from the point of discharge to the boundary of the full capacity 2^{o}C above ambient isotherm (measured during the critical periods) may not exceed ½ of the average ebb tidal excursion.
- The 24-hour average full capacity 2^{o}C above ambient thermal barrier (measured during the critical periods) may not exceed 50% of the accessible cross section of the receiving water body.
- The 24-hour average area of the bottom touched by waters heated 2^{o}C or more above ambient at full capacity (measured during the critical periods) may not exceed 5% of the bottom beneath the average ebb tidal excursion multiplied by the width of the receiving water body.

If a discharger is unable to meet these requirements, the discharger may request alternate thermal effluent limitations under the CWA §316(a). Alternate effluent limitations will be established only if the discharger demonstrates to the satisfaction of Maryland Department of the Environment (MDE) that the existing thermal effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish and wildlife in and on the body of water into which the discharge is made. The demonstration must consider the cumulative impact of the thermal discharge together with all other significant impacts on the species affected, including entrainment and impingement impacts.

In determining whether the protection and propagation of the affected species will be assured, MDE may consider any relevant information including evidence of the absence of the following factors:

- A significant increase in abundance or distribution of nuisance species;
- A significant change in biological productivity;
- A significant elimination or impairment of economic and recreational resources; and

- A significant reduction in the successful completion of the life cycle of representative important species.

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Site Layout Study

Appendix H

Environmental Evaluation

H Environmental Evaluation

H.1 Threatened or Endangered Species

H.1.1 Tiger Beetles

The two tiger beetle species of concern inhabit only the beach and cliff areas of the CCNPP site, which are recognized as valued resources and subject to specific land use protections (e.g., Critical Area and Critical Area Buffer Zones) in part because of the potential presence of these protected species. In addition, the beach and cliff areas along most of the undeveloped shoreline on the site are designated "Habitat Protection Areas" for the beetles under terms established by the Critical Area provisions in Section 8-1 of the Zoning Ordinance. Construction disturbance or preemption of these habitat areas is therefore a particular concern for the Site Layout Study Team.

Terms of the Wildlife Protection Agreement between CCNPP and The Nature Conservancy (CCNPP and Nature Conservancy 2003) include continuance of CCNPP's practice of restricting public vehicular access to the protected areas and granting of limited access to the areas to the Nature Conservancy and its agents for studies and monitoring of the Northeastern Beach Tiger Beetle and Puritan Tiger Beetle populations. Occurrence information included in the following summary is based primarily on annual surveys conducted under terms of the USFWS recovery plans for these two species (USFWS 1993, 1994).

The Northeastern Beach Tiger Beetle occurs on the CCNPP site only along a 100–150 meter section of the beach at the northern site boundary adjacent to Calvert County's Flag Ponds Nature Park, where they are found in small numbers (<50 individuals). Larger numbers occur northward on the Flag Ponds Nature Park property. Larvae of this species would be potentially impacted by beach disturbances, such at heavy equipment, etc. The larvae live in permanent burrows on the beach itself where they develop over a 1–2 year period. They are inactive from mid-November until April, spending this time in their burrows in the ground (8–12 inches deep). However, larvae have not been surveyed at CCNPP and, if present, probably occur only in small numbers. Adults are active, foraging on the beach, from June through September, after which they die off, and would thus be affected by beach disturbances only during their summer activity period.

The Puritan Tiger Beetle occurs on the CCNPP site in a scattered distribution along much of the shoreline from the Barge Slip southward to the southern site boundary. Greatest numbers of adults (and presumably larvae) occur east of the tennis courts at Camp Conoy (northernmost ravine south of the Barge Slip) being considered as a potential location for cooling water structures, but some adults are also present on the beach in this area. Adults have a shorter activity period than the Northeastern Beach Tiger Beetle, and are found along the beach, where they forage, during summer (June–August). Unlike the Northeastern Beach Tiger Beetle, Puritan Tiger Beetle adults move high onto the cliff face to oviposit, and it is in these upper cliff strata where the larvae spend their 2-year life cycle in burrows. Bare cliffs are necessary for adult oviposition and larval development of this species, even though erosion and cliff breakdown periodically eliminate some individuals. Adults of this species would be impacted by the same kind of disturbance on the beach as the Northeastern Beach Tiger Beetle (summer only). Larvae of the Puritan tiger beetle would be adversely affected by disturbances to the cliff sections where they occur.

Two potential impacts to Puritan tiger beetle from alteration of larval habitat have been identified for the South Option. However, both impacts could be avoided by appropriate planning and construction techniques. The first involves direct construction disturbance to cliff habitat, which could be avoided by confining cooling water intake and discharge facilities to already developed areas north of the Barge Slip or to the area of the northern most ravine south of the Barge Slip. Cliff habitat is absent in the former area and field reconnaissance of the latter area by the author (B. Knisley) on February 2, 2006 indicates there is no habitat in the immediate area of the channel because the cliffs are too low and vegetated. The closest Puritan tiger beetle habitat in that area is approximately 25–30 meters north and 30–35 meters south of the current channel. The second potential impact from development of the South Option is increased flow of surface or subsurface water onto or into the cliff face. This could occur as a result from construction work, resulting footprint of the facility (e.g.., cooling tower layout), and stormwater management provisions. Recent studies of the Puritan Tiger Beetle in Calvert County and at the Sassafras River sites indicate that episodes of rapid cliff erosion at some sites is due to cliff top water drainage rather than tidal activity (Knisley, unpublished work; David Miller, pers. comm.). While moderate levels of erosion are necessary to keep the cliff face unvegetated and suitable as habitat, excessive erosion can eliminate (at least temporarily) or reduce beetle numbers.

USFWS and MDNR would be concerned about direct habitat impacts that might jeopardize the populations of either of these species, but particularly the Puritan Tiger Beetle, populations of which have been declining significantly in Calvert County in recent years. Minimizing or, to the extent practicable, avoiding adverse impact to these species is therefore an appropriate general criterion for locating new plant facilities on the CCNPP site. In practical terms, it is expected that this general criterion could be met in a manner that would ensure an acceptable level of protection by the following provisions:

- Minimizing or avoiding physical disturbance of beach areas at the extreme northern end of the site (e.g., northernmost 200 meters) to protect larvae of the Northeastern Beach Tiger Beetle, and cliff areas south of the Barge Slip to protect larvae of the Puritan Tiger Beetle.
- Ensuring that construction work and completed facility do not cause increased flow of surface or subsurface water into or onto the cliff face.

- Avoiding construction disturbance of beach habitat during the period June-September to avoid impact to adults of both species.
- Restoring disturbed beach habitat, possibly including some beach nourishment, following construction.
- Effecting other mitigation if necessary.

Impact consideration associated with North, West, and South location options include:

<u>North</u> – This option poses potential moderate adverse impact to the Northeastern Beach Tiger Beetle if beach habitat within approximately 200 meters of northern property line is disturbed by construction or preempted for permanent facilities due to presence of adults in summer and larvae (if present) year-round. Although previous surveys suggest that few or no larvae are likely to occur in that area, distribution does change somewhat from year to year. The north location option poses potential for adverse impact to adults of the Puritan Tiger Beetle if Barge Slip upgrade activities occur in July-September.

<u>South</u> – The south location option poses potential for adverse impact to the Puritan Tiger Beetle if cliff habitat occupied by larvae is disturbed by construction, preempted by permanent facilities, or is subject to accelerated erosion from increased surface or subsurface water flows onto or into the cliff face, or if beach habitat (e.g., for cooling water structures or Barge Slip upgrade) is disturbed during July-September or preempted for permanent facilities due to use by adults. Restricting construction disturbance and permanent cooling water facilities locations to areas already developed (e.g., the existing intake structure area) would be optimal for protection. It is also expected that restriction of such disturbances and facilities to the area east of the tennis courts at Camp Conoy (northernmost ravine south of the Barge Slip), considered a potentially attractive location from an engineering standpoint, would also be effective in minimizing or avoiding impact to larvae because of the absence of substantial cliff habitat there. There is little or no potential for adverse impact to Northeastern Beach Tiger Beetle for the South option.

<u>West</u> – Potential for impact is dependent on location of cooling water intake and discharge structures. See above.

Additional reconnaissance or survey of beach habitat at the north end of the CCNPP property is recommended in the event the North Option is selected and the cooling water intake and or discharge are routed northward rather than into the existing developed area. This activity would be appropriately conducted when larvae become active, in the late April to May timeframe to confirm presence and approximate abundance of larvae in this location. Continued surveys and monitoring beginning in summer 2006 are advisable to enable appropriate assessment of impact for the preferred and alternative facility location(s). These surveys would enable better accounting for annual variability in distribution and abundance, and enable more thorough location and characterization of habitat and beetle populations in potentially impacted areas.

H.1.2 Bald Eagle

Information from CCNPP environmental staff report indicates that bald eagles regularly utilize Chesapeake Bay shoreline areas of the site, and that active nesting has occurred for many years at an onsite forest location near the bay near the south end of the CCNPP site. The approximate location of this nest, reported by Benassi (1995), was confirmed by a January 2006 reconnaissance of the area by team members (Nuse 2006a, 2006b). The NRC (1999) reported that seven offspring were fledged at this site since 1987, providing an indication of nesting success. The only other bald eagle nest known to occur near the CCNPP site is located at the far north end of Flag Ponds County Park, well over 0.25 miles north of the northern CCNPP site boundary.

The USFWS recommends that CCNPP allow no nonroutine human activities with ¼ mile from active bald eagle nests during the nesting season (December 15 through June 15) unless these activities have first been coordinated with and received the approval of the MDNR. USFWS has further indicated that consultation with the federal agency should be initiated for activities such as major construction and clear-cutting of timber within ¼ mile of the nest, regardless of the time of year the activity takes place (NRC 1999, Appendix E).

In consideration of the above information, it is appropriate to establish the area within 1,500 feet of the bald eagle nest as an exclusion zone for construction activity and location of construction and operation-phase facilities for a new plant. Preliminary layout activities indicate that the new plant could be readily located at any of the candidate locations (North, West, South) in conformance with this exclusion criterion.

H.2 Wetlands

No formal wetland delineations are known to have been performed on the CCNPP site. However, probable wetlands on the site and surrounding areas have been mapped on the basis of aerial photographic interpretation as part of the U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI; WetLand Maps.com. 2006, USFWS 1990). Selected wetlands on the site were also summarily described and mapped as part of a reconnaissance-level biological survey of the site sponsored by Baltimore Gas and Electric Company (BG&E) in 1994, the primary purpose of which was to identify known rare, threatened and endangered species and map and describe plant community types on the site (Benassi 1995, BG&E 1997). The only onsite wetland known to exist on the site but not acknowledged in the above sources is a 1-acre mitigation wetland (BG&E 1995). Figure H.2-1 and Table H.2-1, respectively provide location and summary characteristics of onsite wetlands from these sources, which serve as a basis for the following description.

Aside from estuarine subtidal and intertidal zones of Chesapeake Bay that constitutes the eastern border of the site, "natural" wetlands on areas of the CCNPP site potentially affected by new plant development consist primarily, and perhaps exclusively, of small headwater drainage courses and riparian deciduous forest that borders them. These forested wetlands occur as narrow strips bordering the extreme upper reaches of Perin Branch, which drains the portion of the site north of the existing plant facilities, and the upper reaches of Johns Creek and its tributaries, which drain most of the central and southern portions of the site (only the Camp Conoy areas and land immediately southeast of Camp Conoy drain directly to the bay). Both of these streams are tributaries of St. Leonard Creek, which outfalls to the Patuxent River. Portions of the upper Perin Branch riparian wetlands lie within the designated Chesapeake Bay Critical Area.

The NWI classifies the riparian forest in the extreme upper reaches of these small tributaries, including all Perin Branch drainage courses and the most upstream segments of Johns Creek and its tributaries onsite, as “temporarily flooded” (classified PFO1A; see Figure H.2-1 and Table H.2-1), denoting that water is present only for brief periods in the growing season and water table usually lies well below the surface. The NWI classification assigned to the lower, more westward portions of Johns Creek drainage courses onsite is similar but with a different modifier (“seasonally flooded,” PFO1C), denoting surface water presence for extended periods in spring and probably persistent near-surface water table. The subtlety of this difference as reflected in plant species composition is suggested by the fact that only the latter “seasonally flooded” riparian communities were recognized and mapped by Benassi (1995) as wetlands on the basis of field reconnaissance.

At this level of analysis, the only other potentially natural or near-natural wetlands in site areas of concern for new plant construction consist of three small (≤ approximately 1 acre) areas located within the Chesapeake Bay Critical Area downgradient from, and on the same small incised Chesapeake Bay tributary stream as, the Camp Conoy “fishing pond” impoundment (Figure H.2-1, Table H.2-1,). The one nearest to the fishing pond is categorized as seasonally flooded deciduous scrub-shrub (PSS1E); the remaining two are categorized as permanently flooded impoundments (PUBHH). The Camp Conoy fishing pond (estimated surface area approximately 3 acres) is a man-made impoundment, reportedly associated with Camp Conoy at the time of acquisition for original CCNPP plant development (Nuse 2006).

Remaining wetlands on or near CCNPP site areas of potential interest to new plant facilities arrangement are clearly man-made or a direct result of site development. These include a 1-acre wetland adjacent to and west of the 500-kV transmission corridor created as a mitigation project (not acknowledged by NWI), and several areas that provide control benefits for stormwater from developed areas of the site or from “Lake Davies” (now dry), an area west of the existing plant facilities where dredged spoils from original CCNPP plant construction were disposed. The nonnative and invasive common reed *Phragmites* predominates in these latter wetlands (Benassi 1995, MDNR 2006b).

Resource values provided by interior wetlands on the site include attenuation of stormwater flows and associated erosion and sedimentation potential, and groundwater recharge. The natural wetlands at CCNPP, including the Chesapeake Bay intertidal zone and riparian communities bordering onsite streams, and wetlands in the Camp Conoy area (i.e., fishing pond and wetlands downstream from it) also contribute to the diversity of native flora and faunal species on the site. However, on the basis of existing information as discussed above, there is no reason to conclude that wetlands on the CCNPP site are particularly unique. Benassi (1995) concluded that plant communities on the site, which included wetlands, are common for the Coastal Plain of Maryland. Activities associated with new plant development that occur in or affect wetlands would nonetheless be regulated, and adverse impacts may require mitigation.

In view of information presented above, location of wetlands on the site, and the relatively large land area that would be required for new plant development, establishing wetlands as exclusion zones for purposes of plant site arrangement is neither practical nor likely feasible. It is nonetheless desirable to minimize associated direct and indirect adverse impact on wetlands to the extent practicable.

Wetland impact considerations associated with North, West, and South location options include:

<u>North</u> – Rerouting of approximately 1 mile of upper reaches of Perin Branch and elimination of associated natural riparian forest wetland totaling in excess of 25 acres (estimated) for power island area and cooling towers. Possible construction disturbance of natural intertidal and subtidal zones for cooling water intake and/or discharge facilities. Possible elimination or disturbance of elimination of 1-acre mitigation wetland near transmission line and man-made wetlands in or near Lake Davies for construction-phase facilities.

<u>West</u> – Potential elimination or disturbance of some natural riparian forest wetland associated with Johns Creek and natural intertidal and subtidal zones for cooling water intake and/or discharge facilities. Possible elimination or disturbance of elimination of man-made wetlands in or near Lake Davies.

<u>South</u> – Rerouting of several hundred feet of small Chesapeake Bay tributary(s) and elimination of 3-acre impoundment (fishing pond) and small (1-acre) scrub-shrub wetland in Camp Conoy area. Possible rerouting of a few hundred feet of stream (upper reach of Johns Creek) and elimination or disturbance of a few acres of associated natural riparian forest wetland. Possible construction disturbance of natural intertidal and subtidal zones for cooling water intake and/or discharge facilities. Possible elimination or disturbance of elimination of man-made wetlands in or near Lake Davies for construction-phase facilities.

It is expected that adverse impact on wetlands associated with any of these options could be acceptably mitigated. However, the North option would result in substantially greater impact to wetlands that either the West or South options.

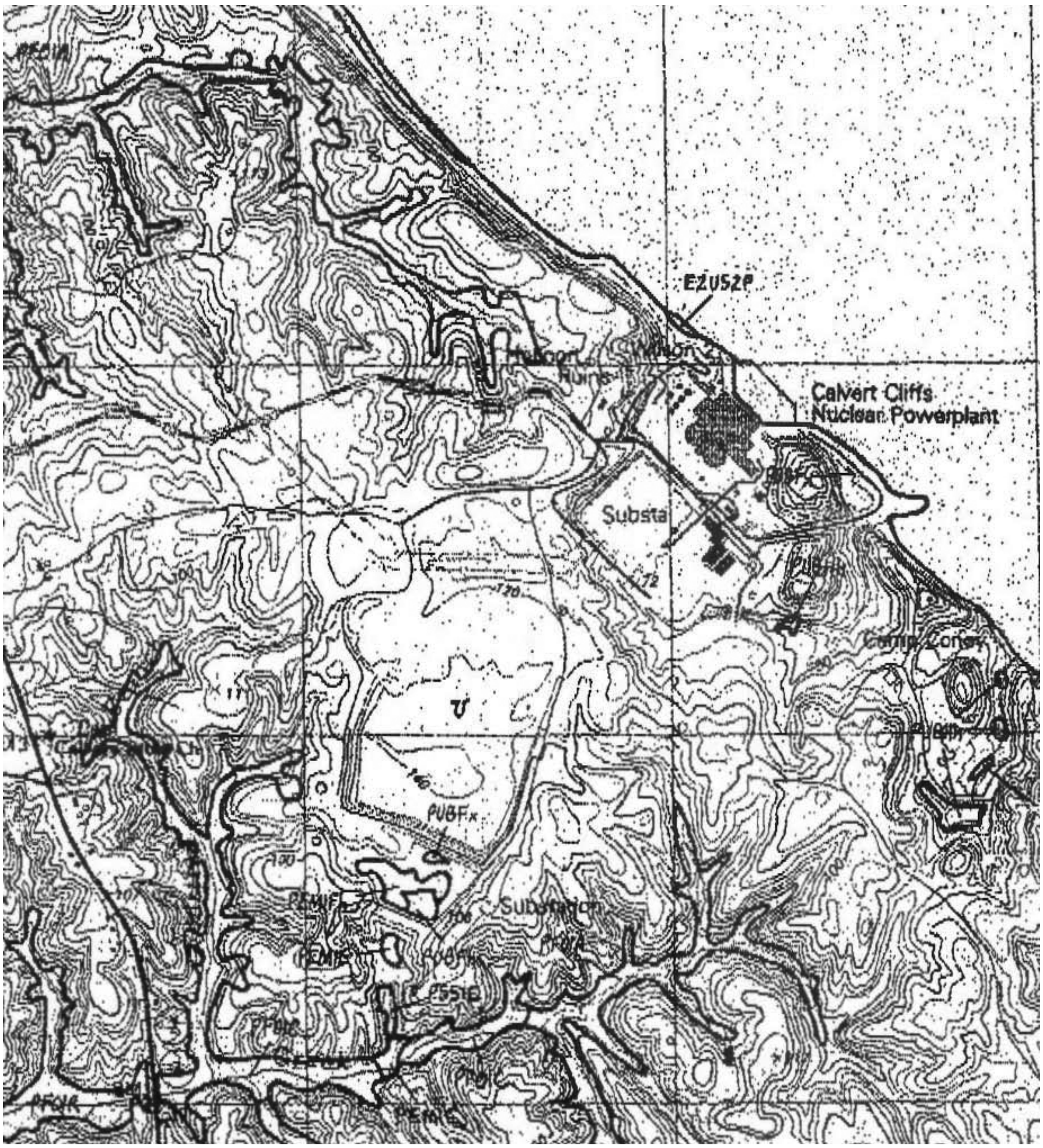
Table H.2-1
CCNPP Site Wetland Summary Data

Class Code[a]	Classification Description[a]	Location and Remarks[b]
E1UB1	Estuarine - Subtidal - Unconsolidated Bottom - Cobble-Gravel	Subtidal zone along Chesapeake Bay shoreline
E2US2P	Estuarine - Intertidal - Unconsolidated Shore - Sand - Irregularly Flooded	Intertidal zone along Chesapeake Bay shoreline; essentially entire beach.
PFO1A	Palustrine - Forested - Broad-Leaved Deciduous – Temporarily Flooded	Riparian zone of onsite Patuxent River tributary (St. Leonard Cr.) headwater streams i.e., Perin Br. tributary on north portion of site; Johns Cr. & its tributary on west and south part of site. Exclusive type along Perin Br and predominant in uppermost segments of Johns Cr and its tributaries onsite. Not reported or mapped as wetland in field reconnaissance report by Benassi (1995). [See also BG&E (1997)].
PFO1C	Palustrine - Forested - Broad-Leaved Deciduous - Seasonally Flooded	Riparian zone of lower portions on Johns Cr and its tributaries onsite. Recognized from onsite reconnaissance as wetlands characterized by red maple (*Acer rubrum*) – sweet gum (*Liquidambar styraciflua*) dominants in overstory and such herbaceous species as rice cut grass (*Leersia oryzoides*), false nettle (*Boehmeria cylindrical*) and sensitive fern (*Onoclea sensibilis*) in the ground layer (Benassi 1995; BG&E 1997).
PSS1E	Palustrine - Scrub-Shrub - Broad-Leaved Deciduous - Seasonally Flooded/Saturated	Two very small (< 1 acre) areas, one along Johns Cr tributary leading from south end of Lake Davies fill area, one along the same ravine and immediately downgradient of the 3-acre Camp Conoy “fishing pond” impoundment.
PEM1E	Palustrine - Emergent - Broad-Leaved Deciduous - Seasonally Flooded/Saturated	Two very small (approx. 1 acre) areas, one along Johns Cr mainstem, one along Johns Cr tributary leading from south end of Lake Davies fill area.
PEM1FH	Palustrine - Emergent - Broad-Leaved Deciduous - Semipermanently/ Permanently Flooded	Small area (2-3 acres) at south end of Lake Davies fill area. Recognized from field reconnaissance as onsite wetland type (emergent wetland associated with spoil areas, typically dominated by common reed grass; i.e., *Phragmites australis*), but not mapped, by Benassi (1995).

Class Code[a]	Classification Description[a]	Location and Remarks[b]
PUBFX	Palustrine - Unconsolidated Bottom - Semipermanently Flooded – Excavated	One very small (approx. 1 acre) area at south end of Lake Davies fill area.
PUBHH	Palustrine - Unconsolidated Bottom - Permanently Flooded – Impoundment	Four small impoundments in swales/ravines of small Chesapeake Bay tributaries in and near Camp Conoy. The largest (approx. 3 acres) is part of the Camp Conoy recreational facility (fishing pond). Two additional ones, both ≤ approx. 1 acre and located on the same ravine as the above fishing pond The fishing pond and upstream-most water impoundment pond were mapped by Benassi (1995) and characterized as supporting some floating and emergent vegetation along the banks. A seep associated with one of the ponds in the Camp Conoy area was noted by Benassi (1995) as dominated by rushes (*Juncus sp*.), sedges (*Carex sp*.), and sphagnum moss (*Sphagnum sp*.), and supported the bladderwort *Utricularia gibba*, formerly considered rare (but not threatened or endangered) in MD. The fourth impoundment, located in another ravine from the previous three, between Camp Conoy and existing plant facilities, is a CCNPP stormwater control facility.
PUBFX	Palustrine – Unconsolidated Bottom – Semipermanently Flooded – Excavated	One small stormwater basin adjacent to switchyard.
Not mapped	Not mapped	Small (1 acre) wetland mitigation area located adjacent to and southwest of 500-kV transmission corridor between Main Access Road and Site Road B on previously cultivated land.

a Source: Cowardin et al. 1979
b Sources: USFWS (1990), Benassi (1995), BG&E (1995, 1997)

Figure H.2-1
National Wetland Inventory Map for CCNPP Site (USFWS 1990)



H.3 Chesapeake Bay Ecological Resources

As a result of extensive environmental review associated with operating license renewal, the NRC (1999) concluded that potential adverse impacts of continued operation of CCNPP Units 1 and 2 on the Chesapeake Bay and associated ecological resources, including fish and shellfish impingement, entrainment, and thermal shock would be small. The existing plant employs a once-through cooling system that withdraws approximately 2.4 million gallons per minute (gpm) of cooling water from the bay through a shoreline intake structure and discharges it back to the bay at a temperature of up to approximately 12ºF above ambient temperature via conduits that terminate approximately 850 feet offshore at about the 10 foot depth contour (BG&E 1997, NRC 1999). A determination of corresponding adverse impacts that may result from use of a once-through cooling water system for a 2-unit plant addition at the CCNPP site is beyond the scope or need of this study. As indicated elsewhere in this report, extensive study, including detailed and lengthy field studies, would be required to acceptably demonstrate the level of impact and compliance with applicable regulatory standards. Therefore, the following discussion with respect to cooling water system impacts is limited to potential construction and operational impacts on ecological resources of the bay associated with use of a closed-cycle cooling system for the new units, particularly as related to location of the intake and discharge structures. Potential impacts on Chesapeake Bay ecological resources from dredging associated with Barge Slip and approach channel upgrade, presumed to be necessary regardless of site layout and cooling water options, are also noted.

As discussed elsewhere in this report, use of a closed-cycle cooling water system for a 2-unit EPR plant addition at the CCNPP site would result in a cooling water intake of approximately 80,000 gpm and discharge of approximately 40,000 gpm. Although the discharge temperature would be higher for the new units, these cooling water flows are less than 5 percent of cooling water flows for the existing plant. Given this information and assuming appropriate dispersion of the heated cooling water discharge, it is reasonable to assume at this level of analysis that adverse impact on Chesapeake Bay ecological resources from cooling system operation for the two additional postulated units would be small, absent the presence of an exceptionally high-value resource in the field of influence of the intake and discharge. At this level of analysis, it is also likely that potential impacts of cooling water intake and discharge construction would be small, absent the presence of an exceptionally high-value resource in areas disturbed by construction or preempted by location of permanent structures. A similar conclusion is assumed at this stage with respect to dredging and construction that may be required for upgrade of the Barge Slip and its approach channel, considering the nature and likely limited extent of these activities.

A review of ecological survey and monitoring reports (Heck, K.L, ed. 1985) and other assessments related to CCNPP construction and operation (e.g., AEC 1973; NRC 1999, Section 2.2.5) indicates that oyster beds are likely the only habitat or resource known to occur in the area that may be of interest in this regard. The potential presence in the

CCNPP area of "essential fish habitat" (EFH) and associated "habitats of particular concern" (HAPCs) designated under the Magnuson-Stevens Act is also of interest because these designations are recent and are particularly applicable to the siting of new facilities. The following subsections therefore focus on the potential presence of these resources in the vicinity of CCNPP.

H.3.1 Eastern Oyster (*Crassostrea virginica*) Beds

Dredging of the cooling water intake channel and navigation channel to the CCNPP Barge Slip as part of initial CCNPP plant construction affected 500 acres of the 680-acre Flag Pond oyster bar immediately offshore of the plant, mitigation for which involved transplantation of oysters to a site on the nearby Patuxent River (AEC 1973). Long-term preoperational and operational studies indicate that oyster bars existed and to some extent persist south of the intake and within the discharge area (Heck, K.L, ed. 1985). The area north of the plant consists of bay bottom that is shifting sand or soft mud and unsuitable for oysters (ANSP, 1968). Areas with beds south of the plant are rocky, making commercial harvest difficult.

Neither the current areal extent nor condition of the existing oyster beds are known, although their condition and productivity likely reflects declines observed bay-wide in recent years due to deleterious changes in habitat resulting from nutrient addition, disease, etc., evidenced further from the fact that little or no commercial harvesting occurs there now. Ongoing monitoring studies indicate that operation of CCNPP has had no adverse impact on oysters (ANSP 1985, Abbe 1988, 1992). These studies further indicate that, while oysters are a Resident Important Species (RIS), populations in and around CCNPP are seriously diminished because of the bay-wide disease problem. The soft Clam, *Mya arenaria* is also an RIS, but its abundance of legal sized clams has not been high enough to support a commercial fishery in this are since before 1971 (NRC 1999, Section 2.2.5).

Considering the information presented above, it is expected that modification and use of the existing CCNPP cooling water intake and/or discharge structures to accommodate the new units offers little or no potential for adverse impact on oyster beds.

A definitive assessment of potential for adverse impact on oyster beds from construction and operation of new cooling water facilities and upgrade of the Barge Slip would require field studies to identify, map, and assess the condition of any oyster beds that may exist in potentially affected areas. However, based on currently known information, there is no reason to expect that these impacts would be considered significant, considering also that mitigation could be applied if needed. Based on information presented above, an offshore cooling water intake and/or discharge located south of existing plant facilities offers greater potential for adverse impact than the north location option due to the known presence of oyster beds south of existing plant facilities.

H.3.2 Essential Fish Habitat

EFH is defined under the Magnuson-Stevens Fishery Conservation Management Act (16 USC §§ 1801 to 1883), as amended by the Sustainable Fisheries Act (SFA) of 1996, as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." "Waters" include aquatic areas and their physical, chemical and biological properties that are used by fish. "Substrate" includes sediment, hard bottom, structures, and associated biological communities that are under the water column. Waters and substrates necessary for fish spawning, breeding, feeding or growth to maturity—covering all stages within the life cycle of a particular species—refers to those habitats required to support a sustainable fishery and a particular species' contribution to a healthy ecosystem (50 Code of Federal Regulations (CFR) 600.10). [See also National Marine Fisheries Service (NMFS) 2006a.]

Section 303(a)(7) of the Magnuson-Stevens Act requires that the eight Regional Fishery Management Councils (RFMC) describe and identify EFH for each federally managed species, and minimize adverse impacts from fishing activities on EFH. Section 305(b)(2)-(4) of the Magnuson-Stevens Act outlines the process for providing the National Marine Fisheries Service (NMFS) within the National Oceanic and Atmospheric Administration (NOAA), and the RFMC with the opportunity to comment on activities proposed by federal agencies that have the potential to adversely impact EFH areas. Federal agencies are required to consult with NMFS (using existing consultation processes for NEPA, the Endangered Species Act, or the Fish and Wildlife Coordination Act) on any action that they authorize, fund, or undertake that may adversely impact EFH. This requirement is therefore applicable to the NRC in connection with issuing a COL for a new nuclear plant.

Adverse effects to EFH, as defined in 50 CFR 600.910(A), include any impact that reduces the quality and/or quantity of EFH. Adverse effects may include:

- Direct impacts such as physical disruption or the release of contaminants;
- Indirect impacts such as the loss of prey or reduction in the fecundity (number of offspring produced) of a managed species; and
- Site-specific or habitat-wide impacts that may include individual, cumulative or synergetic consequences of a federal action.

An EFH assessment of a federal action that may adversely affect EFH must contain:

- A description of the proposed project;

- An analysis of the effects, including cumulative, on EFH, the managed species and associated species such as major prey species, and the life history stages that may be affected;
- The agency's conclusions regarding the effects of the action on EFH; and
- Proposed mitigation if applicable (50 CFR 600.920(g)).

NOAA, National Marine Fisheries Service (NMFS 2006b) has compiled a summary of EFH Designations for the Chesapeake Bay mainstem for Maryland/Virginia. If those species designated as being restricted to seawater (>25 ppt) are eliminated from further consideration, the mainstem portion of the Bay which includes the Calvert Cliffs area may serve as EFH for a total of twelve species, listed in the following table:

Table H.3.2-1

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
windowpane flounder (Scopthalmus aquosus)			X	X	
bluefish (Pomatomus saltatrix)			X	X	
Atlantic butterfish (Peprilus triacanthus)	X	X	X	X	
summer flounder (Paralicthys dentatus)		X	X	X	
black sea bass (Centropristus striata)			X	X	
king mackerel (Scomberomorus cavalla)	X	X	X	X	
Spanish mackerel (Scomberomorus maculatus)	X	X	X	X	
cobia (Rachycentron canadum)	X	X	X	X	
red drum (Sciaenops occelatus)	X	X	X	X	
clearnose skate (Raja eglanteria)			X	X	
little skate (Leucoraja erinacea)			X	X	
winter skate (Leucoraja ocellata)			X	X	

However, not all of the species and life stages identified in the table would be expected to occur in the vicinity of CCNP. For example, Spanish and king mackerel early life stages are generally found offshore and would not normally be found in the mesohaline (5 to 18 ppt) portion of the Chesapeake Bay.

HAPCs are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation (NMFS 2006c). RFMCs may designate a specific habitat area as an HAPC based on one or more of the following reasons:

- Importance of the ecological function provided by the habitat
- Extent to which the habitat is sensitive to human-induced environmental degradation
- Whether, and to what extent, development activities are, or will be, stressing the habitat type
- Rarity of the habitat type

The HAPC designation does not confer additional protection or restrictions on an area, but can help prioritize conservation efforts. Healthy populations of fish require not only the relatively small habitats identified as HAPCs, but also other areas that provide suitable habitat functions. The only known HAPCs designated for the Chesapeake Bay determined from the present review are for the following two species (Dobrzynski and Johnson 2001):

- Summer Flounder (larvae and juveniles) – submerged aquatic vegetation (SAV) and macroalgae beds in nursery habitats.
- Sandbar Shark – lower Chesapeake Bay

It does not appear at this stage of analysis that HAPCs for these two species exist near CCNPP. CCNPP is located remote from the lower bay and field surveys suggest that there are no appreciable SAV beds known to occur in the CCNPP vicinity (Orth and Nowak 1990)

The distribution and life history characteristics, status of the fishery, and impacts of the proposed action on these species, life stages, and their habitats would be addressed in an EFH assessment report, which would be prepared as part of the federal permitting procedures associated with licensing of the new units, placement of in-water structures, or activities that involve dredge and fill. Efforts to avoid, minimize, and mitigate impacts would be presented in the assessment report, as needed. While it is not anticipated that the actions being contemplated under any of the closed-cycle cooling scenarios would result in a significant adverse impacts to EFH, this conclusion would need to be demonstrated through the EFH evaluation process.

H.4 Coastal Zone Consistency

Maryland's Coastal Zone Management Program (CZMP) was developed pursuant to the Federal Coastal Zone Management Act of 1972, as amended. The program was approved by the U.S. Department of Commerce, National Oceanic Atmospheric Administration, in August 1979. Section 307 of the Act requires that federal activities, including federal licenses and permits, be consistent with a state's federally approved CZMP. Applicants for federal licenses and permits are required to certify that the proposed activity is consistent with a state's CZMP. Calvert Cliffs is located within Maryland's Coastal Zone.

Most federal licenses/permits are issued without a separate coastal zone review process as they are deemed to have no impact (i.e., maintenance dredging, sheet pile replacement). However, projects like the Cove Point Expansion and the ongoing work at the Woodrow Wilson Bridge have required a consistency review. A new unit at Calvert Cliffs will require a review. With the current units being tucked into the cliffs and with the lack of cooling towers, the site is somewhat passive. Additional units, particularly those with cooling towers, will be somewhat controversial from a consistency standpoint.

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Appendix I

Cultural Sites

I.1 Cultural Sites

While a systematic cultural resources field survey of the Calvert Cliffs Property has not been performed, several historic period sites have been identified. These historic properties include the following:

The Calvert Cliffs Plant itself which has been recorded as a historical property in the Maryland Historical Trust Survey, including a written statement covering its historical and architectural importance.

To the North

Preston's Cliffs; Wilson Place – Recorded in the State listings as a historic site in 1967 and later as an archaeological site in 1973. The remnants of this farm are visible today as the location of the Visitors Center and Nature Trail. The farm site consists of the foundation and fireplace chimneys of a house, dating to 1691, which was destroyed in 1972 because of its deteriorated condition, a standing log barn, noted as the oldest of its kind still standing in the state (built in 1820) and a modified frame tobacco barn, original construction 1820-1840, that now serves as the Visitors Center and museum. There is one other standing tobacco barn in this general area that has not been evaluated for its historical significance.

To the South

Camp Canoy – Dating to the early 1930's, this site, a former Boy Scout Camp, has two remaining log cabins and a larger log structure. These buildings have been used by the plant for meetings and storage. From a historic perspective, this site and that of a cemetery located at the end of Road M-1 are unrecorded and unevaluated. Upon site investigation of the cemetery, the three headstones have been removed. This area was identified and roped off by Constellation Energy.

To the West

Parran's Park – This site consisted of a historic farmstead that included a clapboard house, original construction about 1750, that burned in 1955 and other farm outbuildings. Part of an original tobacco barn dating to 1840-1860 still exists as part of a reconstructed building and used today as a farm and maintenance center. There are two other tobacco barns nearby that have not been evaluated for their historical significance.

There are no known or recorded prehistoric archeological sites at Calvert Cliffs, although, with the exception of a study in 1992 on a transmission right-of-way, records could not be located to indicate that any field surveys had been undertaken to identify such resources. With numerous important archaeological sites in close proximity to Calvert Cliffs, it is possible that undetected or buried archaeological sites exist within the property lines.

Although the Maryland Historical Trust evaluated two historic properties on the site in 1971, they were found to be in too great a deteriorated condition to be included on the National Register. At present, none of the historical sites mentioned above are listed on the National Register.

Under Section 106 of the National Historic Preservation Act of 1966, the licensing of a new unit will require that we initiate historical and cultural resource consultations with the appropriate agencies. Accordingly, phase I field studies should be anticipated as well as mitigation that could include avoidance or in some cases the relocation of items with historic significance. Both north and south locations have structures that will need further evaluation and we should recognize that structures like the visitors center, standing tobacco barns and cemetery will receive much scrutiny.

During 1992 and 1993, archeological surveys were conducted along a proposed new transmission line right-of-way, Calvert Cliffs to Chalk Point. As a result, two archeological sites were examined during preconstruction surveys. One site was found to retain sufficient subsurface integrity to be considered eligible for inclusion on the National Register of Historic Places; however, the historic and prehistoric artifacts found did not provide unique information and the sites were dropped from further consideration. . The impact areas of the right-of-way were evaluated extensively, and the transmission towers were located in areas that would not affect any intact subsurface artifacts.

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Appendix J

Site Selection Team Biography

David W. Murphy, Bechtel
Siting Team Lead

Mr. Murphy has over 20 years of engineering experience with nuclear power generation facilities. His experience ranges from operating nuclear plant services to the recovery of shutdown nuclear plants and to the development of new nuclear generation. He has supervised projects of varying size including projects of in excess of 800,000 man-hours for mechanical / nuclear engineering. Mr. Murphy has a BS degree in nuclear engineering from University of Maryland and is a Registered Professional Engineer in Maryland. He is an ANS member and has previously served as committee chair for ANSI 51.10.

Thomas Roberts, UNISTAR Nuclear

Thomas Roberts has over 33 years of engineering, construction and operating experience with nuclear power generation facilities. His experience ranges from engineering and construction of new nuclear power plants to support of day to day operations and maintenance of operating nuclear plants. Mr. Roberts has hands on operating experience at various nuclear and fossil power plants. He has managed projects of varying size including projects requiring coordination with federal, state and multiple utility interfaces. Mr. Roberts has a Plant Manager Certification Mr. Roberts has a BS degree in Civil Structural engineering and a minor in Environmental engineering from University of Rhode Island. Mr. Roberts has been a registered Professional Engineer in Maryland and Florida.

Gregory C. DeCamp, CHMM
UniStar Environmental Lead
Constellation Energy

Mr. DeCamp has over 30 years as an environmental consultant to industry and government, particularly electric utilities (nuclear, fossil-fueled, hydroelectric generating stations and associated high-voltage transmission facilities) and U.S. Department of Energy (DOE) projects and operations. He has managed and conducted numerous environmental projects involving facility siting and routing, permitting, design and operations consultation; ecological baseline studies and monitoring; impact assessment; National Environmental Policy Act (NEPA) document preparation; compliance program development; auditing; and facility closure and remediation plan development. Recent professional activities include service as technical manager or section lead for development of environmental reports to the U.S. Nuclear Regulatory Commission (NRC) in support of operating license renewal for seven nuclear power stations. Mr. DeCamp's academic credentials include a B.S. in chemistry from Xavier University (Ohio) and a Masters degree in biology (concentration in ecology) from Bowling Green State University (Ohio).

Mark T. Hunter, UniStar Site Lead

Mr. Hunter has over 34 years of Operations and Maintenance experience with nuclear power generation facilities. His experience ranges from operating nuclear plant services to the recovery of shutdown nuclear plants and to the development of new nuclear generation. He has obtained a Senior Reactor Operating License at the proposed site and has worked in various organizations through out his 29 years at this site.

Kenneth S. Johnson, P.E., Q.E.P.
Manager - Environmental Services, Constellation Generation Group
Fleet Optimization

Kenneth S. Johnson is the Manager of Environmental Services for the Constellation Generation Group (CGG). In this role, Mr. Johnson has overall responsibility and accountable for the performance of leadership duties associated with environmentally sound operation of CGG's fleet of assets (Nuclear, Fossil, etc.). Consequently, he is responsible to maintain, manage and monitor the technical strategic focus and corporate responsibilities as related to environmental issues and risks across the complete energy generation mix, and directly responsible for overall development and implementation of strategic plans and actions in providing high quality and timely environmental technical support to individual and collective CGG merchant plant assets. In addition, as environmental Manager, Mr. Johnson is one of the company's primary interfaces with local, state, federal regulatory agencies and other non-governmental environmental stakeholders.

Mr. Johnson attended Clemson University where he received a Bachelor of Science degree in Civil Engineering and a Masters degree in Environmental Systems Engineering. He is a registered professional engineer (PE) and certified as a qualified environmental professional (QEP). In addition, Mr. Johnson has authored or co-authored numerous publications on environmental issues for the energy industry.

Carla M. Logan, Constellation Generation Group
Environmental Specialist

Ms. Logan has over 25 years of experience in a broad range of environmental issues associated with utilities including nuclear power generation facilities and other industries. Her experience includes managing aquatic toxicology studies, remedial investigations, Constellation's liability at Superfund and other contaminated sites, and conducting environmental due diligence for potential acquisition projects. She is currently the fleet-wide project manager for Constellation Energy's compliance with Clean Water Act Section 316(b) and serves on the Technical Committee for the Kane and Lombard Superfund Site in Baltimore. Ms. Logan has a BA degree in Biological Sciences from University of Delaware. She is a member of the Society of Environmental Toxicology and Chemistry, Johns Hopkins University Part-time Programs Science Advisory Board, and the Society of Risk Analysis.

James F. Burkman, Environmental Scientist, Constellation Generation Group

Mr. Burkman has over 13 years of environmental experience related to the electric utility industry. During that time, he has been directly involved in land use permitting for Constellation Energy's Fossil and Nuclear Fleet. In addition, he contributed to various sections of the Environmental Report for the Nine Mile Point license renewal.

Brenda D. Nuse, Calvert Cliffs Nuclear Power Plant

Ms. Nuse has over 25 years of experience at the Calvert Cliffs Nuclear Plant. During this time her work has included environmental sampling, analysis, data analysis, preparation of environmental reports and permitting. Ms Nuse participated as a site environmental expert in the license renewal project. Her areas of expertise include water, wastewater, wildlife and natural resources. She is the site project lead for 316(b) programs. Ms. Nuse has a BS degree in Biology from St. Mary's College of Maryland.

Douglas Heimbuch, Ph.D., Technical Director at AKRF

Mr. Heimbuch is an environmental scientist with two decades of experience in natural resources, and is an acknowledged expert in the fields of fishery science and biostatistics. He is also experienced in the study of population dynamics, statistical analysis of environmental data, development of environmental sampling designs, estimation of parameters of animal populations, and assessment of effects of power plant operations on fish populations. He has published numerous articles on fish, water quality, and related issues for academic peer review journals. Dr. Heimbuch has analyzed the effects of entrainment and impingement on fish populations for several power plant projects, including the 316(b) Demonstration for the PSEG Salem plant, the mid-Hudson River Power Plants, and studies sponsored by NYPA to assess fish abundance and distribution in waterbodies surrounding New York City. He has evaluated the effectiveness of mitigation measures implemented to address 316(b) issues and has worked with resource economists to link the results from his analyses of fisheries data to information on the recreational and commercial value of fish as part of cost-benefit analyses.

J Howard Hixson III, Biomonitoring Program Manager, Morgan State University-Estuarine Research Center

Mr. Hixson has over 33 years experience in the monitoring of power plant effects on the environment. He spent 24 years at the Calvert Cliffs Nuclear Power Plant monitoring effects on the surrounding waters. His experience ranges from designing studies to working with plant engineers and operators developing procedures to minimize effects and preventing situations adverse to plant operations. He has worked in a wide range of disciplines, from phytoplankton and fish egg and larvae identification to feeding habits and movements of finfish. Mr. Hixson has a BS in Biology from St. Mary's College of Maryland. He has authored or co-authored over 20 reports or publications relating to biomonitoring and environmental impacts.

Edward P. Taft, Alden Research Laboratory
Reviewer

E.P. Taft is President and CEO of Alden Research Laboratory, an international consulting engineering laboratory providing a wide variety of services for electric power utilities, architect-engineering firms, equipment manufacturers, and governmental agencies. Mr. Taft is also responsible for Alden's environmental services, primarily fisheries issues at water projects. He is a recognized expert in this area and has overall responsibility for all Alden services in fish protection and passage. Mr. Taft provides overall technical and managerial guidance to a team of fisheries biologists and engineers, and personally participates on projects. With his extensive experience, Mr. Taft is often called upon to participate in legal proceedings as an expert. He provided extensive comments to the Electric Power Research Institute and the Utility Water Act Group on technical aspects of EPA's new 316(b) Rule during the rulemaking process. He participated in the NPDES Permit Hearings on the design of intake structures for minimizing losses of aquatic organisms at three Hudson River power plants in the late 1970s. He is currently involved in upcoming NPDES hearings for a nuclear power plant in Connecticut and a large coal-fired plant in Wisconsin.

C. Barry Knisley,
Siting Team Member, Environmental Group

Dr. Knisley (B.S. Penn State, M.S, Ph.D. Rutgers) is Wornom Professor of Biology at Randolph-Macon College. He is an entomologist and ecologist with over 30 years of experience studying tiger beetle ecology and conservation, including research with the Northeastern Beach and Puritan Tiger Beetles since 1985. He has authored or co-authored two books and over 40 journal articles on tiger beetles. Dr. Knisley has been the lead researcher on most of the USFWS-listed U. S. tiger beetles and has collaborated with, advised, and conducted contract research for the USFWS, Bureau of Land Management, U.S. Army Corps of Engineers, National Park Service, various state agencies, and environmental firms.

David E. Bailey, Consultant on Cooling Water Use from an Environmental and Regulatory Perspective

Mr. Bailey has over 25 years of environmental experience related to electric utility industry surface and groundwater use and impacts. This includes over 23 years of experience working for Potomac Electric Power Company as their lead water expert. Mr. Bailey has been directly involved in licensing of new generation in Maryland as well as managing acquisition and renewal of water appropriation and discharge permits for generating stations and ash storage sites. Mr. Bailey served in a leadership role in negotiating the new 316(b) Rule with EPA on behalf of the industry. This Rule establishes new requirements for protection of fish and shellfish affected by cooling water intake structures. Mr. Bailey has been working for EPRI Solutions for over two years to provide 316(b) compliance support services for both existing and new electric generation facilities.

Shankar Rao, Bechtel
Engineering Group Supervisor

Mr. Rao is a Senior Mechanical Engineer with over 25 years of engineering experience associated with Power Plant Systems design, procurement, construction and commissioning support. He is currently providing support for early site permitting for a new nuclear power plant. His recent experience includes design, construction and commissioning of the balance of plant (BOP) for Qinshan Nuclear plant in China which is a CANDU reactor designed by AECL of Canada. Past experience includes Appendix R fire protection safe shutdown evaluation, Auxiliary Feedwater system design and analyses, HVAC and chilled water system design. Mr. Rao has a B.S. in Mechanical Engineering and is a Registered Professional Engineer in Maryland.

Clinton P. Lamerson, Construction Team Member

Mr. Lamerson has 40 years construction experience. As a Construction Manager, New Generation Nuclear his experience ranges from construction field engineering, supervision, and site management of PWR and BWR nuclear power stations, fossil power stations, nuclear operating plant services, and power project development. He is responsible for construction input to Early Site Permit applications and combined Construction and Operating License applications. He is also responsible for the development of construction execution plans, construction methods, schedules, and cost estimates.

Chuck Dicey, Plant Design Engineering Supervisor

Mr. Dicey has over 37 years in the design, engineering, construction support, operation of nuclear and fossil power plants. His experience includes new power plant designs (nuclear and fossil), plant upgrades and modifications, power uprate modifications, detailed designs for piping designs and modifications, pipe support details, equipment locations, space allocations, configuration control, and HVAC duct design and modifications. Mr. Dicey has a diploma in mechanical drafting from Fayette Institute of Commerce and Technology. He is also certified as a Six Sigma Yellow Belt (Six Sigma Qualtec/Bechtel).

Yifan Zheng, P.E. - Bechtel

Sr. Engineering Specialist – Hydraulics & Hydrology

Mr. Zheng has over 15 years of engineering experience with Bechtel providing engineering supports for both fossil and nuclear power generation facilities. His experiences are mostly related to the hydraulics and hydrology design, evaluation, and calculations. For nuclear power plant facilities, his experience includes performing engineering analysis for the plant cooling water system, design of hydraulic structures such as pump intake, outfall, and coastal structures, conduct site adequacy assessment, evaluate clean water act 316a and 316b compliance, and participate in the Early Site Permit study for new nuclear generation units. He has been a lead hydraulic engineering specialist for numerous Bechtel power projects in his field. Mr. Zheng has a MS degree in civil engineering from the University of Minnesota – Twin Cities, and is a Registered Professional Engineer in Maryland. He is a member of ASCE, ASME and AWWA, and he also holds the position of the Secretary of the Hydraulic Structure Technical Committee for ASCE.

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Appendix K

Bibliography

The bibliography of the CCNPP Units 3 and 4 siting study is presented here. The items in the bibliography correspond to the sections and Appendices of the study.

Section 2.0

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Section 3.0

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