UN#13-011

Enclosure

Calvert Cliffs Nuclear Power Plant Unit 3,
Tidal Mitigation Plan
January 2013

Calvert Cliffs Nuclear Power Plant Unit 3

Tidal Mitigation Plan

Prepared for:
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Acronym List

AEZ	Aquaculture Enterprise Zone
ASMFC	Atlantic States Marine Fisheries Commission
B-IBI	Benthic Index of Biotic Integrity
CBP	Chesapeake Bay Program
CCNPP	Calvert Cliffs Nuclear Power Plant
CCSCP	Calvert County Soil Conservation District
HEC-23	Hydraulic Engineering Center, Publication 23
MDE	Maryland Department of the Environment
MGS	Maryland Geological Survey
NOB	Natural Oyster Bar
SAV	Submerged Aquatic Vegetation
SWH	Shallow Water Habitat
UniStar	UniStar Nuclear Energy, LLC
USACE	United States Army Corps of Engineers

1. Introduction

UniStar Nuclear Energy, LLC (UniStar), on behalf of its subsidiary Calvert Cliffs 3 Nuclear Project, LLC, has proposed construction of a new nuclear power plant (Unit 3) at the project site known as the Calvert Cliffs Nuclear Power Plant (CCNPP). The site is located in the Lusby area of Calvert County, Maryland, along the shoreline of the Chesapeake Bay, about 45 miles southeast of Washington D.C. (Figure 1). Unit 3 has been proposed to provide additional energy service to meet the growing regional demand. Development of Unit 3 would include several actions within the adjacent waters of the Chesapeake Bay to support the proposed unit. These activities are: restoration of and upgrades to an existing barge slip, installation of a discharge pipe and fish return for the new Unit, and modification of the existing intake area. A joint permit application has been submitted to the U.S. Army Corps of Engineers (USACE) and Maryland Department of the Environment (MDE) that describes the proposed actions and identifies the in-water impacts of the project. The total in-water impact area is 5.7 acres. Of this, 4.5 acres is dredging for the barge slip. The remaining 1.2 acres of impact are associated with the installation of the discharge pipe and fish return and modification of the intake area.

USACE has indicated that it will require mitigation to offset impacts to 4.5 acres of dredging impact on Flag Pond Oyster Bar as a condition of the 404 permit. NOAA – Fisheries Service (formerly National Marine Fisheries Service) has suggested that mitigation be completed in the form of at least 4.5 acres of restoration or enhancement of benthic habitat to improve foraging habitat for fish species. NOAA – Fisheries Service has also expressed a preference that this habitat restoration occurs on a degraded area of an oyster bar. This mitigation plan has been prepared following the USACE 2008 Final Mitigation Plan Rule to the extent possible considering the uniqueness of the project.

1.1 Objectives

The objective of this mitigation project is to offset impacts associated with 4.5 acres of dredging as part of the Unit 3 Project at CCNPP. Coordination with USACE – Baltimore District and NOAA – Fisheries Service has determined that a one to one mitigation ratio is required and the mitigation site is to sustain a one-foot depth of sand, rock, or stone substrate to create or improve foraging/prey habitat for fish species.

1.2 Site Selection

Coordination with NOAA – Fisheries Service has also determined that the mitigation site should have the following characteristics:

1. Depth greater than 6 feet and shallower than 20 feet
2. Located on delineated oyster bar
3. Located within an oyster bar that is not currently a functioning oyster bed
4. Consist of substrate not suitable for supporting prey species

These characteristics were identified in coordination with NOAA – Fisheries Service at the December 2010 meeting (Appendix A). The depth range of between 6 feet and 20 feet has been identified to avoid shallow water habitat (SWH) and potential submerged aquatic vegetation (SAV) beds while also avoiding depths that may be seasonally hypoxic/anoxic. While seasonal anoxia is not expected shallower than a depth of 25 feet, a maximum depth of 20 feet is proposed to ensure that the site and adjacent areas are not seasonally anoxic.

NOAA – Fisheries Service has specifically requested that the mitigation occur on an oyster bar. NOAA – Fisheries Service's preferred mitigation for this action is the restoration of habitat within the Flag Pond Oyster Bar, which is the historic oyster bar where the project impacts will occur. However, other sites would be acceptable if mitigation at Flag Pond Oyster Bar is determined not to be viable. To avoid impacts to productive oyster areas, the project will avoid functioning oyster beds. The mitigation site should also have degraded substrate, such as silts or hard packed clays.

Based on these requirements, UniStar has selected a potential site for the mitigation within the Patuxent River on Jacks Bay Bar (Figures 2 and 3). A site was not selected on Flag Pond Oyster Bar because of sediment movement on the Bar. The bottom type on Flag Pond Oyster Bar is highly variable from year to year and material is unlikely to stay in place on the Bar (Hixson 2011). The effects of currents and wind driven circulation in the shallow areas of the main body of the Chesapeake Bay are similar to those at Flag Pond Oyster Bar. Therefore, it was determined that probability of success is not great enough to site mitigation in the Bay proper. The site selection process is described in detail in Appendix B.

1.3 Site Protection Instrument

The USACE – Baltimore District has stated that it does not believe an easement or other site protection measure would be needed for this project which is located in waters under state jurisdiction (Francis 2012).

1.4 Determination of Credits

NOAA Fisheries Service and USACE – Baltimore District have agreed upon a mitigation ratio of one to one. The impacts requiring offset will occur over 4.5 acres of oyster bar and 4.5 acres of mitigation on an oyster bar are required.

2. Baseline Site Information

The tidal mitigation site for the Calvert Cliffs Unit 3 Project is located on Jacks Bay Bar within the Patuxent River (Figure 2). This site is located near, the Jacks Bay Aquaculture Enterprise Zone (AEZ) (Figure 2). The site is characterized by depths ranging from approximately 12 to 16 feet (Figure 3). A site specific bathymetric survey has not been conducted, but would be completed as part of final site design.

This site has been surveyed using side scan sonar by the Maryland Geological Survey (MGS) (2008-2011). Substrate in the selected mitigation site consists of mud and a mud/shell mix (Figure 4). Areas near the site have bottom types consisting of sand and a sand/shell mix.

The proposed mitigation site on Jacks Bay Bar includes MDNR benthic monitoring station 16215, which is a random sampling location (CBP 2011d). Sampling was completed at this station in September 2009. The B-IBI score for this location was 2, which is considered degraded and does not meet CBP's Benthic Community Restoration Goals. The substrate at this sampling station was 84 percent silts and clays.

Broader scale evaluation of the benthic communities of the Chesapeake Bay and its tributaries has been completed by the Chesapeake Bay Program (CBP). In 2007 and 2008, the lower Patuxent River achieved 21-40% of the CBP restoration goal (Hopkins 2008 and Weinburg 2009). In 2009, the lower Patuxent River achieved 0-20% of the CBP restoration goal (Weinburg 2010). In 2011, the lower Patuxent River achieved 15-25% of the CBP restoration goal (CBP 2011a). Benthic Index of Biotic Integrity (B-IBI) scores for sampling locations in the lower Patuxent River had scores of 2 or lower, signifying that the benthic communities present are severely degraded (CBP 2011b).

There are no site-specific data on dissolved oxygen to make a determination on seasonal variations of water quality at the bottom of the water column. Dissolved oxygen levels within the lower Patuxent River achieve target goals 0-50% of time during the summer period (CBP 2011c).

There are no oyster harvest data available for Jacks Bay Bar.

3. Mitigation Work Plan

3.1 Work Description, Design Methodology, and Specifications

This section describes the design methodology, construction methods, and performance specifications of restoration practices to restore 4.5 acres of hard bottom habitat.

3.1.1 Habitat Description

Ideally, the restoration design will seek to mimic the natural hard bottom habitats found in the Chesapeake Bay and adjacent to the site.

Hard bottom habitat can be composed of shellfish aggregations, dead and alive, as well as natural and man-made hard substrate. Hard bottomed habitat can include stable areas of sand, shell, gravel or stone. Shellfish bottom habitat provides hard substrate for the attachment of many species that would not be present in areas dominated by soft sediments or SAV [Atlantic States Marine Fisheries Commission (ASMFC 2007)]. The dominant shellfish hard-bottom substrate forming species in the Chesapeake Bay is the eastern oyster (*Crassostrea virginica*). Other shellfish species that can also be found in hard-bottom substrates include the estuarine wedge clam (*Rangia cuneata*) and Atlantic ribbed mussel (*Geukensia demissa*) (ASFMC 2007).

Shellfish and hard-substrate bottoms create complex habitats and are areas of high productivity in the Bay, sheltering species of fish, crustaceans, other bivalves, and numerous other invertebrates, birds, and mammals (ASMFC 2007). Invertebrates found in association with hard-bottom shellfish habitat in the Chesapeake Bay include the eastern oyster, Atlantic ribbed mussel, grass shrimp (*Palaemontes* spp.), hooked mussels (*Ischadium recurvum*), barnacles, and other macroinvertebrates such as grastropods, isopods, and polychaetes (ASMFC 2007 and Harwell et al 2010).

Hard-bottom habitats provide refuge, nursery, and habitat for fish, including juvenile and Maryland state protected fish. One or more life stages of each of the 22 ASMFC-managed species, or species groups, utilize shellfish habitat at some point in their life histories (ASMFC 2007). American eel (*Anguilla rostrata*), Atlantic croaker (*Micropongonias undulatus*), Atlantic herring (*Clupea harengus*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic sturgeon (*Acipenser oxyrinchus*), and red drum (*Sciaenops ocellatus*) are a few of the fish species that can be found in and around shellfish and oyster reefs at one point of their life stages. Many of these fish species are closely associated with shellfish habitat as juveniles or larvae and may prey on shellfish or associated species as adults. Other species, such as naked goby (*Gobiosoma bosc*), striped blenny (*Chasmodes bosquianus*), feather blenny (*Hypsoblennius hentz*), freckled belly (*H. ionthas*), skilletfish (*Gobiesox strumosus*), and oyster toadfish (*Opsanus taus*), are known to be resident species of oyster reefs (ASMFC 2007).

3.1.2 Methodology for Design

The methodology for this design draws upon the site selection constraints identified in Section 1.2, and the physical properties of the site bathymetry, currents, and existing bottom substrate. In addition to meeting the structural goals of substrate placement, methodologies are included to increase the habitat value of this substrate. The design methodologies include:

- **Substrate Thickness**. In order to assure continuous and consistent open water placement, a minimum of one foot depth of substrate is required.
- **Bottom Firmness.** In order to support the placement of hard bottom habitat substrates, the restoration site must be able to support the weight of those materials placed upon it. In order to allow this, submerged bearing capacity of the restoration site bottom sediment must be at least 200 pounds per square foot. This capacity should conservatively account for unit densities of stone materials of approximately 165 pounds per cubic foot. Buoyancy effects are ignored for this conservative estimate.
- **Existing Site Sedimentation.** The placement site should be in an area of impaired habitat which is not susceptible to significant shoaling, or deposition of fine sediments. This would negate the placement of those sediments, and the restoration area would quickly become a soft bottom habitat area. This is most easily identified through a study of bottom firmness as sites with loose sediment deposition are likely experiencing shoaling.
- **Tidal Currents.** There is a realistic expectation that any proposed restoration site would experience some deposition of fine grained sediments. Placement depths should be sufficient to protect hard bottom habitats from average daily wave attack shear forces, although storms may cause significant shear stresses at the bed to entrain fine sediments. The range of normal tidal currents, therefore, play the dominant role in maintaining hard bottom habitats through entraining fine sediments directly or through secondary shear stresses due to texture and flow obstructions. Upon completion of a tidal current study for the proposed restoration site, the magnitude of these currents can be determined for the purposes of analyzing sedimentation potential as well as stone substrate sizing.
- **Texture and Flow Diversity.** In order to provide diversity of habitat and flow, including back eddy areas and velocity constrictions, hard bottomed habitat substrate should be placed to have micro-topography and bottom relief. This includes natural mounding that would occur through placement by clamshell bucket, and intentional mounding. Much of this diversity can be provided randomly through the restoration area through the use of controlling the means and methods of placement, rather than creating a specific micro-topography grading plan. Additionally, the variation in existing bathymetry will aid in creating diversity of bottom habitats with varying depths.
- **Stone Substrate Composition.** As these habitats typically are home to a variety of shellfish, ideally the hard bottom habitat substrate would be calcareous stone. This would increase the availability of calcium in the habitat and aid in the production of shell mass as well as the stable bonding of shellfish to the substrate.

Stone Substrate Size. Hard bottom substrates themselves must be sized to resist motion and transport. Due to the nature of oyster dredging equipment, these materials must be no larger than 2 inches diameter. Typical applications of stone sizing based on tidal currents and applicable safety factors would come from pier and bulkhead armor protection equations developed by USACE in Hydraulic Engineering Center Publication 23 (HEC-23), Bridge Scour and Stream Instability Countermeasures. Substrate stone may be sized using HEC-23 methodology for riprap protection in obstructed flow circumstances. In the equation used at left, U is the design velocity, D is the design stone size median diameter, g is the gravitational constant, and S is the specific gravity of the stone utilized. K is a safety factor applied to the sizing equation to account for flow disturbances and other factors which may increase bed shear. Factors between 1.2 and 1.75 are typical for this application. Using this distribution of safety factors, an acceptable range of substrate stone size may be calculated.

$$D_{50} = \frac{0.692(KU)^2}{2g(S_S - 1)}$$

It is generally unrealistic to size substrate materials based on extreme storm events, wave attack, or propeller wash as these methods will yield large rock which is not representative of typical reference hard bottom habitats. Additionally, large stone would lack comparable success and cost effectiveness in meeting the project design goals as compared with smaller-sized materials. While events may occur and move substrate materials, the large expanse and amount of these materials provides for a maintenance of hard bottom habitat, although the absolute position of the habitat may change slightly over time.

The exact sizing of materials, position, placement, and bathymetry of the site remain to be determined, therefore no sizing of materials is presented. Tidal current observation, bathymetry, and bottom probing will be conducted as part of the design process. Specifications will be finalized based on those site specific data.

3.2 Geographic Boundaries

The boundaries of the mitigation area are shown on Figure 2 and are in accordance with the site selection criteria described in Section 1.2. These boundaries will be surveyed with GPS or other survey equipment to demarcate the as-built survey condition. Coordinates of the corners of the tidal mitigation site are shown in Table 1.

Table 1. Tidal Mitigation Site Coordinates

Vertex	Latitude	Longitude
North	38.424236	-76.588338
East	38.42346	-76.587065
South	38.422522	-76.587861
West	38.423224	-76.589197

3.3 Construction Methods, Timing, and Sequence

Construction of the mitigation project will not occur prior to authorization by regulating agencies or prior to confirmatory study of the bathymetry, bottom penetration, and tidal currents. A pilot project would be initiated with the start of upland work at the Calvert Cliffs Unit 3 site. This pilot project will be used to refine the design for the mitigation work, which will be initiated with the start of in-water work associated with the Unit 3 project. The pilot project would be conducted on two 100 foot by 100 foot plots within the proposed mitigation site. The pilot project will be monitored twice over a one year period. The first monitoring event will occur six months after placement of material or after a major storm event, whichever occurs first. The second monitoring event will be one year after placement of material.

It is anticipated that construction of the restoration area will occur via barge placement. Placement of substrate materials can occur through bottom dump or clam shell placement methods. It is anticipated that a combination of these placement methods can create the desired thickness and bed diversity desired to provide stable and diverse hard bottom habitat.

Barging of materials will most likely be based at the Calvert Cliffs Unit 3 site; however any materials loading facility for barge transport may serve as the landside base of construction operations.

Construction would be in accordance with the time-of-year restrictions identified in the authorization special provisions for this project. UniStar has coordinated with Roland Limpert and Michael Naylor of the Maryland Department of Natural Resources (MDNR) regarding time of year restrictions (Naylor 2013). Mr. Limpert stated that restrictions to be protective of anadromous fish would not be required (Limpert 2013). Mr. Naylor indicated that restrictions to be protective of oysters would be required. Oyster time-of-year restrictions are from 16 December through 14 March and 1 June through 30 September.

Construction of the mitigation project would occur in shallow areas at tide sufficient to allow access via barge, and work in a systematic fashion to avoid inconsistencies. Following construction of the initial one foot of placement, additional mounding or texturing may occur in order to meet the final design specifications. An as-built bathymetry, along with confirmation sampling verifying the correct depth of substrate over the project area would typically follow construction.

A general project schedule is listed below. The key schedule assumptions are:

- Studies to finalize mitigation project design including pilot studies will be initiated at the time that upland construction of the Unit 3 project begins; and
- Construction of the mitigation project will begin when in water construction associated with the Unit 3 project begins (approximately 2 years after upland construction starts).

Activity	Duration
Initiation of Upland Construction	Start of Mitigation Studies
Field Studies of Tidal Mitigation Site	3 months
Data Analysis/Pilot Project Design	3 months
Pilot Project Construction	3 months
Monitoring of Pilot Project	Two events within 1 year
Data Analysis/Design of Mitigation Project	3 months
Construction of Mitigation Project	3 months
Monitoring of Mitigation Project	5 years

3.4 Source of Water

The USACE 2008 Final Mitigation Rule requires source of water and water budget to be identified. This hard bottom habitat area will be submerged throughout the year, with typical bathymetry between 12 and 20 feet below mean lower low water.

In order to design substrate suitable for hard bottom habitat without significant transport, and to design habitat and roughness elements associated with the habitat, tidal current meters will be required to be deployed as part of the design validation phase for the selected site.

3.5 Methods for Establishing the Desired Plant Community

No planting plan is proposed for this habitat. This habitat is purposefully sited below the euphotic zone, and is not intended to support SAV. Additionally, the materials utilized for creating hard bottom habitat would not support SAV.

3.6 Plans to Control Invasive Species

No proposed invasive species control is proposed. As this is submerged habitat, control measures for invasive species are extremely limited. The aspects of long term management of the site are discussed in Sections 4.4 and 4.5.

3.7 Proposed Grading Plan

A typical placement section is provided for this tidal mitigation plan as Figure 5. The section describes one foot of placed hard bottom substrate over existing suitable bottom, augmented with larger stone for flow and habitat diversity.

Upon collection of detailed bathymetry for the proposed site, a proposed grading plan will be prepared detailing the size of stone, extents, and quantities of habitat restoration materials required.

3.8 Soil Management

The requirement of soil management is typically a provision that applies to the conditioning of site soils in order to foster vegetation or specific habitat types in wetland and stream mitigation. While not directly applicable to the requirements of hard bottom habitat, the placement of substrate sized to resist movement and the selection of the site in an area which is not subject to shoaling or significant deposition of fine sediments serves to meet the intent of the USACE 2008 Final Mitigation Plan as interpreted for this project.

3.9 Erosion Control Measures

This type of mitigation requires special measures for erosion and sediment control in comparison to landside activities. On November 16, 2012, Ron Babcock of the Calvert County Soil Conservation District (CCSCD) was contacted to provide basic requirements of a waterside erosion and sediment control plan. As placement of substrate would be from barges, no landside improvements are necessary other than those controls already permitted and typical to a barge loading facility. Two practices were identified for this project:

- **Washed Stone.** The placement of washed stone is required by CCSCD to limit the introduction of fine stone particles into the water column, reducing turbidity from placement activities.
- **Turbidity Curtain.** Turbidity curtain is required by CCSCD around the active placement area. This limits the transport of turbidity away from the placement site from re-suspension of fine bed materials, as well as from the placed substrate stone.

The approval of an erosion and sediment control plan by CCSCD is required to begin construction activities at the site. This requirement is typically a special provision of a 404 permit authorizing these activities.

4. Monitoring and Maintenance

4.1 Maintenance Plan

Ideally, no maintenance should be required to maintain this habitat. Hard bottom stone substrate should maintain itself provided sedimentation does not cover the stone, and provided that the bed continues to support the weight of the stone substrate. Minor adjustments may be required in the event of severe storms, oyster dredge activity, or other man-made impacts.

4.2 Performance Standards

Two basic performance criteria are proposed for the restoration. These include:

- Significant deposition of fine sediments should be limited to fine veneer sediment which is easily displaced by tidal flows or the benthos utilizing the habitat. Hard bottom should not be actively converting to soft bottom habitat.
- Hard bottom substrates should maintain their density, thickness, and distribution. Absolute position of the habitat may adjust slightly with storm events and disturbance relating to oyster dredging over time.

4.3 Monitoring Requirements

The monitoring period for this habitat will be established by special provision in the authorization for this activity. Typically, a 5-year monitoring period would be suitable to establish the presence, stability and distribution of hard bottom habitat. Annual monitoring by underwater inspection is planned.

4.4 Longterm Management Plan

UniStar will conduct a pilot project in order to determine the most successful placement methods, depth of material, and characteristics of placed material. The pilot projects will be monitored twice, once six months after construction or after a major storm event, and one year after construction. Information gained from these monitoring events will be used to develop an appropriate long-term management plan for the full mitigation project.

4.5 Adaptive Management Plan

In the event that hard bottom habitat does not maintain itself as demonstrated through the monitoring program, adaptive management practices may be required to adjust bed grade, amend substrate placement, or adjust substrate sizing. The adaptive management plan will be developed after monitoring of the pilot project is complete. Information gained from these monitoring events will be used to develop appropriate metrics for adaptive management for the full mitigation project.

4.6 Financial Assurances

Financial assurance requirements will be determined in consultation with the USACE-Baltimore District.

5. References

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FIGURES

Calvert Cliffs Unit 3 - Tidal Mitigation

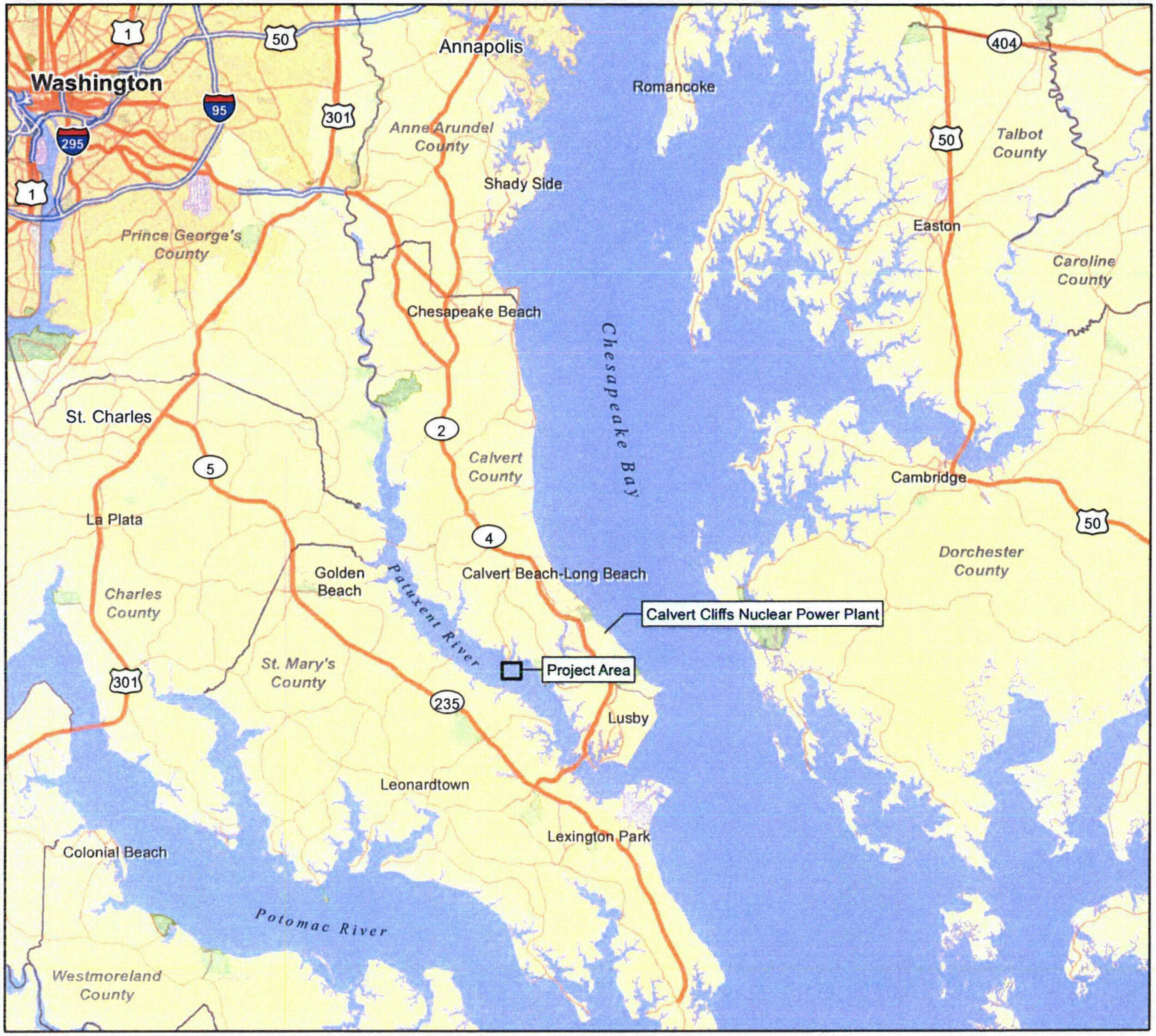

Figure 1

Tidal Mitigation Site - Location Map

0 5 10

Miles

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Calvert Cliffs Unit 3 - Tidal Mitigation

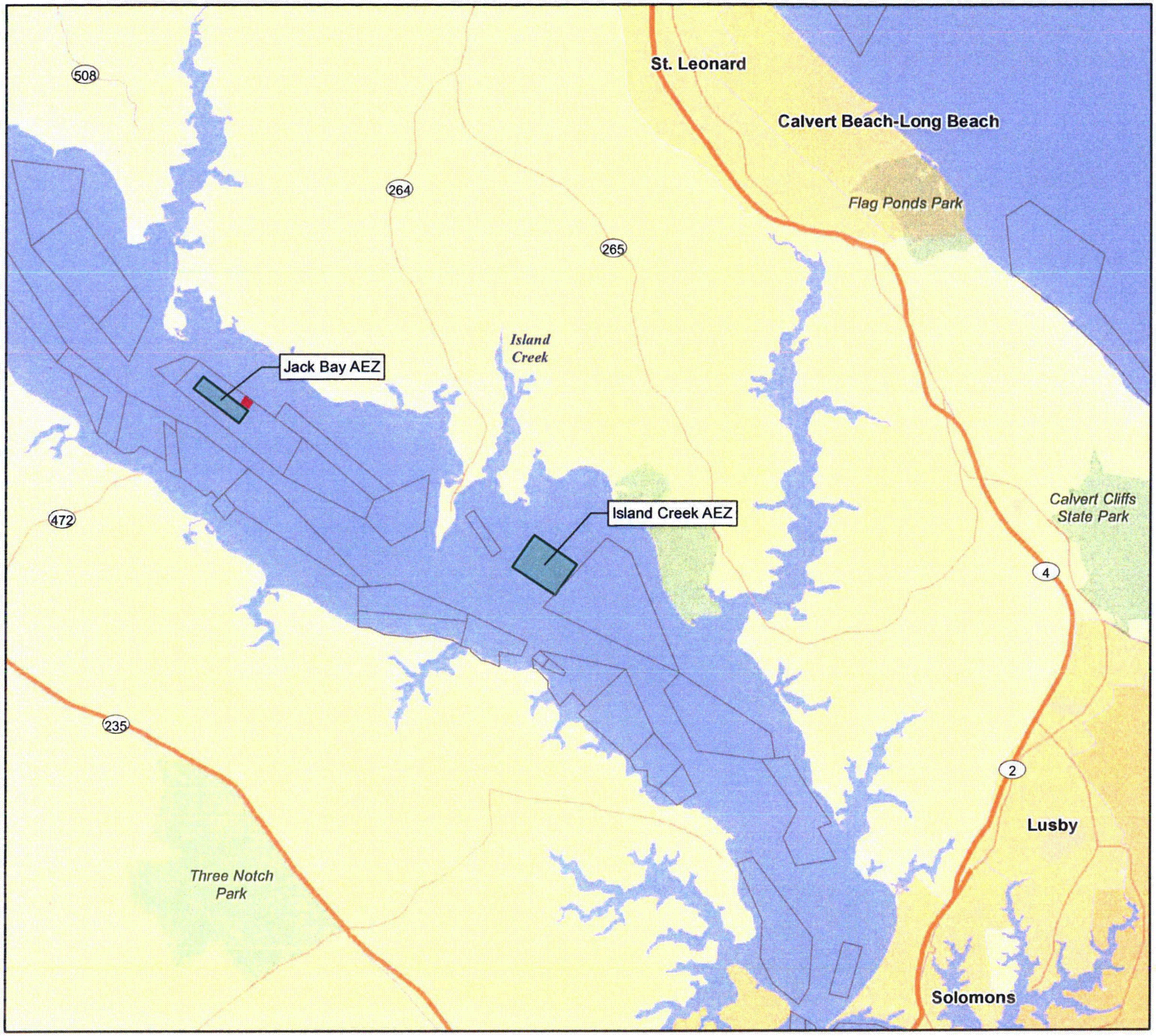

Figure 2

Tidal Mitigation Site - Oyster Bars in the Patuxent River

Legend

Aquaculture Enterprise Zone

Oyster Bars (Includes Historic Yates Bars)

Tidal Mitigation Site

0 1 2

Miles

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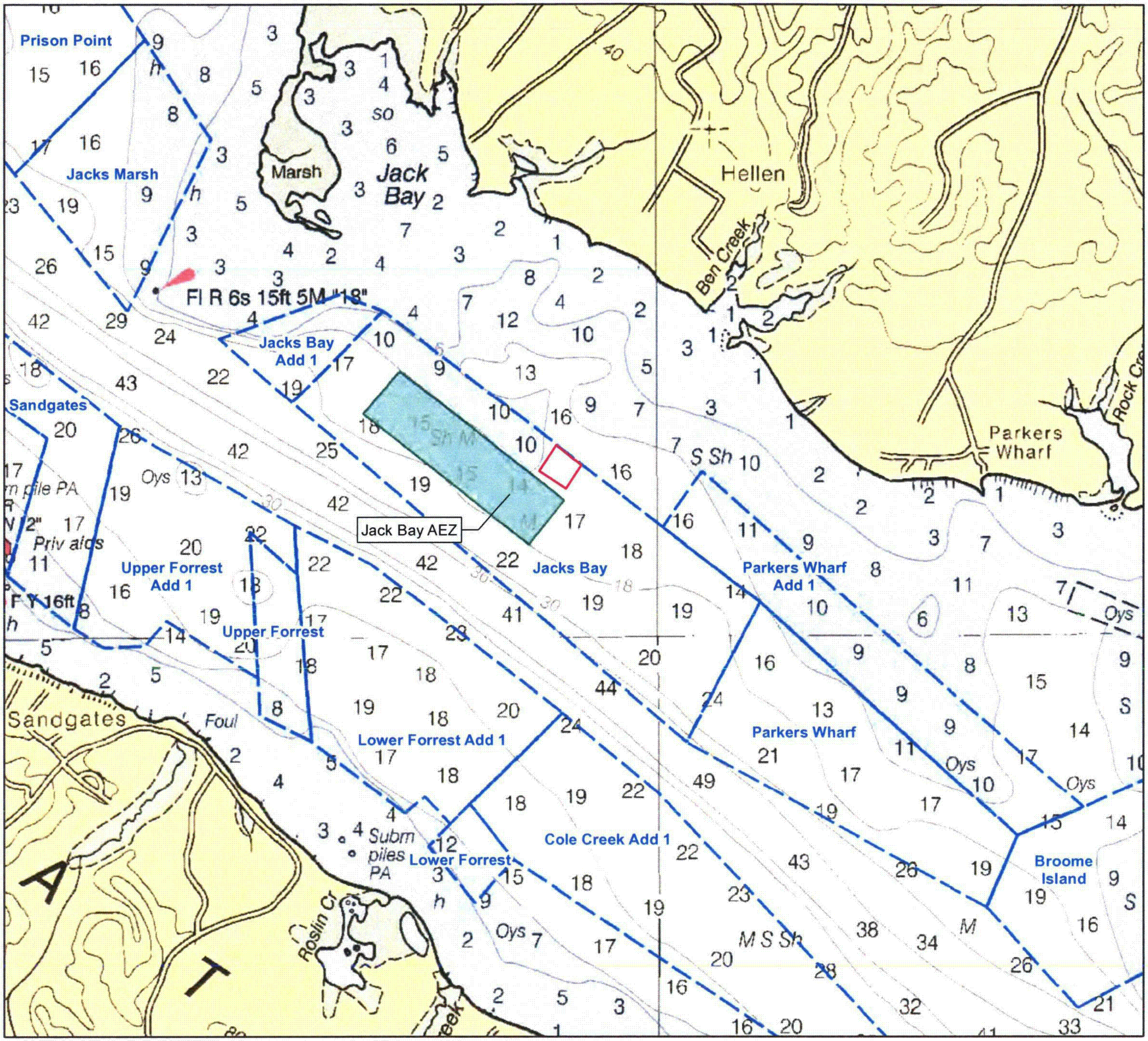

Calvert Cliffs Unit 3 - Tidal Mitigation

Figure 3
Water Depths at the
Tidal Mitigation Site

Legend

Aquaculture Enterprise Zone

Oyster Bars
(Includes Historic Yates Bars)

Tidal Mitigation Site

0 1,000 2,000
Feet

Source:
MDNR, 1997
NOAA, 2007

Path: J:\EA\projects\1462107\MXD\Unit3_TidalMitigation\Mit2_NOAA.mxd

Calvert Cliffs Unit 3 - Tidal Mitigation

Figure 4
Side Scan Sonar Data for the Tidal Mitigation Site

Legend

- Aquaculture Enterprise Zone
- MGS Substrate Data
  - Mud, Mud/Shell
  - Sand, Sand/Shell
- Side Scan Sonar Study Boundaries
- Oyster Bars (Includes Historic Yates Bars)
- Tidal Mitigation Site

0 1,000 2,000
Feet

Source:
MDNR, 1997
MGS, 2008-11

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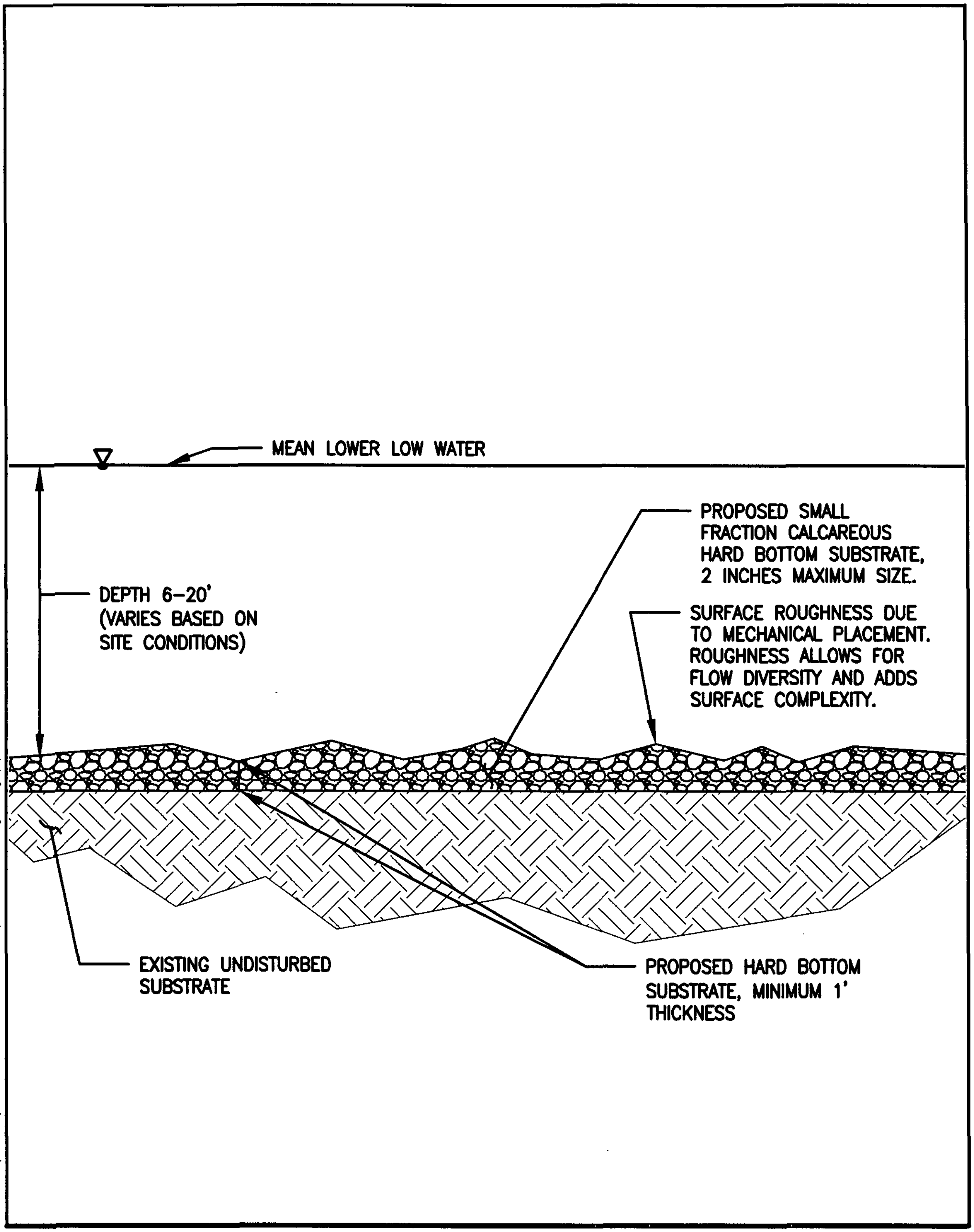

FILE PATH: Q:\PROJECTS\1462108 TIDAL MITIGATION 2ND CONTRACT\HARD_BOTTOM_XN.DWG [LAYOUT1] 1/3/13

FIGURE 5: TYPICAL PROPOSED HARD BOTTOM HABITAT SECTION
(NOT TO SCALE)

APPENDIX A

MEETING SUMMARY

UniStar NUCLEAR ENERGY

EA Engineering, Science, and Technology

Meeting Date: **December 15, 2010**

Meeting Attendees: John Nichols (NMFS), Dimitri Lutchenkov (UniStar), Jim Burkman (UniStar), Ed Miller (UniStar), Carla Logan (UniStar), Christine Papageorgis, Ph.D. (EA), Kaitlin McCormick (EA)

Subject: Tidal Wetland Mitigation; Calvert Cliffs Nuclear Power Plant Unit 3

Summary:

Mr. Miller began the meeting by laying out the meeting objectives: 1) to discuss additional information regarding the tidal mitigation option recommended by Mr. Nichols at the November Joint Evaluation Committee (JE) meeting and 2) to discuss UniStar's proposed approach to provide tidal mitigation.

NMFS is seeking 4.5 acres (1:1 mitigation ratio) of sand/coarse substrate habitat in an oyster reef area to provide forage for fish. Initially, NMFS requested 9 acres (2:1 mitigation ratio) of mitigation via letter to the U.S. Army Corps of Engineers dated 20 August 2010, but the mitigation requested was been reduced to 4.5 acres after discussions at the September and November 2010 JE meetings. At the November JE meeting, Mr. Nichols recommended consideration of two areas identified by the Maryland Geological Survey (MGS) in their 2008 survey of NOB 19-2 as not having such substrate. MGS reported some evidence of anoxic conditions from grab samples in those areas and Mr. Nichols proposed placing material and bringing the area to a depth that would not have seasonal hypoxia.

Figure 1 (attached) shows the two areas (A and B) suggested by Mr. Nichols and a depth analysis completed by EA. Ms. McCormick explained that the depth in these areas is currently less than 25 feet, which is the depth at which MGS indicated areas would not be seasonally hypoxic or anoxic (MGS 2008). Ms. McCormick further explained that site bathymetry data (EA 2006) do not indicate any channels or depressions in areas A and B.

Figure 2 (attached) presents the MGS substrate data for areas outside A and B. MGS' data do not include mapped substrate type for areas A and B. A Maryland Department of Natural Resources (MDNR) dataset for areas A and B is shown on the figure. MDNR data indicate that area B currently has suitable substrates for benthic habitat and that at least a portion of area A also has suitable substrates. These two areas do not seem to be suitable for substrate enhancement projects. In addition to habitat conditions not warranting restoration, Mr. Miller

and Ms. Logan indicated that there were some operational concerns about placement of material near the intake channel and the potential for turbidity to affect operations of Units 1 and 2 at Calvert Cliffs.

As an alternative for potential restoration sites, Ms. McCormick then presented Figure 3 (attached), which shows MDNR substrate data for the remaining area of NOB 19-2. Ms. McCormick noted that there was a large area at the northern edge of the oyster bar that has degraded habitat (mud). Mr. Nichols indicated that the area is a potential restoration opportunity, but that he would want additional information on the site. Mr. Nichols indicated that UniStar should characterize the substrate of this area to determine if it would support the required material to create viable benthic habitat.

Mr. Miller pointed out to Mr. Nichols that coordination with Maryland Department of the Environment (MDE) had indicated that the dredged material from the project would not be suitable for placement. MDE's placement criteria for beneficial use of dredged material in an unconfined manner is that not more than 10 percent of the material can pass through a 100 point sieve. UniStar provided Mr. Nichols with a copy of the grain size results, which shows that 28 percent or more of the material, depending on the sample, would pass through a 100 point sieve. Mr. Nichols noted that he had also spoken to Jonathon Stewart at MDE and noted that this project is being held to Maryland's very high standard. From NMFS perspective, a material of 70 percent sand would be allowable for this use. Mr. Nichols would like to see the dredged material used, if possible, or suitable portions used and the rest disposed of in other areas. Mr. Miller noted that at this time the disposal site for the dredged material was on Calvert Cliffs Nuclear Power Plant property at Lake Davies.

Mr. Miller asked Mr. Nichols if he would be amenable to coarser material than sand being placed, such as gravel. Mr. Nichols noted that this would be better material than sand, if the substrate in the area would support it. Mr. Miller asked if it was possible to place less than 3 feet of material, because of the high cost of material from an upland source. Mr. Nichols stated that he would be willing to allow 1 foot of placement, if coarser material, such as gravel was used, and the underlying substrate was suitable (e.g., hard pan clay). Mr. Nichols would like to see:

- More specific identification of an area, based on site investigations
- Field investigations of the specific site, including:
    - Substrate characterization
    - Bathymetry
    - If areas are near or below -20 feet mean sea level (MSL), seasonal oxygen monitoring data

Mr. Nichols indicated that he did not want to see a net loss of hard bottom with suitable benthic substrate on oyster bars. He indicated that scoured hard pan clay would be an ideal substrate to improve. He wants to make sure that substrate enhancement occurs in an area that is suitable for the enhancement and that monitoring is critical. If there is not at least one foot of material left during the monitoring period, Mr. Nichols would want material to be augmented to allow a permanent substrate change.

Ms. McCormick explained that UniStar is also willing to look at other sites on oyster bars and had mapped MDNR substrate data over oyster bars in the region, shown on Figure 4 (attached). Ms. McCormick also confirmed that Mr. Nichols would be amenable to work on an area of NOB 19-2 that did not currently have substrate mapping, if sufficient data were collected to verify the suitability of the site. He also noted that if a project was done in shallower areas (<20 ft), then seasonal oxygen studies would not be needed.

Mr. Nichols noted that his understanding is that he and the Corps of Engineers are requesting 4.5 acres of benthic mitigation, rather than the 9.0 acres originally contemplated in the 20 August 2010 NMFS letter to satisfy the tidal mitigation requirements of the project. He would want monitoring a period of 5 years, and corrective actions as needed to ensure that the site met the tidal mitigation goals.

Mr. Miller noted that UniStar's goal is to meet the requirements, but that the identification of a specific area with supporting investigations could not be completed in time to meet the current timing requirements of the Final Environmental Impact Statement (FEIS) for the project and for the Corps permit decision. He inquired as to whether or not there was a way to come to an understanding of a conceptual tidal mitigation plan and process that would allow for development of a sound detailed plan and would meet the permitting and approvals schedule. Mr. Lutchenkov further noted that resolution of tidal mitigation was the critical path for finalizing the FEIS. Mr. Lutchenkov then asked whether or not it would be possible for the permit to be worded to allow 4.5 acres of substrate enhancement to be completed with the mitigation site to be finalized, based on NMFS approval, after studies were completed. Mr. Nichols noted that there have been several cases where the permit conditions have identified a process or a project to be completed with some flexibility based on project development process, funding processes, and other needs. Mr. Miller indicated that this is what UniStar was hoping for, because it is willing to commit to a concept plan, but the time to complete the studies does not support the current FEIS schedule. He also noted that it is not in NMFS or UniStar's interest to have an unsuccessful tidal mitigation project that would require substantial corrective management or development of a new project.

Mr. Nichols agreed that a description of the mitigation concept and outline of steps to finalize the design and implement the project would satisfy the current needs of the permitting process. UniStar agreed to develop a meeting summary for Mr. Nichols' review and comment or concurrence that could be forwarded onto the Corps and other project stakeholders summarizing the next steps. Further, both Mr. Burkman and Mr. Nichols will follow up with Mr. Woody Francis of the Corps to make him aware of the discussions.

UniStar and Mr. Nichols agreed upon the following process to identify a suitable mitigation site for placing coarse substrate on mud/silt bottom or scoured hardpan clays:

1. Determine the suitability of the dredged material from the project for use in the substrate enhancement project. It must be technically feasible and cost effective to use the on-site material or material from an upland source will be used.
2. Complete substrate and bottom mapping of the proposed mitigation site

a. Complete a desktop study of available data to select one or more potential sites
b. Complete field investigations to confirm the substrate suitability to support sand/gravel/dredged material
c. Complete a bathymetric survey

3. Complete seasonal studies of dissolved oxygen to determine viability of habitat at the proposed mitigation site if a site with depths greater than 20 feet is proposed.
4. Develop a project schedule to complete the surveys and studies for site identification and mitigation project implementation.

These tasks will be included in the concept plan.

Ms. McCormick asked how Mr. Nichols would want material placed. Mr. Nichols indicated that bottom dumping of the material from a scow was acceptable to him and that he did not think additional grading would be required, because the material would settle into place with the water currents.

Mr. Miller and Ms. Logan asked whether Mr. Nichols believes a silt curtain would be required during placement if coarse material, such as gravel, was placed. Mr. Nichols indicated that placement of coarse material would not necessarily require silt curtains and noted that silt curtains were not as successful in open water conditions as in more sheltered areas. However, since the action would occur on an oyster bar, silt curtains could be required especially if placement were within 500 yards of cultch. Mr. Nichols also noted that there may be time-of-year (TOY) restrictions for oysters. Mr. Nichols stated that both the winter and summer TOY periods would likely be implemented, but that a waiver could be requested from the state and Corps.

Mr. Burkman inquired as to whether or not this mitigation could potentially conflict with any submerged aquatic vegetation (SAV) habitat. Mr. Nichols indicated that the depths for oyster bars were greater than the 2 meter depths that would support SAV.

Mr. Lutchenkov requested confirmation that this approach and creation of 4.5 acres of benthic habitat (coarse substrate one foot deep) would meet NMFS requirement for tidal mitigation. Mr. Nichols indicated that this would satisfy the NMFS tidal mitigation requirement.

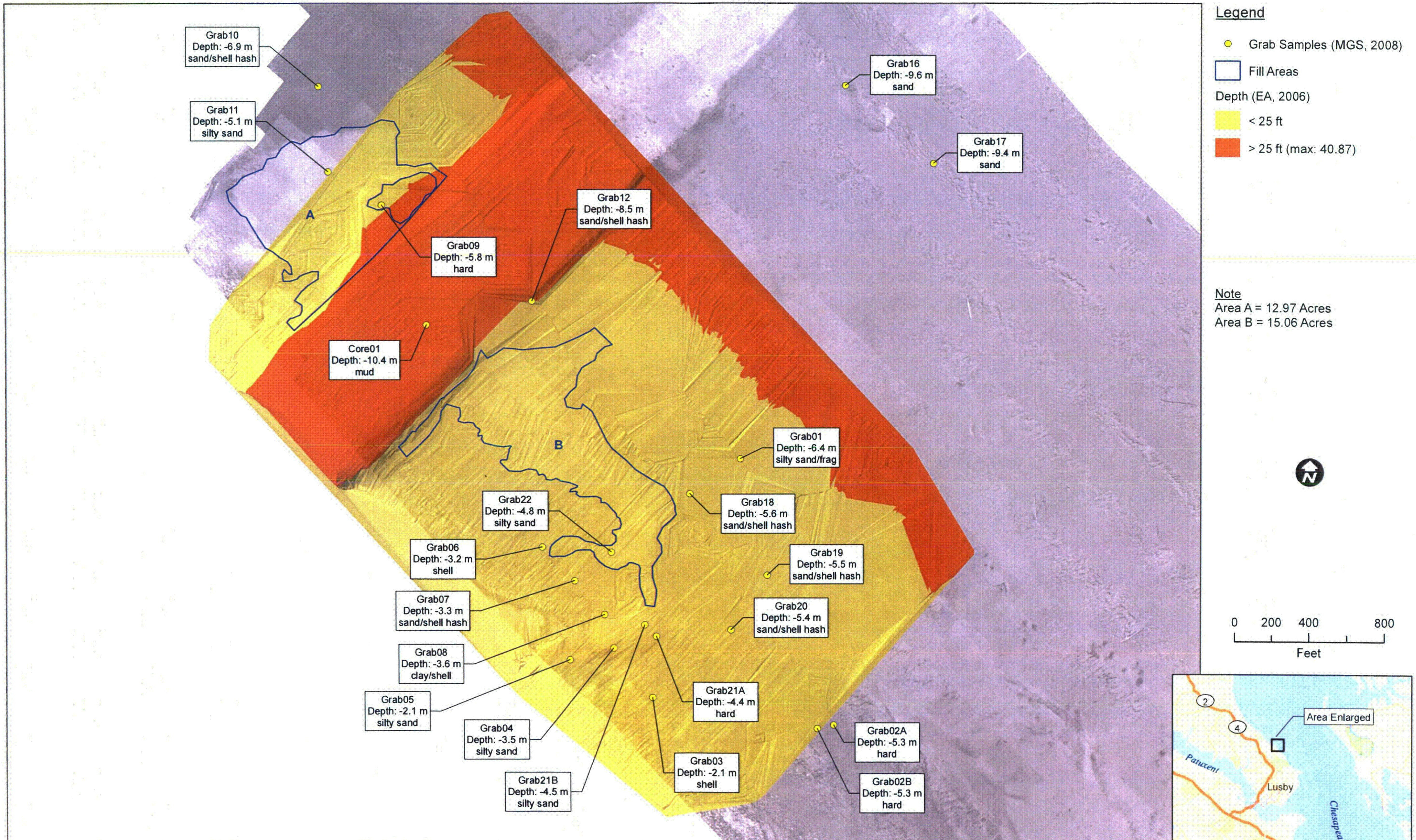

Figure 1
Depth Analysis based on MGS 2008 Grab Samples and Side Scan Sonar and EA's 2006 Bathymetric Survey

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2010

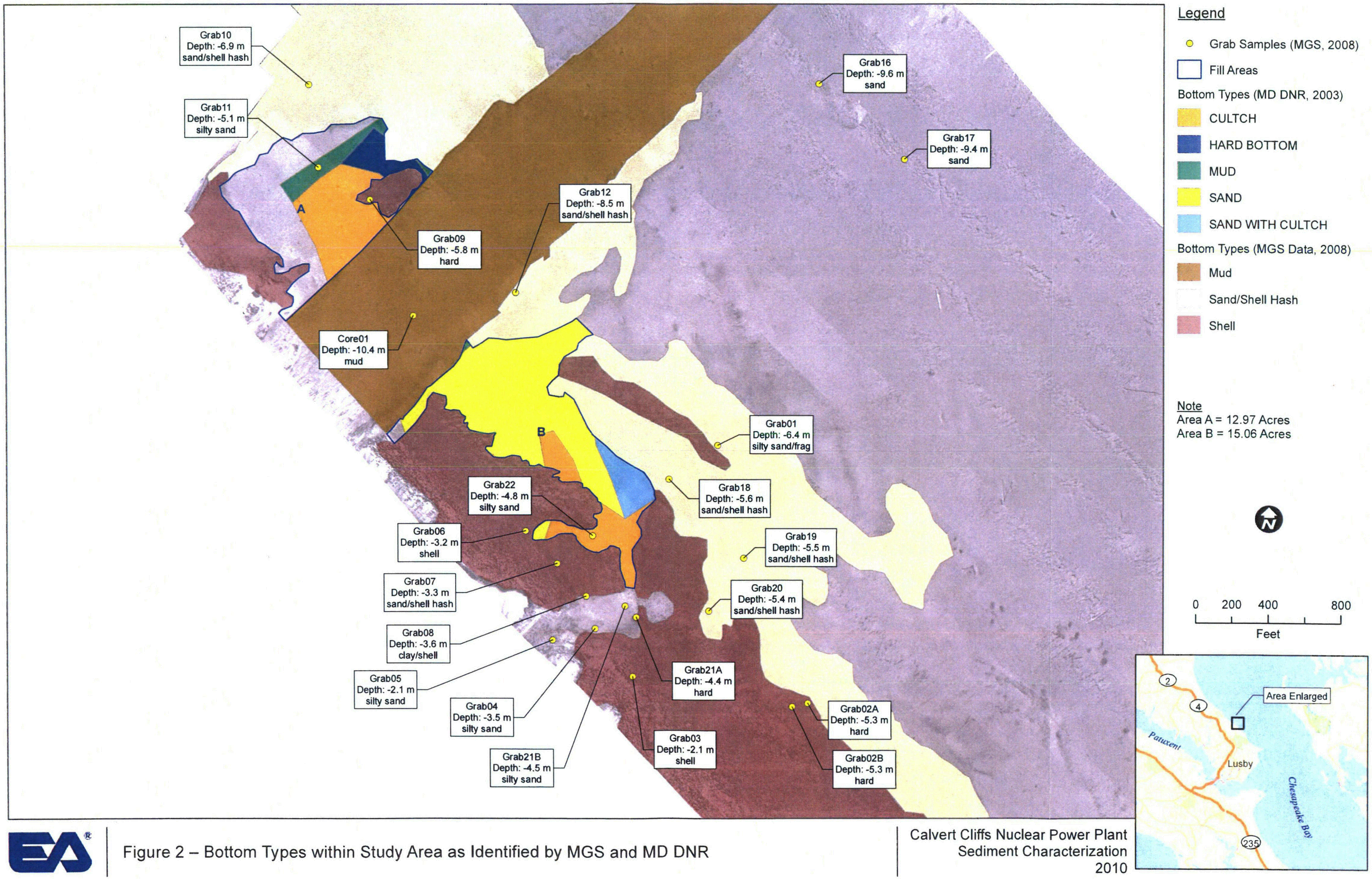

Figure 2 – Bottom Types within Study Area as Identified by MGS and MD DNR

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Sediment Characterization
2010

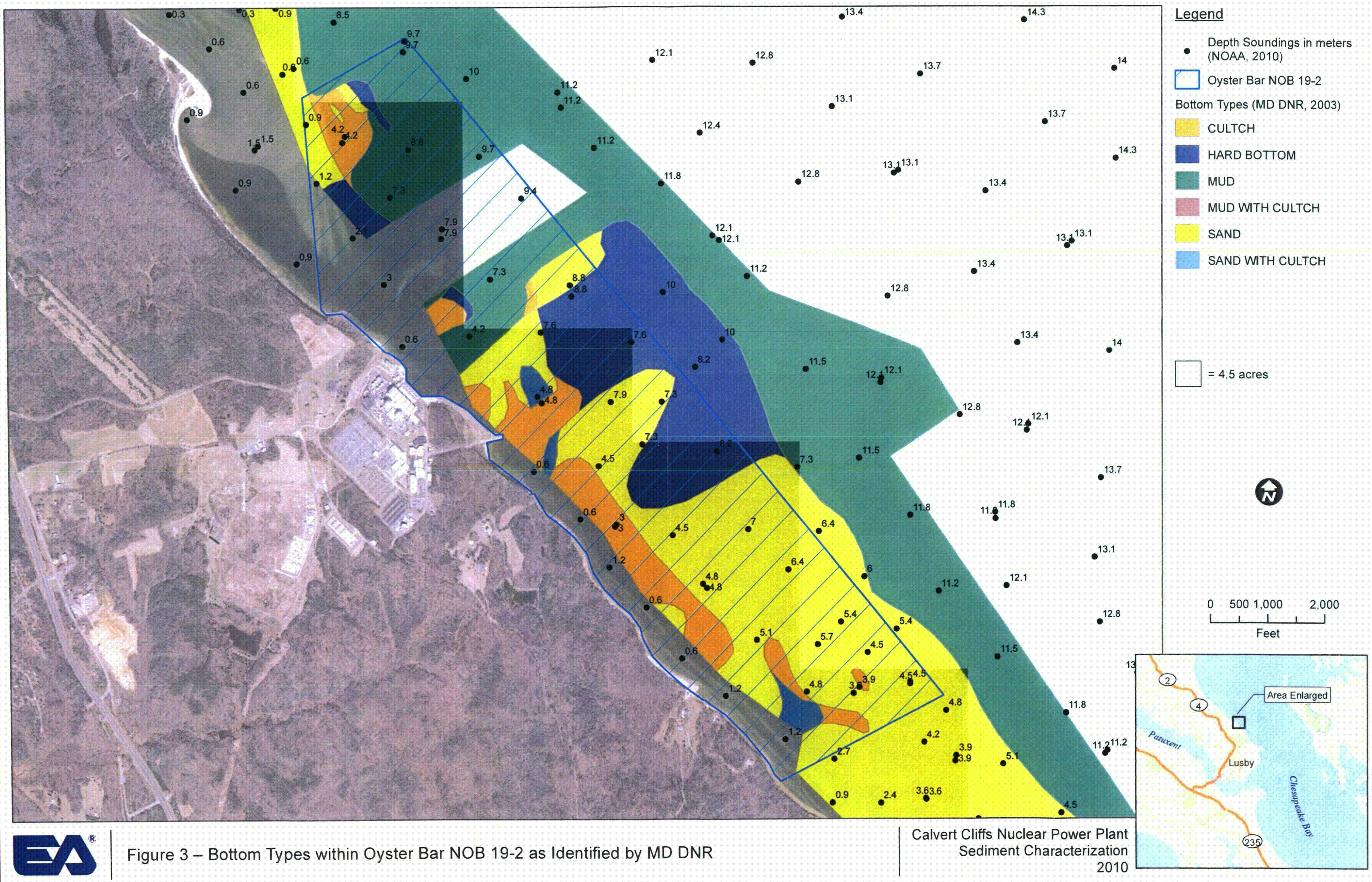

Figure 3 – Bottom Types within Oyster Bar NOB 19-2 as Identified by MD DNR

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Sediment Characterization
2010

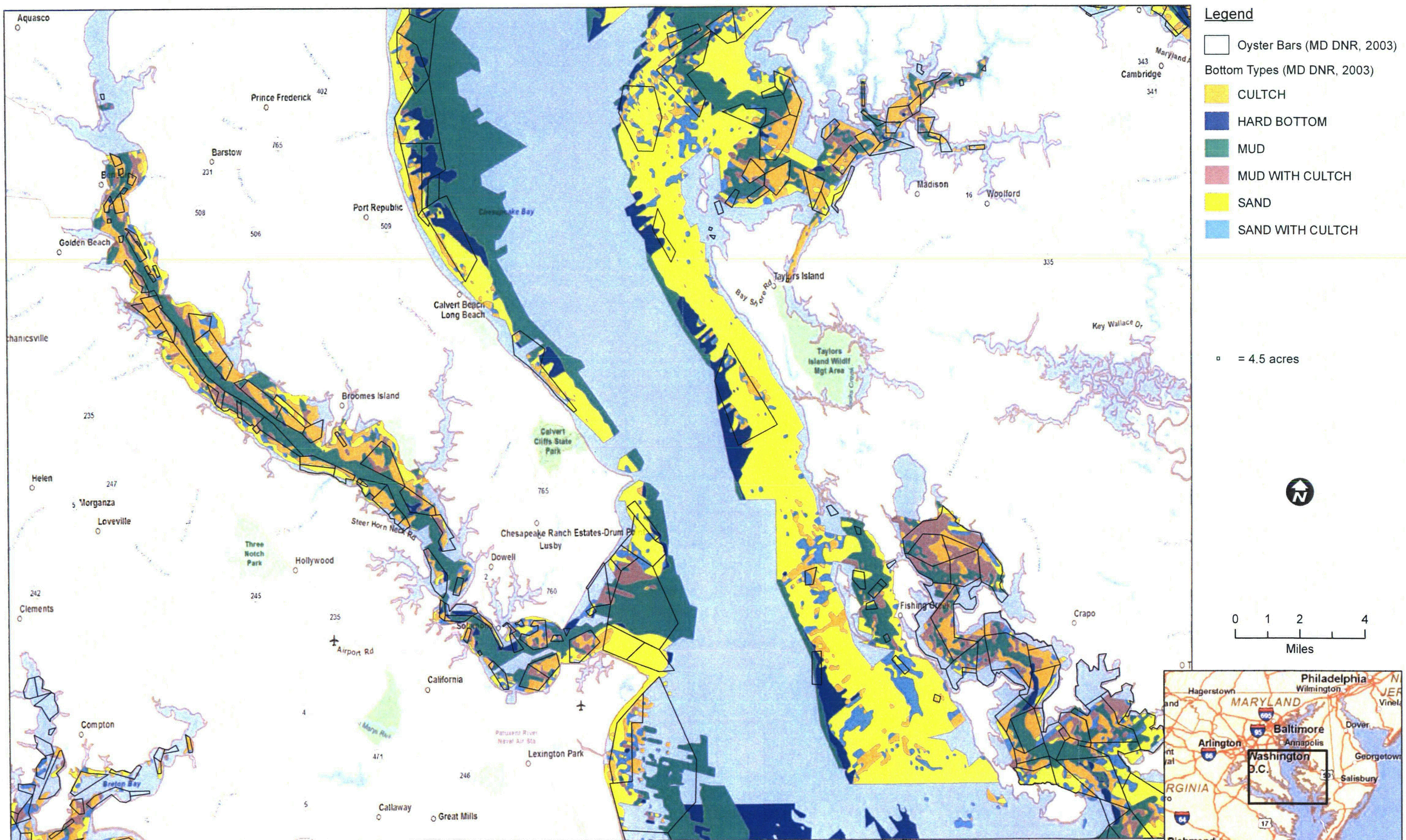

Figure 4 – Bottom Types within the Vicinity of the Patuxent River as Identified by MD DNR

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Sediment Characterization
2010