FINAL DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT

SAXIS ISLAND ACCOMACK COUNTY, VIRGINIA

SECTION 206 AQUATIC ECOSYSTEM RESTORATION

U.S. Army Corps of Engineers
Norfolk District
803 Front Street
Norfolk, Virginia 23510-1096

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DEPARTMENT OF THE ARMY
NORFOLK DISTRICT CORPS OF ENGINEERS
FORT NORFOLK 803 FRONT STREET
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INTRODUCTION

The Island of Saxis, VA, with its small bay, inland tidal creeks, and wetland areas, is rich in water and related resources. There are problems, needs, and opportunities that need to be addressed to optimize and protect the use of these resources. Specific areas of concern are related to the environmental conditions and aquatic ecosystem restoration. This ecosystem restoration report presents the findings of investigations that addressed the interrelationships among the identified problems, needs, and opportunities; developed a specific plan of action; and identified the need for and Federal interest in construction of a project.

STUDY AUTHORITY

This report was prepared under the authority contained within Section 206 of the Water Resources Development Act of 1996, Public Law 104-305. Under this authority, the Secretary of the Army can carry out a program of aquatic ecosystem restoration and protection with the objective of restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition.

Projects may be constructed upon a finding by the Secretary of the Army that the environmental, economic, and social benefits of the project, both monetary and non-monetary, justify the cost, and the project would not result in environmental degradation. Project implementation depends on non-Federal interests entering into a cooperative agreement in accordance with the requirements of Section 221 of the Flood Control Act of 1970, as well as providing 35 percent of the cost associated with project construction including provision of all feasibility costs, design, and lands, easements, rights-of-way, and relocations (LERRD). The non-Federal sponsor must also agree to pay 100 percent of the operation, maintenance, repair replacement, and rehabilitation (OMRR&R) costs associated with the project.

This report proposes the use of segmented intermittent breakwaters with attached tombolos along the shoreline of Saxis Island that will provide the conditions required to restore lost estuarine wetlands and to create protected subaqueous habitat conducive to restoring Submerged Aquatic Vegetation (SAV) and improved beach habitat. There will be appropriate native vegetation plantings in the restored riparian, beach, and wetland habitat. These restored habitats would, in turn, support spawning and juvenile rearing areas for benthos, finfish, and shellfish, including blue crabs throughout this portion of the upper bay. Habitat for the Federally-threatened Northeastern Tiger Beetle will also be enhanced. Currently, the Northeastern Tiger Beetle is found on Saxis beach as a small, non-reproductive population. The proposed restoration is likely to enable the Northeastern Tiger Beetle to increase its numbers substantially on Saxis Beach and allow for successful reproduction.

STUDY PURPOSE

This Detailed Project Report is accomplished for the purpose of determining the Federal interest in and providing water resources improvements to Saxis Island for the

purpose of aquatic ecosystem restoration. The study focus was the development of a cost-effective plan that successfully restores aquatic and beach habitat along Saxis Island.

The recommendations made in this report with regard to aquatic ecosystem restoration fall within the interest and authority of the Corps of Engineers. Further action by Norfolk District leading to the implementation of the recommended plan will only be pursued with the concurrence and support of the non-Federal sponsor.

ENVIRONMENTAL ANALYSIS

The Environmental Assessment (EA) analysis evaluated direct, indirect, and cumulative impacts associated with associated with various alternatives and the proposed plan for the aquatic ecosystem restoration along the Saxis Island shoreline. The evaluations are based on Federal, state, and local statutory requirements, as well as an assessment of Corps of Engineers environmental, engineering, and economic criteria.

The Final EA is included following the Recommendations Section of this report. This assessment has been reviewed by Federal, state, and local agencies and the public. The comments received have been addressed, and the FONSI has been signed by the District Engineer.

STUDY PARTICIPANTS AND COORDINATION

The Norfolk District Engineer is responsible for conducting the overall study in cooperation with the Executive Committee comprised of representatives of Technical Services Division, Planning Branch, and the mayor of the town of Saxis. An advisory committee was also formed comprised of field-level representatives from the town of Saxis, the Norfolk District, applicable state and Federal agencies, and the Virginia Institute for Marine Sciences. This Advisory Committee determined the appropriate aquatic ecosystem restoration project as proposed at Saxis is in harmony with the ongoing cooperative efforts of the state and local governments and will produce the primary benefit of aquatic ecosystem restoration. The primary state and Federal agencies included US Fish and Wildlife Service (USFWS), the Corps of Engineers, and the Virginia Institute of Marine Science (VIMS).

PRIOR STUDIES AND PROJECTS

PROJECTS

The proposed aquatic ecosystem restoration project is located adjacent to the town of Saxis on Saxis Island in Accomack County, VA. The site of the proposed Saxis Island Aquatic Ecosystem Restoration is immediately northeast of two existing Federal projects. One is a timber tongue-in-groove bulkhead that was constructed along the Chesapeake Bay (Pocomoke Sound) side of the public landing by the Norfolk District under Section 14 authority in 1986. The other is the Starlings Creek Federal navigation project, originally a Congressionally-authorized project constructed under authority of the River and Harbor Act of 1935, with its Harbor of Refuge constructed under Section 107 authority in 1960, located adjacent to and immediately southwest of the bulkhead. The proposed aquatic ecosystem restoration of salt marsh and SAV lies north and east of these projects within a 32-acre footprint adjacent to approximately 6,000 feet of shoreline, also shown on Exhibit A.

PRIOR CORPS OF ENGINEERS STUDIES AND REPORTS

A report, performed under the Authority of the River and Harbor Act, assessed dredging a channel through part of Pocomoke Sound into Starlings Creek and dredging a turning basin within Starlings Creek. This report was completed in 1935. Another study, under Section 14 of the Flood Control Act of 1946, assessed the placement of a timber bulkhead within Starlings Creek to protect the shoreline. A report on Starlings Creek/Accomack County was completed in 1960 under the authority of Section 107 of the River and Harbor Act of 1960. This report approved the construction of a harbor of refuge, 7 feet deep, 200 feet wide, and 500 feet long. A channel 60 feet wide and 7 feet deep Mean Lower Low Water (MLLW) connects the turning basin with a harbor of refuge.

Chesapeake Bay Study

This study was a comprehensive investigation of the use and control of water resources within the Chesapeake Bay that was authorized by Section 312 of the River and Harbor Act of 1965. Areas of study included water supply, navigation, shore erosion, flood control, recreation, and the fisheries and biota of the Chesapeake Bay. The study resulted in two reports. The first report, entitled "Chesapeake Bay Existing Conditions Report (1973)," provided an assessment of the existing physical, chemical, biological, economic, and environmental conditions of the Chesapeake Bay. The second report, entitled "Chesapeake Bay Future Conditions Report (1983)," provided an assessment of the future water resources needs of the Chesapeake Bay to the year 2020.

Virginia Hurricane Evacuation Study

This study was a comprehensive evaluation of the evacuation needs of the Virginia coastal communities, including Northampton and Accomack Counties, vulnerable to flooding from storm surge. The primary goals of the study were to identify: (1) expected areas of storm surge inundation and the population at risk; (2) required evacuation routes and shelter resources; and (3) appropriate times to issue an evacuation order. The study was conducted under the authority of Section 206 of the 1960 Flood Control Act and represented a joint management effort between the Federal Emergency Management Agency (FEMA) (Region III) and the Corps of Engineers (Norfolk District). The final products of the study included a technical data report, storm surge inundation maps, and a hurricane evacuation computer model.

Chesapeake Bay Shoreline Erosion Study, Feasibility Report with Technical Appendices

The report, dated October 1990, was developed by Baltimore and Norfolk Districts along with North Atlantic Division staffs with assistance from the State of Maryland and the Commonwealth of Virginia. The study evaluated shoreline protection measures that would protect both land and water resources of the Chesapeake Bay from adverse effects of continued erosion. Numerous experimental projects were constructed as model sites within the Maryland and Virginia confines of the Chesapeake Bay, and the projects were monitored for overall effectiveness.

Flood Insurance Studies

Two Flood Insurance Studies and several Floodplain Information Reports on the Eastern Shore have been completed by the Corps of Engineers for FEMA. The studies delineate flood hazard areas, develop flood frequency data, and compute floodway data for areas identified by FEMA as having flood problems. This information is used by FEMA to establish actuarial insurance rates and to provide basic data for use by the local interests in initiating land-use regulations. The Flood Insurance Studies on the Eastern Shore included Saxis (1982).

Eastern Shore Reconnaissance Report

A reconnaissance report on the water resources of the Eastern Shore of Virginia was completed in June 1996. This study examined problems involving natural resources, erosion, and navigation issues throughout the Eastern Shore of Virginia. For Starlings Creek, this report recommended further study to address shoreline erosion widening the mouth of Starlings Creek and the increased wave action and associated damage to boats and mooring structures within Starlings Creek. A stone jetty on the southwestern shore adjacent to the mouth of Starlings Creek was recommended, and a Section 107 study is underway for construction of the jetty. The study currently is on hold, awaiting feasibility funds from the town of Saxis as the local cost-sharing sponsor.

REPORTS BY OTHERS

The "Shoreline Situation Report for Accomack County," (Hobbs et al., 1975), prepared by VIMS, indicated the historic erosion rate on Saxis Island was almost 5 feet per year (ft/yr). Erosion rates greater than 3 ft/yr are considered severe.

"Saxis Shoreline Management Plan with Habitat Enhancement," (Hardaway, et al., 1999), was prepared by VIMS to address regional environmental planning and restoration initiatives, incorporating habitat considerations into shoreline stabilization design. The VIMS evaluation process compared various structural headland control configurations and their relative impacts on, and potential benefits to, target species. These efforts anticipated early on that headland breakwaters, beach nourishment, and wetlands plantings could be utilized to realize project goals. The following table summarizes these reports.

Table 1. PRIOR REPORTS

Report and Authority	Agency	Subject or Recommendation
Starlings Creek Federal navigation project authorized under authority of the River and Harbor Act of 1935.	Corps of Engineers	Proposed entrance channel 60 feet wide and 7-feet deep from that depth in Pocomoke Sound to the mouth of Starling Creek; a turning basin of the same depth 100-feet wide and 1,100-feet long inside the entrance.
Starlings Creek Channel and Harbor of Refuge, under the authority of Section 107 of the River and Harbor Act of 1960.	Corps of Engineers	Reported favorably on a proposal to create a channel 60 feet wide connecting the turning basin with a harbor of refuge, 7 feet deep, 200 feet wide, and 500-feet long.
Saxis Island Emergency Shoreline Protection, Section 14 authority of the 1946 Flood Control Act, in 1986.	Corps of Engineers	Proposed timber tongue-in-groove bulkhead along the northern and western portions of the landing.
Eastern Shore Water Resources Study, 1996, House Committee on Public Works and Transportation Resolution adopted on 3 November 1993.	Corps of Engineers	Reconnaissance Report to determine the Federal interest in, and feasibility of, providing water resources improvements to the Eastern Shore of Virginia for the purpose of tidal flood damage reduction, navigation, and environmental restoration.
Virginia Hurricane Evacuation Study Joint management effort between the FEMA (Region III) and the Corps of Engineers (Norfolk District), Section 206 of the 1960 Flood Control Act.	Corps of Engineers	Comprehensive evaluation of the evacuation needs of the Virginia coastal communities, including Northampton and Accomack Counties, vulnerable to flooding from storm surge.

Table 1. PRIOR REPORTS
(Cont'd)

Report and Authority	Agency	Subject or Recommendation
Chesapeake Bay shoreline Erosion Study, Feasibility Report with Technical Appendices, October 1990.	Corps of Engineers	Study evaluates shoreline protection measures within Virginia and Maryland confines of the Chesapeake Bay.
Flood Insurance Studies, for FEMA.	Corps of Engineers	The studies delineate flood hazard areas, develop flood frequency data, and compute floodway data for areas identified by FEMA as having flood problems.

LIMITS OF SCOPE

Aquatic Ecosystem Restoration projects authorized by Section 206 of the Water Resources Development Act of 1996 are limited to projects that may be designed to halt erosion or to control sedimentation if the primary purpose is to improve aquatic or terrestrial ecosystem structure and functions. These projects can include, but are not limited to, restoration of degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. They should involve consideration of the ecosystem's natural integrity, productivity, stability, and biological diversity. There should be no adverse impacts associated with the project.

EXISTING CONDITIONS

STUDY AREA

The town of Saxis is located on the Eastern Shore of Virginia along the Chesapeake Bay (Pocomoke Sound), approximately 80 miles north of Norfolk, VA, and 100 miles southeast of Washington, DC, and is shown on Exhibits A and B. The proposed project area is adjacent to the town. The town is isolated from the rest of the county and is separated from the mainland by Freeschool Marsh, which is part of the 5,574-acre Saxis Wildlife Management Area. The Pocomoke Sound side, which is the town's western boundary, has extensive loss of vegetated aquatic, intertidal wetland, and beach habitat. The placement of segmented offshore breakwaters with attached tombolos along approximately 6,000 feet of

intertidal shoreline is proposed in order to restore and/or enhance the beach, dunes, scrub-shrub, intertidal wetlands, and shallow water habitat. This will allow the creation of protected subaqueous habitat conducive to the recovery of underwater grasses (SAV's). There is strong support from the state and local community for restoring ecosystem of the area and preventing further habitat loss. The town of Saxis recognizes the importance of maintaining the integrity of state waters for the citizens of the Commonwealth.

ENVIRONMENTAL RESOURCES

The following information summarizes the environmental resources in the study area. For more detailed information, please see the associated EA.

Biological Resources

The study area and surrounding Pocomoke Sound are biologically diverse. Aquatic floral and faunal communities in the area vary from marine to brackish estuarine to nontidal freshwater streams that feed Freeschool Marsh. The flora and fauna found in the study area correspond to that of a typical, non-vegetated Bay beach ecosystem that has been developed and manipulated by the placement of dredged material. During the Shoreline Management Plan with Habitat Enhancement study prepared by VIMS, major vegetated communities were characterized. The vegetation along the shoreline is dominated by common reed (*Phragmites australis*), with stands of emergent marsh, beach, scrub-shrub, and old field communities. The Saxis Island study area comprise approximately 210 acres, including extensive acres of relatively subtidal and intertidal areas, tidal marsh, beach, and dune habitat, all of which are rapidly declining in extent and quality.

SAV, principally rooted vascular macrophytes, is one of the most important and productive ecosystems in the Chesapeake and coastal Bays. VIMS reported that historical aerial surveys provided evidence that SAV once was abundant around Saxis. It died off in local waters by 1965. Currently, no SAV are found near the study site, which is evidence that SAV does not survive along rapidly eroding shorelines with associated high levels of total suspended solids in the water column. There has been a general decrease in SAV acreage throughout the Chesapeake Bay due to a decline in water quality.

The shellfish and finfish found in the waters of Saxis are important to commercial and recreational fishing, and they play a large role in the economy of the community. Commercially important shellfish and crustaceans include oysters, clams, and crabs. The finfish include menhaden, flounder, scup, striped bass, herring, mullet, weakfish, bluefish, spot, croaker, and sea trout. VIMS reported Summer flounder and Atlantic Croaker abundant during their spring sampling period, with blue crabs and menhaden more abundant in the summer months. Anchovies also dominated spring samples collected by VIMS, and Atlantic Silversides co-habit with them during the summer months. VIMS did not collect any live oysters or clams and observed sparse cultch at a few of their sample locations

The upland areas are generally densely-vegetated except for a few lawn areas. The Saxis shoreline has been largely eroded in the area and, where present, consists of a narrow strip of sand backed by dunes. The vegetation communities along the Saxis shoreline are

classed as following: beach, dune scarp, marsh, phragmites dominated, scrub-shrub, and old field. The dunes are sparsely vegetated by species typical of dune communities, including dune grass (*Ammophila breviligulata*), seaside goldenrod (*Solidago sempervirens*), and bitter panicum (*Panicum amarum*) covering 0.1 acre. Smooth cordgrass (*Spartina alteriflora*), saltmeadow hay (*Spartina patens*), and marsh elder (*Iva frutescens*) dominate the marsh, which covers 9.2 acres of the shoreline. White mulberry (*Morus alba*), black locust (*Robinia pseudoacacia*), black cherry (*Prunus serotina*), hackberry (*Celtis occidentalis*), wax myrtle (*Myrica cerfera*), and groundsel tree (*Baccharis halimifolia*) make up the scrub-shrub of approximately 3.5 acres, Northern Bayberry (*Myrica pensylvanica*) and red cedar (*Juniperus virginiana*) constitute the canopy layer landward of the dune grass community. The old field vegetated areas cover approximately 1.0 acre and are made up of pokeweed (*Phytolacca americana*), horseweed (*Erigeron canadensis*), dog-fennel (*Eupatorium capillifolium*), and blackberry (*Rubus argutus*). However, the vegetation along the shoreline is dominated by common reed *(Phragrnites australis)* and groundsel bush (*Baccharis halimifolia*), that covers approximately 19.9 acres. Total area of the various vegetation communities along the Saxis shoreline, exclusive of lawns, is approximately 39.5 acres.

Saxis Island and the surrounding area support a wide variety of fauna, especially bird communities. During the spring and summer, no less than 13 different sensitive species of egrets, ducks, hawks, ibis, and shorebirds use the natural areas for nesting and foraging. A Department of Game and Inland Fisheries comprehensive bird survey (1993) on the unassigned state lands of the Eastern Shore found a total of 34,536 colonial birds nested. Passerines; gulls and terns; shorebirds; raptors; wading birds; waterfowl; and pelagic birds were all represented in the avifauna. VIMS surveyed the entire length of the Saxis shoreline adjacent to Pocomoke Sound, the upland portions of the island including the causeway, and the marshes surrounding Saxis Island in 1998. Their survey dates corresponded with critical seasonal migratory patterns, and the observations recorded a diverse assemblage of birds that included a mixture of year-round residents, wintering birds, migrants, and summer nesting birds. Christmas Bird Counts (CBC) from the Audubon Society and USFWS Breeding Bird survey (Sauer et al., 1997) concurred with the findings.

The existing bay beach and dune habitat of Saxis Island provide nesting habitat for colonial shore birds. The tidal marshes on the island provide feeding habitat, while areas in the Freeschool Marsh surrounding Saxis Island provide nesting habitat that is protected from mammalian predators. Some of the species that are found and observed on Saxis Island include the royal tern (*Sterna maxima*), common tern (*Sterna hirundo*), least tern (*Sterna albifrons*), herring gull (*Larus argentatus*), great black-backed gulls (*Larus marinus*), Ring-billed gull (*Larus delawarensis*), laughing gull (*Larus antricilla*), bonaparte's gull (*Larus philadelphia*), double-breasted cormornat (*Phalacrocorax auritus*), and great blue heron (*Andrea herodias*).

Saxis Island and surrounding areas provide nesting and overwintering habitat for waterfowl such as American black duck (*Anas rubripes*), bufflehead (*Bucephala albeola*), mallard (*Anas platyrhynchos*), and canada goose (*Branta canadensis*). Common goldeneye (*Bucephala clangula*), gadwall (*Anas strepera*), surf scooter (*Melanitta perpicilata*), red-

breasted merganser (*Mergus serrator*), and ruddy turnstone (*Arenaria interpres*) are also seen in the area. Common loons (*Favia immer*) use the area throughout the spring. The study area supports a nesting colony of osprey (*Pandion haliaetus*) throughout the year. Mink are known to inhabit the study area, as well as red fox (*Vulpes vulpes*), muskrat (*Ondatra zibethicus*), striped skunk (*Mephitis mephitis*), and raccoon (*Procyon lotor*).

Threatened and Endangered Species

Species of concern located in the project area include the Federally-threatened Northeastern Beach Tiger Beetle (*Cincindela dorsalis dorsalis)* (Gowan and Kinisley, 2001). Sandy intertidal areas are foraging areas for tiger beetles that require approximately 2 to 3 meters of beach above MHW. A survey conducted by Dr. C. Barry Knisley of Randolph-Macon College on 11 July 2000 indicated the presence of a small population of adults (three were collected) and the presence of marginal habitat. A survey in October 2000 performed by Dr. Knisley for larval northeastern beach tiger beetles was negative.

Several species of Federally-listed marine turtles may forage in the project area. The most common is the Federally-threatened loggerhead turtle (*Caretta caretta caretta*). The loggerhead is an oceanic and estuarine species that reaches its northern nesting limit along the barrier beaches of the Delmarva Peninsula and feeds within the barrier bays and the Chesapeake Bay on a wide variety of benthic organisms including blue and horseshoe crabs. It is present in the Chesapeake Bay from spring through fall. Other marine turtles that may be found in the region include the endangered Atlantic ridley (*Lepidochelys kempii*) and the threatened green turtle (*Chelonia mydas*). Their occurrence is rare. None of these sea turtles are known to nest on beaches in the project area.

Other species of concern include the Federally-threatened, migratory bald eagle (*Haliaeetus leucocephalus leucocephalus*) and the state-threatened Henslow's sparrow (*Ammodramus henslowii susurrans*). The VIMS (Hardaway et al., 1999) report lists the following species that also breed and live in the area: Least tern, osprey, black rail (*Laterallus jamaicensis*), and the northern diamondback terrapin.

The Virginia Department of Conservation and Recreation, Division of Natural Heritage (DNH) maintains a Biological and Conservation Data System for occurrences of natural heritage resources within the project area. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species; unique or exemplary natural communities; and significant geologic formations. Correspondence from DNH indicates that while natural heritage resources exist in the project vicinity, due to the scope of the activity and distance to the resources, no adverse impacts to those resources would be anticipated.

NATURAL FORCES

Physiography, Geology, Topography, and Soils

Saxis Island on the Eastern Shore of Virginia is situated within the Coastal Plain Physiographic Province. This province is categorized by largely unconsolidated gravels and loams of marine and fluvial origin that were deposited by glacial melt waters during the Pleistocene epoch. The Chesapeake Bay occupies a drowned river valley excavated by the Susquehanna River and its tributaries during the late Pleistocene. The Beach Channel along the southwestern shoreline of the Eastern Shore of Virginia is a remnant of the old Susquehanna Channel. The general character and distribution of bottom sediments in this region of the Chesapeake Bay consists of gray or black mud with occasional thin layers of sand.

The island is a low, upland feature on the open Pocomoke Sound side of Freeschool Marsh. The shore faces approximately northwest with an average fetch to the northwest, west, and south west of 2.3 nautical miles. With the longest effective fetch to the southwest as well as the high frequency of winds from that direction, waves are generated that significantly impact the longshore transport system tending to drive sediment to the north. The southwest and west conditions combined are more frequent than the northwest which supports the District's other analyses, since the morphologic evidence points to a northward trending littoral transport system (i.e., shoreline offsets and North End Point spit). As southwest waves approach the Saxis shoreline, they shoal nearly 350 feet before they impact the shore due to the nearshore bathymetry. Westerly waves are impacted by the nearshore bathymetry, shoaling about 8°. The northwest component is altered little by the nearshore; the angle of wave approach only changes by about 2°, and the wave height does not diminish as rapidly as other directions. During northwest storm conditions, waves are onshore-offshore along the town's shoreline, but waves directly impact the spit at North End Point tending to elongate it. During southwest and west conditions, the North End Point spit is sheltered from wave energy. Under modal conditions, a very few, small regions of increased wave energy are shown along the shore. However, under storm conditions, energy tends to be concentrated (convergence) just south of the cape stabilized with well casings near the northern limit of the town. North and south of this cape, some divergence (spreading laterally) of wave energy occurs. The northwest modal and storm conditions show very little convergence or divergence, whereas the storm trajectory for southwest condition shows convergence in the region of the dredged material containment area. The shoreline within the town limits, characterized as a low marsh with a narrow beach, has a historical erosion rate of about 4.9 ft/yr. The beach overlies a marsh substrate along most of the shoreline. Rosen (1976) defined Saxis' shoreline as consisting of two types: a predominantly marsh shore along the southern half and an impermeable beach along the north half with marsh shore occurring again across North End Point. Impermeable beaches are underlain with an erosion-resistant clay or marsh substrate.

The study area's topography is mostly featureless and largely marshy. The surface relief is mostly level, and there are no rolling areas or bluffs along the edges of the drainage

features. The elevations range from sea level to 6 feet as you leave the island east, through Freeschool Marsh and the Saxis Wildlife Management area.

Norfolk District conducted a subsurface investigation during the month of November 1999. Due to the shallow water conditions, a barge-mounted tripod with a Briggs & Stratton hammer engine was used to collect the split spoon samples. Borings 99B01 through 99B05 were performed in the vicinity of the proposed terminal groin, and borings 99B06, 99B07, 99B09, 99B11, 99B13, and 99B15 were performed along the shoreline in the vicinity of the proposed breakwaters. Refer to Exhibit B for a map showing boring locations and coordinates. Samples collected during the subsurface investigation were classified according to the Unified Soils Classification System. Selected samples were analyzed for Atterberg Limits, gradations, and moisture content. Refer to the attached boring logs, grain size distribution graphs, and Atterberg Limits results, located in Appendix 1, Engineering, Design, and Cost Estimates. Norfolk District personnel used the information collected to perform a foundation analysis to check bearing capacity, stability, and settlement of the proposed structures.

Additionally, VIMS conducted a limited geotechnical exploration consisting of hand auger and surface samples along the existing shore and nearshore areas in support of its Shoreline Management Plan. VIMS compiled nearshore sediment samples and beach samples to determine grain-size characteristics of the shore zone. This information was also used to assess bottom and foundation conditions for potential breakwaters. VIMS analyzed surface samples for percent gravel, sand, silt, and clay from the beach's upper berm; midbeach; toe; and nearshore on profiles along the 6,000-foot shoreline. VIMS' hand auger borings were analyzed for the same criteria from 7 additional profile stations at the toe of beach, 50 feet, 100 feet, and 150 feet offshore. The VIMS' Rapid Sand Analyzer (RSA) was used to determine the grain size distribution of the sand fraction.

VIMS conducted vertical aerial imagery on two occasions that was used to determine shoreline position and vegetative communities. VIMS reported that historical aerial photographs provide evidence that vegetated, tidal marshes once were a more prominent feature along this shoreline; however, this habitat is rapidly being lost from the existing Saxis shoreline. Shoreline erosion has been extensive in the Saxis beach area over time. This is fully described in the without project condition section of this study

The Planning Guidance Notebook, ER 1105-2-100, Appendix F, Continuing Authorities, describes categories of projects funded using the Section 206 authority for restoration of aquatic ecosystem structure and function. This will usually include manipulation of the hydrology in and along bodies of water, including wetland and riparian areas. The Saxis Island Aquatic Ecosystem Restoration project was funded during the Federal Fiscal Year 1999 after approval of the Preliminary Restoration Plan (PRP), which determined a feasibility level study was warranted. The EC further defines eligibility criteria that must be considered. Project limits applicable to Section 206 projects may be designed to halt erosion or control sedimentation, if the primary purpose is to improve aquatic or terrestrial ecosystem structure and functions. This project is proposed with a multiple

resource focus objective with a particular thrust toward determining avoidance of potential impacts to the Federally-threatened Northeastern Beach Tiger Beetle. The project proposes creating additional favorable sandy intertidal areas that are foraging areas for this species. Additionally, this project is registered with Coastal America and is in keeping with its goals. Also, environmental impacts of structural measures and consideration of other less damaging alternatives were considered and determined less beneficial than what is proposed.

The Chesapeake Bay Shoreline Erosion Study, dated 1990, documents 45,000 acres lost to shoreline erosion over the past century. For comparative purposes, this acreage is equivalent to an area the size of the District of Columbia eroding into the Chesapeake Bay every 100 years. The documented shoreline erosion rates along the comparative reach of Saxis beach is similar to the study's findings of shoreline recession rates of 4 to 10 feet per year along some reaches in the Chesapeake Bay. This erosion results in a significant loss of valuable beach and wetland habitat (Ibison et al., 1990).

A problem directly related to shoreline erosion is the deposition of the eroded sediment into the Chesapeake Bay. Suspended sediment is one element of water quality that has been linked directly to the decline of SAV in the Saxis area. The Chesapeake Bay Shoreline Erosion Study documents that in an average year, about 4,700,000 cubic yards of shoreline material were estimated to be deposited in the Chesapeake Bay. This eroded sediment degrades the Chesapeake Bay's water quality and adversely impacts its living resources. The study went on to estimate that shoreline erosion contributions in the Virginia portion of the Chesapeake Bay was as much as 5 percent and 24 percent of the controllable nonpoint source nitrogen and phosphorus loads, respectively (Ibison et al., 1990). In Saxis Island, the type, knowledge of the sediment recesses, and, especially, the sources of sediments that feed the littoral system along that shoreline is well defined. This has allowed the District to appropriately locate the natural resource protection and enhancement measures we are proposing with this project.

Climate

The climate of Saxis Island on the Eastern Shore of Virginia is classified as modified continental with mild winters and warm and humid summers. The Chesapeake Bay is slow in reacting to atmospheric changes, contributing to the humid summers and mild winters. The average annual temperature over the northern half of the Eastern Shore in the vicinity of Saxis is approximately 58 degrees Fahrenheit (°F) with 103 °F and -5 °F, representing the highest and lowest temperatures of record, respectively. The average annual precipitation is approximately 42-1/2 inches and fairly evenly distributed throughout the year.

Tides in the waters surrounding the Eastern Shore are uniformly semidiurnal with a mean range of 2.4 feet (spring range of 2.9 feet) near Saxis Island. Tidal currents recorded in Tangier Sound, south and west of Saxis Island, average about 1.2 knots during flood tides and 1.1 knots during ebb tides.

The prevailing winds are from the south to southwest at an average annual velocity of about 10 miles per hour. Saxis Island and the Eastern Shore are vulnerable to hurricanes and

have experienced destruction from 10 major hurricanes between 1901 and 1986. Northeast storms that occur during the fall and winter account for more significant erosion than hurricanes. The 100-year flood plain encompasses those areas within the 11-foot contour on the bayside.

Land Use

Land use in Saxis is predominantly residential with commercial uses, which are associated with the seafood industry, concentrated in the harbor area. Public and semi-public uses include three churches, a park, a basketball court, and a disposal area for dredged material from the Starlings Creek channel. There are also several vacant parcels within the town limits, but various constraints prevent their development. No significant land use changes are anticipated in the near future because of the developed nature of the town and the physical constraints, such as hydric soils and a shallow water table, while limit development of the vacant land. Most future development will be of a redevelopment nature rather than new development. The town plan, adopted in 1997, shows minor changes, such as the creation of a separate category for commercial waterfront land use encompassing commercial, public use, and vacant land at the western end of the town and a category for parks and open space, which encompasses most of the vacant and public use land.

The main road, which connects the town to Route 13 and the rest of the Eastern Shore is Route 695, a rural road about 11 miles long. Most of the town's streets are maintained by the Virginia Department of Transportation, and many of these are in need of repair.

Socio-Economic Resources

The town of Saxis, which is part of Accomack County, was incorporated in 1959. It covers about one-third of a square mile, primarily along Pocomoke Sound. In 2000, the town's population was 337, an 8 percent decline from 1990 and the continuation of a trend of population decline that began in 1960 (US Census Bureau, 1999). As the population of Saxis has been decreasing, it has also been getting older with the out-migration of younger people and a declining birth rate. Accomack County, by contrast, has increased since 1970 with a 2000 Census population of 38,305 and an average annual growth rate of 1.9 percent since 1990.

The economy of Saxis is based primarily on the seafood industry, especially blue crabs that are caught in local waters and processed by local seafood companies. Many of the crabs caught between April and November are peeler crabs, which are held in floats until they shed and are sold as soft crabs. Much of the economic activity of the community is concentrated in the harbor area, adjacent to Starlings Creek. This is the location for both the boats that are berthed at the harbor and the seafood companies that pack crabs and other seafood primarily for the shipping to the northeast.

Data from the 1990 census show the importance of the seafood industry to the residents of the town. Twenty-six percent of the employed residents of the town were working in the agriculture, forestry, and fisheries category, which would be predominantly the fisheries industry for Saxis. This percentage compares to a figure of 9 percent for

Accomack County as a whole. Wholesale and retail trade combined provided 38 percent of the employment for Saxis, compared to 25 percent for Accomack County. Manufacturing and services provided much of the remaining employment for the town and the county as well. Figures for 1998 for Accomack County show slight declines since 1990 in agricultural, forestry, and fisheries; manufacturing; and construction employment and increases in the trade and services sectors with governmental employment stable (Bureau of Economic Analysis, 1999).

Income levels in Saxis in 1990, as measured by per capita income, were 16 percent below those of the county and 44 percent below the state average (US Census Bureau, 1999). Estimates for 1998 show Accomack County with a per capita income that was 68 percent of the state average and 70 percent of the national average (Bureau of Economic Analysis, 1999), indicating an area significantly less prosperous than the rest of the state.

Housing in Saxis is predominantly owner-occupied (86 percent) and single family as of 2000. As of 1990, 83 percent of the units were single family, 15 percent were manufactured or mobile homes, and only 1 percent multi-family. Most of the housing is old, having been built before 1920. The average value of the owner-occupied housing in Saxis was approximately half the value of owner-occupied housing in Accomack County.

HISTORICAL RESOURCES

The history of Saxis began in 1666, when it was patented by Englishmen, one of whom was named Robert Sykes. Originally the area was known as Sykes Island, which eventually evolved into Saxis Island. Initially much of the area was used to raise cattle, which provided beef, hides, butter, and cheese. By 1800, there were four families with a total population of 35 on the island. Even during the mid-nineteenth century, the island was so remote that the only communication and trade with the rest of the Eastern Shore took place by boat. Towards the late 1800's, the population increased, cattle farming declined because of space limitations, and seafood became the main livelihood for the residents. By 1884, a post office was established and a village road laid out, and in 1896, Sykes Island became known as Saxis Island. Although a "corduroy" or "washboard" road was built across Freeschool Marsh to connect Saxis with the mainland, most of the communication between the island and the mainland continued to occur by boat. The current causeway connecting Saxis to the mainland was constructed in 1925, and a channel was dug at the harbor on Starlings Creek in 1920, making the town accessible to larger boats and a larger seafood market.

The marsh adjacent to Saxis, Freeschool Marsh, was at one time owned by Samuel Sanford, a wealthy merchant who lived on the Eastern Shore. In 1712 he left the use and profits of this land for the schooling of poor boys in upper Accomack County, which continued until 1873, when the public school system was established. The land was sold, with the proceeds used for building a school on the island. No historic resources are found within or near the proposed project area, and the Virginia Department of Historic Resources concurs with a finding of no impact to historic resources (see in correspondence section of Final EA).

Although numerous archaeological sites have been found on the Eastern Shore, none have been recorded in the town of Saxis. The closest site to Saxis that has been recorded is located along the edge of the Freeschool Marsh.

RECREATION

The predominant recreation resources in the area are related to the Saxis Wildlife Management Area and the Chesapeake Bay. Birdwatching, hunting, fishing, and boating are available in the immediate vicinity. Public access to the water is available from Virginia Game and Inland Fisheries boat ramps in the Saxis Wildlife Management Area. Saltwater fishing opportunities include striped bass, flounder, gray and speckled trout, croaker, bluefish, black drum, and channel bass.

WITHOUT PROJECT CONDITION

PROBLEMS AND NEEDS

The process of evaluating the problems and needs of an area is facilitated by examining the resources and developmental trends of that area. Furthermore, this information is helpful in the formulation of various solutions that could address the needs that are identified in the study. Numerous resources were used to assess Saxis' Pocomoke Sound (western) shoreline from Starlings Creek northward to North End Point, including the 6,000 feet of shore within the town limits, the study area, which extends from the north end of the commercial wharf and bulkhead to the north end of the town limits. A brief presentation of the base conditions of the study area follows.

Saxis' shoreline is characterized as low marsh with narrow beach. Upland areas are generally densely-vegetated with the exception of a few lawn areas. The predominant vegetation along the island is the invasive species common reed grass *(Phragmites australius).* SAV existed in the nearshore region in the early part of this century, but VIMS documents its disappearance by 1965.

Historically, the Saxis shore has experienced erosion rates, which have resulted in a great loss of habitat and damage to the local ecosystem, as high as 4.9 ft/yr (1851 to 1942). Anthropogenic changes along the shoreline altered this rate in recent history when infilling and bulkheading of the industrial peninsula north of Starling Creek began in 1938. Historical aerial photos from VIMS indicate a dredged approach channel in 1955; however, records of dredging began in 1961 when the Federal project was moved into the Norfolk District from the former Washington District of the Corps of Engineers. Records at the Norfolk District show that sandy dredged material from the Federal channel was placed along Saxis' shoreline in 1965 and again in 1974. Dredged material has been placed in two upland placement sites in 1961, 1966, 1970, and from 1979 to the present (2001). VIMS documents that the sandy dredge material placed on the shoreline reduced the overall rates of habitat lossalong the shoreline by supplying material to the littoral transport system. Additionally, they describe the average erosion rate decreasing to about 1.2 ft/yr between 1942 and 1968, while the distal end of North End Point spit prograded at about 400 ft/yr at a rate of over 15 ft/yr. The North End Point spit has now accreted to a point where it has nearly closed off an embayment. The

average overall erosion rate, and concomitant habitat loss, had increased to 1.7 ft/yr between 1968 and 1986.

From 1986 to 1998, Saxis' shoreline regained a high, overall average rate of erosion of about 3.8 ft/yr, which is near the historical rates encountered between 1851 and 1942. A barge, grounded several years ago approximately in the middle of the town's shoreline, segmented the coast by acting as a detached breakwater. This allowed the deposition of sand salient in the lee of the structure that temporarily interrupted the littoral transport system. During this time period, the subaqueous sand bar grew over 600 feet off the distal end of North End Point spit almost closing off the embayment in the lee of the spit. This erosion has resulted in the loss of considerable acreage of beach and estuarine marsh and has created conditions inhospitable for SAV. The ecosystem outputs that were lost have been significant. For a successful project, the restoration of new habitat is needed, as is some means of protection from erosion. Otherwise, the restored habitats will likely erode away.

FUTURE WITHOUT PROJECT CONDITION

The without project condition is defined as a continuation of the loss of the fish and wildlife habitat, including that of the Federally-threatened Northeastern Tiger Beetle, which has already been lost or degraded by high wave energy and resultant high total suspended solids (TSS). These conditions have resulted in aquatic habitat with low species diversity and numbers, loss of SAV, and other problems related to high TSS. The following discussion of future conditions is based on a without project condition and assumes that the environmental quality benefits of a restored ecosystem will not be accomplished.

The town of Saxis shoreline that fronts the Chesapeake Bay is eroding at a severe rate. As evidenced in the Saxis Town Plan (Saxis Planning Commission, 1997), Saxis recognizes the importance of maintaining the integrity of state waters and the Chesapeake Bay to the citizens of the Commonwealth and Saxis. The town indicates that restoration of critical habitats, such as the grass beds, is essential for fostering increased fish and shellfish production in the area. While Saxis used to be economically-dependent on the harvesting of blue crabs, fish and oyster from the Chesapeake Bay, that situation is changing due to the decline in the Chesapeake Bay's water quality and fisheries (Saxis Planning Commission, 1997). Further negative impacts are expected without project implementation. It is highly likely that Saxis will lose the remnant beach it currently has, the Northeastern Tiger Beetle will be extirpated from the area, and erosion will commence on current riparian habitats. SAV will continue to be unable to recolonize the area and current open bottom habitat will only be able to support low populations of benthic infaunal organisms with little diversity.

Importance of Proposed Outputs

Estuarine areas, like those adjacent to Saxis Island, serve as important habitat, especially as spawning and nursery areas for Chesapeake Bay resources, such as finfish and crabs. In the 1987 Chesapeake Bay Agreement, the Chesapeake Executive Council agreed to "provide for the restoration and protection of living resources, their habitats, and ecological relationships." Since the agreement was signed, the Chesapeake Bay Program has been working to restore water quality and key habitats in the Chesapeake Bay. Evidence indicates

that SAV habitat is critical to sustaining populations; juvenile blue crab density is about 30 times greater in grass beds than adjacent unvegetated areas. They also grow faster in grass beds and are less likely to be subjected to predation. Protected shallow water habitat provides refuge for juvenile fish and blue crab to escape from predators, as well as foraging habitat for diving ducks that winter in the area. Shallow water areas are more productive than deeper waters because of greater penetration by sunlight and oxygen. Where vegetated by SAV beds, shallow water areas provide spawning, nursery, feeding, and refuge habitat for numerous species of waterfowl, finfish, and shellfish, and serve a critical role in cycling nutrients, stabilizing sediments, and controlling water turbidity in the estuarine ecosystem. SAV beds in the study area are considered to be a highly-significant resource. One of the main reasons the Northeastern Tiger Beetle is Federally-threatened is due to loss of open beach habitat with low levels of human activity. Saxis Beach currently provides minimal habitat for the Northeastern Tiger Beetle, and, if restored, is likely to augment the local population and possibly allow the Northeastern Tiger Beetle to successfully reproduce.

Chesapeake Bay as a Federal and State Resource

This project is in concert with the goals set forth by the Commonwealth's Chesapeake Bay Preservation Act and various management plans. For example, the blue crab fishery management plan, adopted in 1997 as part of the Chesapeake Bay Program, contained specific recommendations to bolster underwater grass beds, which are important to the survival of juvenile blue crabs, serving as critical nursery areas. In connection with the Chesapeake Bay Program's water quality improvement and habitat protection focus, all of the Chesapeake Bay Program's fishery management plans have taken on a broader scope to include specific habitat protection and restoration goals. In the spirit of the Commonwealth of Virginia's enactment of the Chesapeake Bay Preservation Act of 1988 (10.1-2100, et seq., of the Code of Virginia), the aquatic ecosystem restoration project, as proposed at Saxis, is in harmony with the ongoing cooperative efforts of the state and local governments, and will produce the primary benefit of aquatic ecosystem restoration.

PLAN FORMULATION

GENERAL

This section of the report presents the rationale for the development and refinement of alternative plans for the proposed aquatic ecosystem restoration project at Saxis Island, VA. The formulation and evaluation of possible alternatives are conducted in accordance with the US Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, dated 10 March 1983. In accordance with these Principles and Guidelines, alternatives were screened to arrive at plans most responsive to the problems and needs of the particular areas, giving consideration to their contribution towards the enhancement of the four accounts of National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). Being an ecosystem restoration project, development of a National Ecosystem Restoration (NER) plan is central to assess the potential benefits of the proposed project.

These four accounts were established to facilitate evaluation and display of the effects of alternative plans. They encompass all significant effects of a plan on the human environment as required by the National Environmental Policy Act of 1969 (42 USC. 4321 et seq.). They also encompass social well-being as required by Section 122 of the Flood Control Act of 1970 (Public Law 91-611, 84 Stat. 1823). The EQ account and NER plan show the significant effects on ecological resources that cannot be measured in monetary terms. The OSE account shows urban and community impacts and effects on life, health, and safety. The NED account shows effects on the national economy and can be used to establish Federal interest. In ecosystem restoration projects, EQ benefits are prioritized, and NED benefits are secondary. The RED account indicates that there is a positive impact of the NED plan on employment and income in the regional economy from construction and OMRR&R activities.

PLAN FORMULATION PROCESS

In general, the plan formulation process follows four major steps, as listed and summarized below. Again, this procedure is in accordance with the Principles and Guidelines and related regulations.

1. Step 1 is the identification of all possible measures, Corps or non-Corps, that have the potential to solve, either partially or totally, the problems of the study area. All measures identified are also screened for the purpose of determining their ability to address study objectives. Measures found to be highly impractical are eliminated at this stage.

2. Step 2 consists of the development of preliminary plans from those measures that passed the Step 1 screening. A description of environmental, social, and cultural concerns is presented. Preliminary or initial screening continues to be accomplished during this stage.

3. Step 3 consists of the evaluation of each remaining plan, including least cost comparisons, environmental assessment, and social and cultural concerns. Also accomplished during this step is the further reformulation of plans, as deemed necessary.

4. Normally, step 4 consists of the selection by the Corps of Engineers of the plan that best addresses the planning objectives and conforms with established planning criteria. In this instance the preferred plan is to construct eight breakwaters with attached sand tombolos and establish appropriate native vegetation along the shoreline of Saxis Beach.

Estuarine areas like those adjacent to Saxis Island serve as important habitat, especially as spawning and nursery areas for Chesapeake Bay resources such as finfish and crabs. The shoreline conditions along the island no longer can support the fundamental constituents of a structurally diverse estuarine ecosystem. In the 2000 Chesapeake Bay Agreement, the Chesapeake Executive Council agreed to "Restore, enhance and protect the finfish, shellfish and other living resources, their habitats and ecological relationships to sustain all fisheries and provide for a balanced ecosystem." Since the agreement was signed, the Chesapeake Bay Program has been working to restore water quality and key habitats in the Chesapeake Bay.

The Assistant Secretary of the Army, Civil Works, signed the Agreement of Federal Agencies on Ecosystem Management in the Chesapeake Bay, dated 14 July 1994, highlighting the Corps of Engineers as the lead agency in the "habitat restoration" arena. In accordance with that document, the proposed project would fall under the Chesapeake Bay Program's Habitat Restoration Strategy, which directs the Corps of Engineers to fully implement all habitat restoration authorities to improve the conditions of aquatic habitat in the Chesapeake Bay. Under Section 206 authority of Water Resources Development Act (WRDA) of 1996, a feasibility study would determine the Federal interest in improving aquatic habitat along Saxis Island.

The Saxis Island shoreline once provided valuable tidal marsh and shallow water habitat that served as nesting and foraging areas for a diverse array of fish and wildlife species, including Federal- and state-listed protected species. The once-evident vegetated tidal marshes and associated habitat that were the more prominent features along this shoreline are rapidly being lost. Based on existing historical data and field observations, it has been determined that much of the fish and wildlife habitat has been lost or degraded by high wave energy and resultant high suspended solids loads related to shoreline loss/erosion. These conditions have resulted in aquatic habitat with low species diversity and numbers, total loss of SAV, and other problems related to high suspended solids loads (Blankenship, 1998).

If no action is taken, physical losses through erosion will continue to degrade the area and result in even more loss of habitat. The project area will not naturally return to a productive state for fish, shellfish, SAV, or wetlands and will remain a degraded habitat.

PROJECT GOALS

This section discusses the project goals and objectives and includes planning constraints identified in the study to limit the field of alternatives.

The primary goal of this project is effective aquatic ecosystem restoration of estuarine marsh and SAV with a secondary goal of erosion control with a beach designed to achieve a high level of protection. This is in accordance with Section 206 of the WRDA 1996 (Public Law 104-305). This project is not associated with any Federal project. Through the District's evaluation process, the District compared various structural configurations and their relative impacts on, and potential benefits to, target species. It was anticipated early on that headland breakwaters, beach nourishment, and wetlands plantings would be utilized to realize project goals. Project objectives include:

- Restore the beach to historical width;
- Increase habitat diversity, including riparian, dune, beach, marsh, and SAV habitats;
- Reduce shore erosion/improve water quality;
- Increase wave sheltered shallow water habitat; and
- Avoid down drift shore starvation.

HABITAT EVALUATION AND PROJECT OBJECTIVES

The three major habitat types present in the study area, bay beach, tidal marsh, and shallow water were qualitatively evaluated to determine specific project objectives. Each of the three habitat types serves diverse functions, including fish and wildlife habitat, critical to the health of the overall estuarine ecosystem. For this reason, it was determined that the project should provide an equivalent degree of protection to each of the three existing habitat areas and would be evaluated in terms of habitat acres created. In accordance with the overall project goal of restoring aquatic ecosystem to Saxis Island through the creation of headland breakwaters, the project objectives were determined to be the five described above. Discussions of their habitat values and other functions as project objectives follow.

Increase Bay Beach

Along Saxis Island, bay beach suitable as nesting and feeding habitat for birds has largely been lost. Presently, Saxis' shoreline contains little favorable nesting and feeding habitat for colonial shorebirds, like the Least tern and Gull-billed tern, which are listed as Federal species of concern. With the exception of the narrow beach and non-vegetated intertidal sand community, the scarcity of scrub-shrub habitat also limits the use of the area by other colonial wading birds, such as great blue heron, great egret, snowy egret, and little blue heron. This loss of critical habitat is considered a major factor contributing to an overall decline in numbers of colonial water birds nesting in the Saxis Island region of Accomack County.

Important nesting area and feeding habitat for low-lying uplands provide nesting habitat for the Federal species of concern Diamondback Terrapin known to frequent Pocomoke Sound and surrounding areas, and the beach areas provide a substrate on which horseshoe crabs lay their eggs. Additionally, a high beach habitat along Saxis is conducive to Northeastern Beach Tiger Beetle reproduction.

The USFWS placed a high value on increasing the beach habitat. This was done to emphasize the benefit of maintaining/improving habitat for the Federally-threatened tiger beetle, and to perpetuate beach habitat for other species. Other reasons for this objective are: 1) it is the primary habitat there now, and it seems better to maintain/increase its value rather than convert to something entirely different; 2) it is a relatively uncommon habitat in the Chesapeake Bay; and 3) it is declining in many areas as erosion control projects are implemented. Because beach and dune habitat serve valuable habitat and protective functions, preservation of these resources was determined to be a key project objective.

Increase Habitat Diversity - Estuarine Marsh

Estuarine marshes provide habitat for a myriad of animal species and marine resources, including juveniles of species of regional commercial significance, such as bluefish and blue crab. Along Saxis' shoreline, filter feeders such as anchovies and menhaden; omnivores like the Atlantic silversides; and forage fishes, such as summer flounder and croaker, are also present. These tidal wetlands also provide vital support to the estuarine food web and to the estuarine ecosystem as a whole. Some historically-significant species found along Saxis, such as killifishes, are excellent prey for wading birds and forage

fishes, and their absence may influence the behavior or colonial waders along this reach of Virginia's eastern shoreline. The "diversity" portion of this objective refers to the project's potential for increasing the presence of four habitats, regularly flooded marsh, upper berm irregularly flooded, scrub-shrub, and breakwater within the project area.

The 5,574 acres of tidal wetlands and marsh surrounding the study area provide important environmental educational opportunities through bird watching. Part of the Saxis Wildlife Management Area that is administered by the Virginia Department of Game and Inland Fisheries could be expanded to add acreage along the shoreline for this purpose.

Because habitat diversity would be best served by increasing the presence of estuarine marshes within the footprint of the project, preservation and an increase of these resources was determined to be a project objective.

Reduce Shore Erosion/Improve Water Quality

Intense shoreline erosion rate over the past several decades, coupled with the significant negative impact of this on the water quality, has resulted in severe losses to SAV along the Saxis shoreline.

To reduce shore erosion/improve water quality objective, therefore, encompasses two major areas. The first aspect of this objective is to reduce the erosion of the upland and wetland habitats along the shoreline. Approximately 65 percent of the shoreline is wetland, and the balance is upland. The wetlands vary in their habitat quality but in general appear to have mediocre value due to the prevalence of the undesirable invasive reed, *Phragmites australis,* and the effects of ditching, diking, filling, and other human alterations. The upland is predominantly residential land characterized by grass lawns and patches of shrub-scrub vegetation. The second aspect under this objective is to improve water quality by reducing the input of sediment derived from shoreline erosion. This benefit would be primarily manifested by a localized increase in water clarity. The magnitude of this effect will be limited by the dominant effect of regional factors on water quality.

Because reducing shoreline erosion and increasing water quality is beneficial in the context of supporting healthy habitat suitable for shellfish, finfish, and other wildlife, this element of the project was determined to be a project objective. Additionally, and in connection with the Chesapeake Bay Program's water quality improvement and habitat protection focus, all of the Chesapeake Bay Program's fishery management plans have taken on a broader scope to include specific habitat protection and restoration goals.

Increase Sheltered Shallow Water

Creation of protected shallow water areas was determined to be a project objective because of the valuable functions this habitat type provides to the area. Protected shallow water habitat provides refuge for juvenile fish and blue crab to escape from predators, as well as foraging habitat for diving ducks that winter in the area. Where vegetated by SAV beds, shallow water areas provide spawning, nursery, feeding, and refuge habitat for numerous species of waterfowl, finfish, and shellfish, and serve a critical role in cycling nutrients,

stabilizing sediments, and controlling water turbidity in the estuarine ecosystem. SAV beds in the study area are considered to be a highly-significant resource.

This objective focuses on improving the habitat value of the nearshore shallows by reducing the wave energy. The high wave energy climate under the existing conditions tends to cause a relatively unstable bottom substrate, a high level of suspended sediments, and a physically demanding environment for nekton. A reduction in the wave energy should improve conditions for benthic invertebrates and small adult and juvenile fishes. It would also improve the potential for development of SAV.

Minimize Down Drift Shoreline Erosion

The objective of minimizing down drift shoreline erosion is intended to address the possibility that some of the alternatives, particularly the breakwaters without fill, could reduce the amount of littoral material that reaches the adjacent shoreline on the north side. The area of concern is a relatively short section of shoreline (approximately 3,000 feet), but it contains relatively high quality beach and marsh habitats.

Options Initially Screened Out

Several other plans were considered but were eliminated from further consideration during creation of the PRP. Other options initially considered included a continuous breakwater with beachfill behind it, beach nourishment alone, and a continuous breakwater with no fill behind it along the present shoreline. A continuous breakwater with beachfill behind it would have restored all 32 acres, but the beach habitat created would likely become colonized by scrub-shrub vegetation due to its protection from wave energy. The invasive common reed may also be able to colonize this type of highly-protected habitat. Historic photographic information indicates that a substantial portion of the area was once estuarine marsh as well as beach. Also, this option would not have provided any sheltered shallow water habitat that would allow SAV colonization. Overall ecosystem benefits would have been considerably less, and the cost would have been much higher to implement. It would also have been a much less natural shoreline configuration and would have completely starved any longshore sand transport down current. Beach nourishment alone, which would have included some vegetative plantings, was also considered. This option would have resulted in a highly natural shoreline profile, and project benefits, with the notable exception of the lack of sheltered shallow water habitat for SAV colonization, would have been realized. However, the local sponsor would be unable to repair this type of project if it were damaged in a storm, and the ongoing erosion issues (as no SAV would colonize the area) would likely damage this restored habitat over time. SAV provides important buffering from excessive wave energy and tends to stabilize nearshore sediments. A continuous nearshore breakwater was another option initially considered. This would be an invasive procedure, and while it would provide considerable shoreline protection, it would provide relatively few environmental benefits. The local sponsor desired a project with significant ecosystem benefits that restored lost nearshore habitat. This last option that was eliminated from further consideration would have provided shoreline protection but little else.

DESIGN OBJECTIVES

Given the regional significance of Saxis Island as diverse habitat for fish and wildlife, the goal for this ecosystem restoration project is to reestablish and maintain the Saxis Island estuarine marsh, shallow water, and bay beach habitat. The potential creation of habitat, particularly bay beach habitat, is viewed as the main benefit of any alternatives considered. Maintaining the various Saxis Island habitats requires shoreline stabilization structures to reduce wave energy during the 25-year design life of the project. A 25-year project life span was the period of time over which the project will have significant environmental benefits. This timeline was agreed upon as an appropriate timeline between USFWS and the Corps of Engineers and is in agreement with Corps of Engineers' planning policy (ER 1105-2-100, Page 2-11, dated 22 April 2000.) The method used to restore the aquatic ecosystem shall protect the Saxis Island habitats to the degree historically provided by the naturally occurring beach. Based on the elevations of remaining natural beach in the area, the proposed headland control should provide protection from wave and tidal action to an elevation of + 5.0 feet North American Vertical Datum (NAVD). The specific objectives established to meet the habitat restoration goal are constrained by the following economic, engineering, and environmental criteria, as per the requirements of Section 206 WRDA 1996.

- Construction of headland control breakwaters should create and protect Saxis Island habitats to the degree historically provided by expanding the beach, increasing habitat diversity, reducing shore erosion, and avoiding down drift shore erosion. The proposed system has 8 headland breakwaters (300-foot crest length), placed about 200 feet from the existing MLLW shoreline and spaced 450 feet apart. Relatively large tombolos will form in the lee of these long breakwaters enabling the establishment of shrub mix and high marsh grass habitats favorable to birds. Alteration of the wave climate behind the breakwaters will provide a protective barrier for the establishment of SAV.

- Placement of beach material or other construction must not occur over areas currently identified as estuarine marsh.

- The selected alternative should have a minimum 25-year design life.

BENEFIT ANALYSIS

In order to conduct an economic evaluation of the proposed alternatives that meets the specific objectives and constraints identified in the previous sections, the environmental outputs for each alternative must be identified and evaluated. An output can be defined as the result or benefit produced in order to achieve a planning objective.

The objective of this project is to restore the estuarine marsh, shallow water, bay beach habitat, and a more diverse ecosystem. The environmental output to address the project objectives of restoration of aquatic ecosystem habitats would be the area (in acres) of estuarine marsh, bay beach, and shallow water habitat created by each alternative.

From an ecological perspective, the proposed design provides the fundamental constituents of a structurally diverse estuarine ecosystem. The proposed habitat enhancement plan will produce approximately 32 acres of new or enhanced habitat. The stabilization structures and beachfill will displace some existing beach and shallow, sub-tidal bottom.

There will be some conversion of aquatic habitats to upland habitat, but there will be no net loss of habitat. This conversion represents a return to historical conditions. The bottom type will be restored from its present shallow open water, unvegetated status to a beach that will include sheltered and unsheltered shallow water habitat, potential SAV habitat, estuarine marsh, open beach, and scrub-shrub habitat types. A conversion of open bottom to these habitats will occur during construction. While the existing resident infaunal benthic community may be adversely affected, overall productivity, species diversity and numbers, Benthic Index of Biotic Integrity, and water quality is expected to increase. SAV will likely re-colonize the sheltered shallow water habitat created. Therefore, although adverse short-term impacts will occur to some fauna inhabiting the present substrate within the project area due to burial by the placement of beach sand and breakwater stone, long-term benefits associated with restoring Saxis beach greatly outweigh these impacts.

With the exception of the no-action alternative, all the headland control breakwaters alternatives will provide protection for varying areas of estuarine marsh, bay beach, and shallow water habitat. Therefore, secondary benefits of habitat creation were also evaluated. Each of the alternatives will create different amounts of beach habitat and protected shallow water habitat, as seen in the following table.

TABLE 2. RESTORATION OPTIONS AND BENEFITS CREATED BY ALTERNATIVES

PROJECT ALTERNATIVE	PROJECT OBJECTIVES					TOTAL SCORE
	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/Improve Water Quality	Increase Sheltered Shallow Water	Avoid Down Drift Shore Starvation	
	Rating X Weight Factor (1.0) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.3) = Product Score	
16 BW w tombolo	8 X 1.0 = 8	10 X 0.7 = 7	10 X 0.7 = 7	4 X 0.7 = 2.8	9 X 0.3 =2.7	27.5
8 BW w tombolo	10 X 1.0 = 10	9 X 0.7 = 6.3	9 X 0.7 = 6.3	4 X 0.7 = 2.8	10 X 0.3 =3	28.4
16 BW w salient	5 X 1.0 =5	8 X 0.7 = 5.6	8 X 0.7 = 5.6	7 X 0.7 = 4.9	6 X 0.3 = 1.8	22.9
8 BW w salient	7 X 1.0 = 7	7 X 0.7 = 4.9	7 X 0.7 = 4.9	7 X 0.7 =4.9	7 X 0.3 = 2.1	23.8
16 BW w/o fill	3 X 1.0 = 3	6 X 0.7 = 4.2	6 X 0.7 = 4.2	10 X 0.7 = 7.0	1 X 0.3 = 0.3	18.7
8 BW w/o fill	4 X 1.0 = 4	5 X 0.7 = 3.5	5 X 0.7 = 3.5	10 X 0.7 = 7.0	2 X 0.3 = 0.6	18.6
No Action	1 X 1.0 = 1	1 X 0.7 = 0.7	1 X 0.7 = 0.7	1 X 0.7 = 0.7	10 X 0.3 = 3	6.1

16 BW w tombolo = 16 breakwaters attached to the shore with sand tombolos
8 BW w tombolo = 8 breakwaters attached to the shore with sand tombolos
16 BW w salient = 16 breakwaters detached from shore, a sand extension (salient) will be placed behind the breakwaters extending from the restored shoreline partway out to the breakwater. There will be open shallow water between the salient and breakwater.
8 BW w salient = 8 breakwaters with sand salients placed behind them along the shoreline.
16 BW w/o fill = 16 breakwaters with no additional sand placed on Saxis Beach.
8 BW w/o fill = 8 breakwaters with no additional sand placed on Saxis Beach.

Bay beach along Saxis Island is important feeding and nesting habitat for a variety of species, including colonial shorebirds and the diamondback terrapin. Several protected colonial nesting shorebird species, including the piping plover, least tern, and black skimmer, nest on the bay beach adjacent to Saxis Island. Suitable beach nesting habitat is scarce in the study area. The availability of suitable beach nesting areas in the project vicinity is likely to be a limiting factor in the community of colonial nesting shorebirds. Because the created beach area is expected to provide nesting habitat for wildlife, such as shorebirds and diamondback terrapin, creation of these areas is considered a secondary project benefit.

Protected shallow water habitat serves as refuge for juvenile fish and shellfish and as foraging habitat for waterfowl. Where vegetated by SAV beds, shallow water habitat plays critical roles in nutrient cycling, foraging and refuge habitat, and sediment stability. SAV beds tend to occur in more quiescent or semi-protected back bay waters rather than in higher energy environments such as are found along the coast. Alteration of the wave climate behind the breakwaters will provide a protective barrier for the establishment of SAV. The project alternatives will result in the creation of additional protected shallow water areas behind the created bay beach and dune areas from what was previously higher energy, unprotected shallow water. Creation of protected shallow water habitat is expected to provide habitat value and is therefore considered a secondary project benefit.

Because the creation of bay beach and dune habitat and protected shallow water habitat will have a positive effect on protected species and other wildlife in the study area, the relative areas created were identified as components of the environmental output used in the economic evaluation. The other components of the environmental output, the areas of beach, estuarine marsh, and shallow water habitat protected, is based on the specific objectives of this project. The three habitat types were quantified in acres.

ECONOMIC ASSUMPTIONS

INTRODUCTION

This section summarizes the assumptions and procedures used in developing the costs for the breakwaters and wetland planting sites. All prices used in this analysis are in FY 2003 dollars, with a 5-7/8 percent interest rate used in present value and annualization calculations. The project-planning period is 25 years, with construction beginning in 2004. A 25-year life was used, as that is common among marine construction sites, and the benefits given to the Corps of Engineers from the USFWS were based on a 25-year project period. As the project costs and benefits are in current values, no inflation factor was added to the cost estimates, even though construction is not anticipated to begin for another year.

BREAKWATER CONSTRUCTION - COST ASSUMPTIONS

In June 2003, the Norfolk District Civil Works engineers provided construction costs for each of the six breakwater options. These project costs were revised and adjusted by the Norfolk District Cost Engineering Section. The construction costs for all of the six breakwater options include site preparation and earthwork. Site preparation costs include mobilization, brush clearing, timber matting, stone, erosion control, and demobilization.

Earthwork includes all costs for either excavation or filling, as applicable. Some example costs for an excavation site would include the actual excavation, hauling, and disposing of material. Examples of costs associated with a filled site would be costs associated with acquiring the material, transporting it to the site, and depositing it. For this project the majority of the earthwork costs will be filling costs, with material consisting of Class III riprap rock, geotextile fabric and beach sand. In addition, costs associated with access roads, staging areas and site surveys that would be necessary were included in the cost analysis.

LANDSCAPING - COST ASSUMPTIONS

In June 2003, the Norfolk District Cost Engineering Section developed prices for the planting to be done, based on guidelines and plans supplied by the Norfolk District Civil Works Section. These landscaping prices are assumed to cover the costs of purchasing, transporting, storing, and planting all of the shrubs, bushes, trees, and grasses. The landscaping costs are also assumed to cover the topsoil material needed for these plantings. The construction contractor will be responsible for a 90 percent survival rate on all of the plantings throughout the first 3 years.

ADDITIONAL COST ASSUMPTIONS

In addition to construction costs, costs associated with real estate acquisition have also been considered and identified. The total real estate costs are $9,000 and consist of obtaining the right of entry at five access points. However, as they would be the same for whichever alternative was chosen (insensitive to plan selection), they were not considered in the total costs used in the analysis. Rather, they were added to the total of the selected project after the economic analysis was conducted. Real Estate assumptions and estimates are defined in more detail in the Real Estate supplement, Appendix 3.

As this is an environmental restoration project, and there is an endangered species involved, a monitoring plan was needed. The details of this monitoring plan follow this economics section. Again, as the monitoring costs, which are $4,000 per year for the first five years, and once every five years thereafter, will be the same under all of the alternatives (insensitive to plan selection), they were not considered in the total costs used in the economic analysis. Rather, they were added in to the total cost of the selected plan after the analysis had been done.

Construction management costs were also included in total project costs, after the NER Plan was selected. Construction management costs were 9 percent of the total construction costs, which is $199,099. These costs were insensitive to plan selection, as they were proportional among alternatives.

Potential conflicts with existing utility lines, including telephone, gas, electric, sewer, storm, cable, and water were considered. No specific utilities have been identified that would be affected by construction. However, a 15 percent construction contingency has been included in the construction costs, in order to cover any unforeseen expenses.

DESCRIPTION OF FORMULATION ALTERNATIVES - BREAKWATER CONSTRUCTION AND PLANTINGS

Introduction

Six different breakwater alternatives were developed, as well as the no action plan. There were three different types of breakwater options - tombolo, salient, and no fill - each with a 16 and 8 breakwater option. The no action plan, although it had a cost of zero, did produce some environmental benefits. The environmental benefits are reported as a product score provided by the USFWS. The seven alternatives had different product scores, as the habitats produced by the different options would provide varying amounts of environmental benefits.

Other options initially considered included a continuous breakwater with beachfill behind it, beach nourishment alone, and a continuous breakwater with no fill behind it along the present shoreline. The continuous breakwater with beachfill behind it would have restored all 32 acres but only as beach habitat. Historic photographic information indicates that a substantial portion of the area was once estuarine marsh as well as beach. Also, this option would not have provided any sheltered shallow water habitat that would allow SAV colonization. Overall ecosystem benefits would have been considerably less, and the cost would have been much higher to implement. It would also have been a much less natural shoreline configuration and would have completely starved any longshore sand transport down current. Beach nourishment alone, including some vegetative plantings, was also considered. This option would have resulted in a highly natural shoreline profile, and project benefits, with the notable exception of the lack of sheltered shallow water habitat for SAV colonization, would have been realized. Further, the local sponsor would be unable to repair this type of project if it were damaged in a storm, and the ongoing erosion issues (as no SAV would colonize the area) would likely damage this restored habitat over time. A continuous nearshore breakwater was another option initially considered. This would be an invasive procedure, and while it would provide considerable shoreline protection, it would provide relatively few environmental benefits. The local sponsor desired a project with significant ecosystem benefits that restored lost nearshore habitat.

Description of Costs

In order to determine the average annual costs for each alternative, the implementation costs and the Plans and Specifications (P&S) costs were derived. The implementation costs consist of the costs of construction costs (site prep and earthwork), and the associated planting costs. Each of the 6 breakwater options would use the same amount of rock and would cost the same, as would each of the eight breakwater options. However, for each of the three different fill options, the amount of sand used would vary. In addition, depending on the amount of fill used, the number of plantings that would be done would vary, as different habitats would be created. A 15 percent contingency cost was added to the total construction costs, which included the implementation costs, planting costs, staging areas, access roads and survey costs. A breakdown of all of these costs can be found in Table 8 and Table 9 in Appendix 2, Economics and Benefits Analysis.

Once the costs for each of the six alternatives were determined, the associated P&S costs, and the interest during construction were added, in order to calculate the total costs. The average annual equivalent costs were derived, based on a 25-year project life, using a 5-7/8 percent discount rate and October 2002 (Fiscal Year 2003) price levels. These values can be found in Table 10 in Appendix 2.

Description of Environmental Benefits

USFWS rated the environmental benefits with a product score (see Table 2). This product score consisted of an environmental benefit rating from 0 to 10, with 10 being the most environmental benefits possible, and multiplying the rating score by a weight factor of 0 to 3, with 3 being the most weight given to that benefit. The product scores provided by the USFWS were assumed to be the scores at the end of the 25-year life of the project. In order to account for the entire life of the project and to derive the average annual benefits, a growth or decay rate was applied to each of the environmental benefits for six of the seven alternatives. The no action plan was assumed to have constant benefits over the life of the project.

The growth or decay rates were determined by researching the literature and determining when the habitat would attain its full environmental potential. These rates were then inputted into the function: $Q(t) = Q_o * e^{k*t}$, where Q_o is the initial quantity of the benefit; k is the growth or decay rate; and t is time. Depending on the structure that was built, the habitats would change over time, providing varying environmental benefits. For all of the 6 breakwater alternatives the benefits were assumed to increase exponentially, although at different rates, except for the 8 and 16 no fill alternatives for increasing beach habitat. This was assumed to slowly decrease over the project life, as there will be no fill to capture any sand for beach substrate. In addition, the 16-tombolo option was assumed to have a slight decay rate over the project life for increasing sheltered shallow water habitat. This was because the 16 tombolos would provide too much protection and, therefore, capture so much sand that there would be a decrease in the shallow water habitat. In addition, the 16-tombolo option was also assumed to start with exponential growth of beach habitat, but after year 10, the beach habitat would begin to decrease. This is because although more sand would be deposited, it is assumed to become vegetated by the upland vegetation over time.

The quantity at time (t) was found for each environmental benefit, for all seven alternatives. This was done each year for 25 years and also for the initial year zero. The benefits from each year were then totaled and divided by 26, in order to derive the average annual benefit, for each benefit, for each alternative. These values can be found in Appendix 2, while the average annual benefits are summarized in the following table. The no action plan resulted in 6.1 environmental benefits, which were assumed to be constant over the 25-year life of the project. As there were positive environmental benefits from the no action plan, that value of 6.1 was subtracted from all of the average annual benefits of the 6 other alternatives before any analysis was conducted. Therefore, the no action plan was assumed to have zero environmental benefits. This was necessary in order to conduct the cost effectiveness and incremental cost analysis.

Table 3. AVERAGE ANNUAL ENVIRONMENTAL BENEFITS

Alternative	Increase Beach Habitat	Increase Habitat Diversity	Improve Water Quality	Increase Shallow Water Habitat	Avoid Down Drift Starvation	Total	Total Minus No Action Plan
16 BW Tombolo	5.15	6.57	4.84	2.80	2.62	21.99	15.89
8 BW Tombolo	6.52	5.91	4.44	2.795	2.92	22.58	16.48
16 BW Salient	3.46	5.39	4.14	4.92	1.73	19.63	13.53
8 BW Salient	5.03	4.72	3.75	4.92	2.03	20.44	14.34
16 BW No Fill	3.28	5.14	3.21	0.29	0.25	12.18	6.08
8 BW No Fill	4.38	5.79	2.80	0.59	0.54	14.09	7.99
No Action	1	0.7	0.7	0.7	3	6.1	0

The following table shows the growth and decay rates assumed for each of the environmental benefits. A negative rate indicates a decay, or decrease, in that benefit, while a positive rate indicates that it will increase exponentially at that rate. A rate of zero indicates that there was no growth or decay and that the benefits remained constant.

Table 4. THE GROWTH AND DECAY RATES ASSUMED FOR EACH OF THE ENVIRONMENTAL BENEFITS

Alternative	Increase Beach Habitat	Increase Habitat Diversity	Improve Water Quality	Increase Shallow Water Habitat	Avoid Down Drift Starvation
16 BW Tombolo	Year 0-10 = 0.8 Year 11-25 = - 0.007	Year 0-5 = 0.05 Year 6-25 = 0.005	Year 0-10 = 0.4 Year 11-25 = 0	Year 0-25 = - 0.0001	Year 0-5 = 0.05 Year 6-25 = 0.0002
8 BW Tombolo	Year 0-10 = 0.8 Year 11-25 = 0.007	Year 0-5 = 0.05 Year 6-25 = 0.005	Year 0-10 = 0.35 Year 11-25 = 0	Year 0-25 = 0.0001	Year 0-5 = 0.05 Year 6-25 = 0.0001
16 BW Salient	Year 0-10 = 0.4 Year 11-25 = 0.005	Year 0-5 = 0.03 Year 6-25 = 0.003	Year 0-10 = 0.25 Year 11-25 = 0	Year 0-25 = 0.0001	Year 0-5 = 0.05 Year 6-25 = 0.002
8 BW Salient	Year 0-10 = 0.3 Year 11-25 = 0.005	Year 0-5 = 0.03 Year 6-25 = 0.003	Year 0-10 = 0.2 Year 11-25 = 0	Year 0-25 = 0.0001	Year 0-5 = 0.05 Year 6-25 = 0.001
16 BW No Fill	Year 0-25 = - 0.007	Year 0-5 = 0.01 Year 6-25 = 0.001	Year 0-10 = 0.2 Year 11-25 = 0	Year 0-25 = 0.001	Year 0-5 = 0.05 Year 6-25 = 0.02
8 BW No Fill	Year 0-25 = - 0.007	Year 0-5 = 0.01 Year 6-25 = 0.001	Year 0-10 = 0.15 Year 11-25 = 0	Year 0-25 = 0.001	Year 0-5 = 0.05 Year 6-25 = 0.01
No Action	Year 0-25 = 0	Year 0-25 = 0	Year 0-25 = 0	Year 0-25 = 0	Year 0-25 = 0

COST EFFECTIVENESS AND INCREMENTAL COST ANALYSIS

In order to make more informed decisions with regard to the development and eventual selection of the NER Plan, the study team has utilized two decision-making techniques called cost effectiveness analysis and incremental cost analysis, as required by Corps of Engineers Planning Guidance. Cost effectiveness analysis identifies that plan, or plans, that produces the greatest level of environmental output for the least cost. The environmental outputs, however measured, in turn reflect the environmental benefits such as

biological diversity, fish and wildlife habitat, nutrient cycling provided by the plan or plans. Incremental cost analysis examines the changes in costs and the changes in environmental outputs for each additional increment of environmental output. The "Best Buy" plans represent those plans that produce the greatest increases in environmental outputs for the least increases in costs. The Norfolk Planning Resources Branch, using the software program IWR-Plan, accomplished these two analyses in house. The IWR-Plan software is produced by The Institute of Water Resources (IWR), a Field Operating Activity (FOA) of the Corps of Engineers.

Breakwater Construction and Plantings

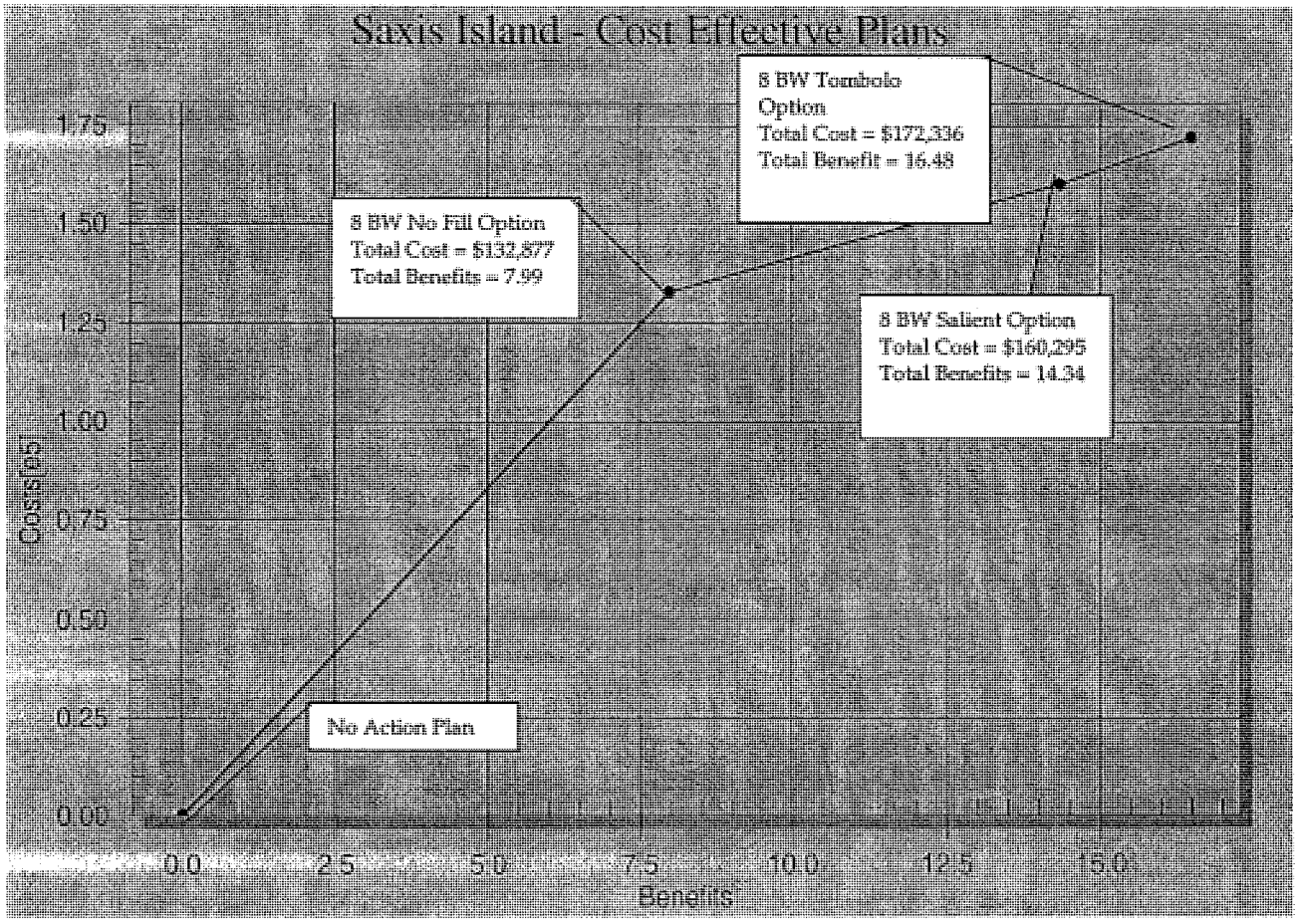
The average annual equivalent costs and average annual benefits (product scores) were used to conduct cost effectiveness and incremental cost analyses for the seven alternative breakwater plans. As the 7 plans are mutually exclusive (either an 8 or 16 breakwater option would be built, with only 1 of the three fill options), the 2 analyses were relatively straightforward.

Cost effectiveness analysis indicated that the three fill options for the eight breakwater alternatives (eight breakwater tombolo, eight breakwater salient, eight breakwater no fill), as well as the no action alternative, are cost effective. That is, each of those four plans is the least costly means of providing the associated level of output or benefit. The following table shows the average annual benefits (product scores), annual costs, and average costs per product score for each of the seven alternatives. Figure 1 shows the cost effective analysis results, showing average annual environmental benefits (horizontal axis) and average annual costs (vertical axis) of the eight breakwaters with the three fill options, and the no action plan.

Table 5. BREAKWATER CONSTRUCTION AND PLANTINGS - RESULTS OF COST EFFECTIVENESS ANALYSIS

Alternative Plan	Product Score (Benefits)	Total Annual Costs ($)	Average Cost (Cost/ Benefit) ($)
No Action	0	0	NA
16 BW No Fill	6.08	169,288.33	27,843.48
8 BW No Fill	7.99	132,877.27	16,630.45
16 BW Salient	13.53	198,960.12	14,705.11
8 BW Salient	14.34	160,295.26	11,178.19
16 BW Tombolo	15.89	211,554.03	13,313.66
8 BW Tombolo	16.48	172,335.95	10,457.28

Figure 1. COST EFFECTIVE PLANS - BREAKWATER CONSTRUCTION AND PLANTINGS



After conducting the cost effectiveness analysis, incremental cost analysis examines the changes in costs and changes in environmental benefits (product score) for each additional increment of output. The first step is, starting with the No Action plan, to calculate the incremental change in costs and the incremental change in benefits of moving from the No Action plan to each of the cost effective plans. The incremental change in costs is divided by the incremental change in benefits (outputs) to generate an average cost per unit of output for each of the four cost effective plans. The plan with the lowest overall average cost per unit of output, moving from the No Action plan, is the first "Best Buy" plan. Referring to the following table, it can be seen that in this case the eight breakwater with tombolo fill is the first "Best Buy" plan, as it had the lowest overall average cost with $10,457.28. Both the eight breakwater with no fill and the eight breakwater with salient fill alternatives had higher overall average costs ($16,630.45 and $11,178.19, respectively) than the eight breakwater with tombolo fill alternative. Therefore the eight breakwaters with no fill alternative and the eight breakwaters with salient fill are not "Best Buy" plans. There are

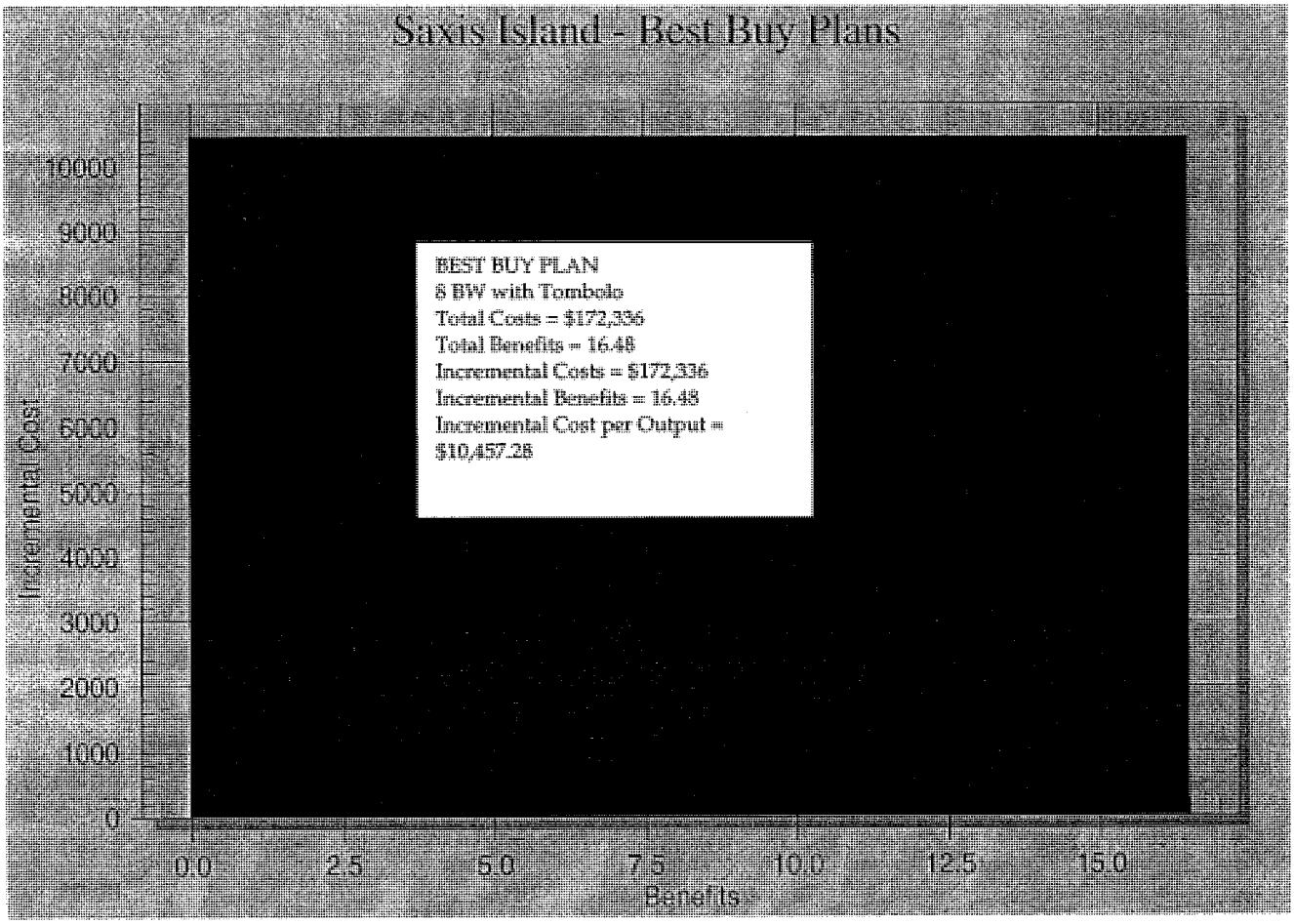
more environmental benefits to be gained at a lower cost per unit of output from the eight breakwaters with tombolo fill alternative.

After the first "Best Buy" plan is identified, subsequent incremental analyses is done to calculate the change in costs and change in outputs of moving from the first "Best Buy" plan to all of the remaining (and larger) cost effective plans. However, the eight breakwater with tombolo fill alternative has the highest level of environmental benefits (product score) with 16.48. This alternative, is therefore, the only "Best Buy" plan after the No Action plan. The following table summarizes the information from the incremental cost analysis of the breakwater and plantings alternatives, and Figure 2 displays the information graphically.

Table 6. BREAKWATER CONSTRUCTION AND PLANTINGS - RESULTS OF INCREMENTAL COST ANALYSIS (BEST BUY PLAN)

Alternative Plan	Product Score (Points)	Annual Costs ($)	Average Cost ($/Point)	Incremental Cost ($)	Incremental Product Score	Incremental Cost Per Unit ($/Point)
No Action	0	$0	N/A	$0	0	N/A
8 BW Tombolo	16.48	$172,335.95	$10,457.28	$172,336	16.48	$10,457.28

Figure 2. BREAKWATER CONSTRUCTION AND PLANTING ALTERNATIVES - "BEST BUY" PLAN



Summary

The results of the cost effectiveness and incremental cost analyses indicate that there are four cost effective plans, of which there is only one "Best Buy" plan in addition to the No Action plan. This "Best Buy" plan is the eight breakwaters with tombolo fill alternative and is the recommended plan for this project. This plan provides the most units of environmental benefits (16.48) at the lowest cost for that amount of benefits. The recommended plan is worth it, as it will protect and provide for the greatest amount of beach habitat over the life of the project. This habitat is essential for the endangered tiger beetle, which is rare along coastal Virginia. Additionally, the recommended plan provides for the greatest amount of habitat diversity and water quality improvements among the cost-effective plans. The recommended plan is acceptable, efficient (cost effective), and complete.

AVERAGE ANNUAL BENEFITS AND COSTS

The following table displays the average annual cost summaries for the recommended NER plan, as well as the average annual benefits. Total project costs are estimated to be $3.24 million. This includes construction, P&S, real estate, monitoring, and construction management costs. More detailed information on how the average annual costs and benefits were derived can be found in Appendix 2.

Table 7. EQUIVALENT TOTAL AND ANNUAL COSTS AND BENEFITS FOR THE NER PLAN (FY 2003 Price Level, 25-Year Period of Analysis, 5.875 Percent Discount Rate, Base Year 2004)

Discount Rate: 5-7/8%		
Period of Analysis: 25 years		
Price Level: FY 2003		
Base Year: 2004		
BENEFITS		
Average Annual Functional Score		22.58
Average Annual Score Minus No Action Plan Score		16.48
TOTAL PROJECT COSTS		
Initial Construction		$2,212,209
	Annualized =	$152,552
Preconstruction, Engineering and Design		$199,000
	Annualized =	$13,723
Interest Durning PED		$17,197
Interest During Construction		$70,692
Total Interest		$87,889
	Annualized =	$5,724
Construction Management		$199,099
	Annualized =	$13,730
Operations and Mangement		$500,000
	Annualized =	$17,146
Real Estate		$9,000
	Annualized =	$621
Monitoring		$36,000
	Annualized =	$1,539
Total Average Annual Costs		**$205,036**
Total Project Costs		**$3,243,197**

Interest During Construction

Interest during construction (IDC) for the recommended breakwater and planting alternative is estimated to be $70,692, based upon a construction period lasting 12 months and a 5-7/8 percent interest rate. Additionally, the costs for P&S were estimated to be $199,000 and would require nine months. Based on a 5-7/8 percent interest rate, the IDC for P&S is $17,197. This gives a total of $87,889 in interest during construction for the recommended plan. Construction for all of the 6 breakwater alternatives and plantings is assumed to occur in a 12-month period, and P&S was assumed to take 9 months for each alternative as well. IDC was therefore assumed to be proportional among all alternatives for plan formulation. Plan selection was, therefore, insensitive to these costs, although IDC was included in the total costs before the recommended plan was chosen. Total average annual costs, including IDC, are estimated to be $205,036.

THE SELECTED PLAN

General Description

Based on the results of the economic analysis, the most cost effective plan that also meets the project goal and aquatic ecosystem restoration objectives is the Best Buy Plan, the construction of eight breakwaters with attached sand tombolos and native vegetative plantings. This alternative calls for the installation of shoreline stabilization structures with beachfill that will displace a commensurate amount of existing beach and sub-tidal bottom. The proposed structural solution would provide approximately 15.1 acres of intertidal and subaqueous structure for use by littoral marine fauna and wading birds, while cost effectively providing the important secondary benefit of creating bay beach, scrub-shrub, and dune and protected shallow water habitat. A total of 32 acres of habitat will be restored and/or enhanced by the proposed project.

The proposed system has 8 headland breakwaters (300-foot crest length) placed about 200 feet from the existing MLLW shoreline and spaced 450 feet apart. Tombolos/salients will be artificially formed in the lee of the long breakwaters, enabling the establishment of shrub mix and high marsh grass habitats favorable to birds. Alteration of the wave climate behind the breakwaters will provide a protective barrier for the establishment of SAV. The proposed system is shown on Exhibits A and C.

The preferred plan alternative should not require renourishment. With continued maintenance and allowing for creation of beach along the shoreline, this alternative is ultimately expected to provide 18 acres of beach and dune habitat. In addition to the beach habitat, it would provide approximately 14 acres of enhanced aquatic habitat.

Expected Environmental and Cultural Resource Impacts and Benefits

Impacts to significant resources related to the following activities will be evaluated in this section: (1) breakwater and tombolo construction; and (2) road and staging area construction.

SAV, Wetlands, and Aquatic Resources

Due to lack of SAV in the area, there will be no adverse impacts to existing resources. Moreover, there will be a positive impact due to the restoration component of the project whereby approximately 1 acre (35,000 square feet) of SAV habitat will be constructed. Additionally, SAV may be able to colonize much of the sheltered shallow water habitat for a total SAV gain of 13.9 acres over the expected project life. Initial aerial estimates of other habitats created include 8.8 acres of beach, 1.9 acres of tidal marsh, 1.7 acres of dune, 3.4 acres of scrub-shrub, and 2.5 acres of breakwater (hard substrate) habitat. Aerial estimates of other habitats created at 25 years include 8.4 acres of beach, 2.1 acres of tidal marsh, 1.9 acres of dune, 3.6 acres of scrub-shrub, and 2.5 acres of breakwater (hard substrate) habitat.

Construction of the breakwaters will directly impact 2.5 acres of benthic habitat during time of construction due to direct impacts, such as crushing and smothering, and indirect impacts from change of substrate. However, the breakwaters themselves will provide significant habitat for sessile invertebrate attachment, as well as shelter and forage area for mobile shell and finfish.

Construction of the tombolos and associated beach/dune habitats will involve the placement of material on and seaward of the existing Saxis shoreline. The effect of the placement of this material is minimal when material placed on the beach is similar (in grain size and other physical characteristics) to that which already comprises the beach. The placement of material on the beach will result in some loss of beach organisms by burial and nearshore organisms by increased turbidity effects. Impacted populations should be able to recover quickly. Several environmental studies of beach nourishment indicate that there are no detrimental long-term changes in the beach fauna as a result of beach nourishment. The effects of the deposited sediments, when similar in composition (grain size and other physical characteristics) to existing beach material (whether indigenous or introduced by an earlier nourishment or construction event), do not appear to have the potential to reduce the numbers of species or individuals of beach infauna.

The beach/shoreface profile will be slightly altered due to the proposed project. Beach zones can be defined based on the relationship between faunal composition and water levels (i.e., above high tide, intertidal, and subtidal). Altering the slope of the profile would necessarily alter the proportion of surface available for each zone; hence, altering the proportion of fauna typifying each zone (Thompson, 1973). Ultimately, beach slope is established and reestablished by a number of variables including wave period, wave amplitude, water table height, and composition of the material. Introduction of new material comparable to existing material, regardless of material orientation at the time of deposition, also minimizes changes in beach slope.

Following initial placement of beachfill, there will be an increase in longshore sediment transport away from the filled beach. This movement will probably have beneficial impacts on downdrift beaches.

Breakwater Construction. Potential adverse effects to local fauna associated with breakwater construction and post-construction include increased turbidity, direct encounters with falling boulders, burial, and substrate changes. Increased turbidity has the potential to lower dissolved oxygen, but due to the dynamic nature of the surf zone and nearshore, these effects will be minor and short-lived. Local populations should be able to recover quickly.

A permanent substrate change will occur with the construction of breakwaters from a relatively soft sandy bottom to a hard, impenetrable rock substrate. The adverse effects will only impact those benthic areas that are under the footprint of the breakwaters. Cursory examination of existing nearby jetties and breakwaters support sessile species such as oysters, mussels, barnacles, anemones, hydroids, bryozoans, and algae. Other species that utilize breakwaters and jetties are those found nestled in between the boulders themselves, which provide refuge from predators and/or foraging areas. Such species include the blue crab and Atlantic starfish.

With this new habitat type and subsequent colonization by new species to the study area, it is anticipated that all levels of the food chain will benefit. Avian fauna will likely utilize the exposed portions of the breakwaters as resting areas and utilize surrounding waters as a food source. It is anticipated that net benefits will accrue to the biota in the study area with the placement of breakwaters.

The breakwaters will alter the existing longshore transport in the local area. Also to be considered are a 200-foot community fishing pier proposed by the town of Saxis as well as a jetty proposed by the town of Saxis and the Corps of Engineers in the vicinity of Starlings Creek. Overall, the impacts to the longshore transport have been evaluated and determined to be slightly positive. This is due to a small loss of placed sand from the tombolos to the longshore sand transport system over the life of the project.

Many positive impacts are expected from the restoration and stabilization of the Saxis shoreline. The reestablishment of almost an acre of SAV beds will provide excellent habitat for juvenile fishes and shellfish. Reestablishment of the marsh habitat will restore habitat for waterfowl and other birds, mammals, and invertebrates.

Operation, Maintenance, Repair, Rehabilitation, and Replacement

Monitoring of the project will be conducted by the Corps of Engineers for 25 years following completion of construction. OMRR&R of the project could involve some non-native vegetation removal (*phragmites*). This is estimated to cost $1,000 per year for the life of the project. Based on the evaluation of geomorphology near Saxis Island, periodic beach replenishment should not be necessary as the beach feature, as designed at +6 feet MLLW, it will address most expected storm events. Replacement of rock structure is not expected, as it should remain intact in any storm event. However, an additional annualized cost of $19,000 in OMRR&R costs are included to cover any costs associated with repair and/or replacement of the beach or sand structures. Although the breakwaters are designed to withstand a 100-year event, there is a 1 percent chance per year that they could be destroyed. Additionally, the sand tombolos are designed to withstand a 20-year storm event; therefore,

there is a 5 percent chance that they will need to be replaced every year. Although the OMRR&R costs are not expected to be used in excess of $1,000 per year, they are included to cover any unforeseen events.

Social Impacts

The recommended plan would not have any significant adverse effects. The main effect would be a change in the appearance of the shoreline with the construction of the breakwaters and tombolos. From the landward side, the appearance of the shoreline will change from a narrow sandy beach to wider areas of wetlands, vegetation, and sandy beach. The breakwaters themselves should not be visible from the shore since the height of the fill material behind the breakwaters will be 1 foot higher than the height of the breakwaters. Vegetation will further obscure any possible view of the breakwaters. From the water side, the breakwaters will be visible. They will extend about 3-4 feet above the water surface at MLLW.

Cultural Impacts

It is not anticipated that the recommended plan would have any significant adverse effects on historical resources. There are no known resources in the project area, and it is unlikely that there are any resources in the affected area that could be discovered by traditional archaeological techniques. The project area is located in shallow water (1-2 feet), and, thus, not accessible by traditional excavation techniques. Any watercraft that might have sunk in the vicinity would most likely be visible because of the shallow depths. Additionally, the shoreline in the project area has been highly erosional in nature, reducing the potential for significant intact sites.

Expected Economic Impacts

Positive economic impacts may result from restoration of historical shallow water and wetland areas. Benthic organisms and fish are expected to benefit, which will contribute to recreational and commercial fisheries, although economic impacts to fish and wildlife resources are not expected to be quantifiable. No incidental economic benefits, which are costs not incurred as a result of the project, were identified.

Design Parameters

Because this is an aquatic ecosystem restoration project, the project was designed with a life of 25 years rather than the Corps' traditional 50-year project life. This design life was selected as the maximum reasonable expected life-span for the headland control breakwaters.

Construction

Prior to construction, additional surveying and subsurface investigations will be performed. Based on the results of the surveying, the final alignment of the proposed breakwaters will be selected. Results of the subsurface investigation will be used to evaluate the potential for settlement of the project.

The general construction sequence will be as follows:

- Subgrade preparation (either excavation or filling to reach the desired subgrade elevation);
- Installation of the rock breakwaters;
- Artificial beachfill for tombolos/salients; and
- Vegetative planting.

Consistency with Project Purpose

Projects authorized by Section 206 of the WRDA of 1996 are not limited to ecosystem protection, restoration, and creation projects because there is no connection with Federal navigation projects. This study proposes that headland control structures and an artificially filled beach profile be designed to address habitat deficiencies and their restoration. Implementation of the project will not detrimentally impact navigation.

Expected Environmental and Cultural Resource Impacts and Benefits

The proposed aquatic ecosystem restoration project is expected to benefit the Saxis Island estuarine ecosystem by restoring the high quality fish and wildlife habitat. In general, adverse impacts associated with the project are expected to be minor and temporary in nature. There will be some conversion of aquatic habitats to beach habitat, but there will be no net loss of habitat. This represents a return to historical conditions. Project construction activities will cause minor and short-term increases in turbidity, resulting in localized and temporary adverse impacts to water quality.

Construction activities will result in the mortality of benthic organisms inhabiting the subtidal and intertidal zones where the breakwaters will be placed. Overall, these adverse impacts to benthic organisms are expected to be minor. Most of the organisms inhabiting these areas are mobile and will be only temporarily displaced during the duration of construction. The fish and wildlife species using the project area may be disturbed by the staging and construction activities, causing them to avoid the site. The disruption is expected to be relatively minor and will cease when the project is finished. It is expected that mobile species will relocate to adjacent habitat areas during construction and will return upon project completion.

By restoring valuable habitat, the project will benefit the myriad of fish and wildlife species that use the Saxis Island tidal marshes, shallow waters and beach and dune areas for all or part of their life cycle. The numbers of colonial and beach nesting birds using the area are expected to increase with the accretion of additional beach and dune. Beach and dune habitat suitable for nesting is increasingly scarce, and dredged material placement areas are frequently utilized as nesting habitat by these species.

The restoration project is expected to positively affect the identified Federally-threatened Northeastern Tiger Beetle as well as state protected species by restoring previously existing habitat and creating additional habitat for nesting and foraging.

SAV beds occur in shallow back bay waters of the study area and are not present in the higher energy environment where construction activities will take place. Adverse impacts to SAV beds during construction are therefore not expected to occur. The project will serve to restore quiescent conditions favorable SAV beds to the project area. The project will benefit Freeschool Marsh surrounding Saxis Island, by protecting its habitat resources.

Based on the benefits that will result from this project, the Norfolk District has submitted this project for inclusion in the Coastal America program. Coastal America is a multi-agency partnership whose purpose is to protect, preserve, and restore the Nation's coastal ecosystems; to facilitate collaboration and cooperation in the stewardship of coastal living resources; and to provide a framework for action that produces results to serve as models for effective management of coastal living resources.

Costs

The total project cost for the recommended modification, which includes costs for preparation of the plans and specifications, construction of the project, OMRR&R, and monitoring for the first 5 years, and every 5 years thereafter, is estimated to be $3.24 million. There is no incremental cost associated with this project. The total costs, less OMRR&R and IDC is estimated to be $2.66 million. Of this total, 65 percent will be Federally-funded, and 35 percent will be funded by the non-Federal sponsor. A 15 percent contingency has been included. A summary of costs is shown in Table 7. The average annual project cost is estimated to be $205,036 (at a 5.875 percent Federal discount rate). The estimates are based on October 2003 (FY 2003) price levels.

Final Environmental Assessment

Aquatic Ecosystem Restoration Project,

Saxis Island, Virginia

Prepared by

Norfolk District
US Army Corps of Engineers
Norfolk, Virginia

August 2003

AQUATIC ECOSYSTEM RESTORATION PROJECT,
SAXIS ISLAND, VIRGINIA
ENVIRONMENTAL ASSESSMENT

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FINDING OF NO SIGNIFICANT IMPACT
AQUATIC ECOSYSTEM RESTORATION PROJECT
SAXIS ISLAND, VIRGINIA

I have reviewed and evaluated the Environmental Assessment for this project in terms of the overall public interest. The possible consequences of the alternatives (including the no action plan) were considered in terms of probable environmental impact, social well-being, and economic factors. The proposed project involves the construction of 8 stone, detached breakwaters, with approximately 18 acres of intertidal, riparian, and beach habitats created shoreward of the breakwaters. Overall this project will provide approximately 32 acres of habitat for the flora and fauna of the Saxis Island ecosystem.

During this study, the environmental impacts of the proposed project were not found to be significant. There would be some loss of the existing benthos in the footprint of the breakwaters, and a conversion of subaqueous habitat to intertidal and beach habitat would occur as well. This existing habitat is not unique and would be replaced by more diverse, productive habitat. This conversion actually represents a return to more historical conditions. Water quality impacts are expected to be minor and short-term; long-term impacts are expected to be positive after the establishment of the project.

Since the no action alternative would lead to the continued degradation of the nearshore environment, including further loss of wetland habitats, this alternative was not chosen. The other structural alternatives were not selected because they involved higher costs per unit environmental benefit. The expected long-term positive environmental effects from breakwater and tombolo construction are greater than the negative impacts resulting from construction activities. Because of lack of significant impacts, an Environmental Impact Statement will not be required.

8/27/03
Date

Yvonne J. Prettyman-Beck
Colonel, Corps of Engineers
District Engineer

FINAL ENVIRONMENTAL ASSESSMENT
SECTION 206 AQUATIC ENVIRONMENTAL RESTORATION
SAXIS ISLAND, VIRGINIA

1.0 PROPOSED ACTION

As depicted in Figure 1, the project considers the placement of eight segmented offshore breakwaters along approximately 6,000 feet of intertidal shoreline located on the western boundary of the Town of Saxis, VA. The placement of the breakwaters would result in the restoration of approximately 32 acres of previously lost or degraded wetland or subaqueous habitat. Each breakwater will be made from stone and the headland breakwaters of a 300-foot crest length will be placed about 200 feet from the existing mean lower low water (MLLW) shoreline and placed 450 feet apart. And 110,000 cubic yards of sand will be placed behind the breakwaters. This sand will be placed to form distinct tombolos behind each breakwater and will connect the restored shoreline to the breakwaters. This material will be placed in such a way to allow successful plantings of 1.9 acres of estuarine intertidal *Spartina spp.* marsh. Much of the created beach area will be sloped to allow sufficient wave energy to strike it and maintain its unvegetated state. A +6 ft MLLW berm will be created as well to address 25-year storm event, although the entire proposed system as designed would withstand a 100-year storm event, with possible need for replacement of sand and vegetation within the system. This should ensure that the restored habitats will remain over time with little maintenance or need for additional beach nourishment. The aerial extent of the proposed aquatic ecosystem of salt marsh and submerged aquatic vegetation (SAV) lies within a 32 acre footprint adjacent to 6,000 feet of shoreline. The placement of the breakwaters would result in the restoration of approximately 18 acres of previously lost or degraded wetland or subaqueous habitat through the creation of tombolos in the lee of the breakwaters and by the strategic placement of sand. The breakwaters would also protest the existing remnant wetlands and beach, which are currently eroding at a rate of up to 4.9 feet per year.

The project site is immediately northeast of two existing Federal projects. One is a timber tongue-in-groove bulkhead that was constructed by the Norfolk District under Section 114 authority in 1986 along the Chesapeake Bay (Pocomoke Sound) side of the public landing. The other Federal project, located adjacent to and immediately southwest of the bulkhead, is the Starlings Creek Federal Navigation Project, originally a Congressionally-authorized project constructed under authority of the River and Harbor Act of 1935, with its Harbor of Refuge constructed under Section 107 authority in 1965.

2.0 NEED FOR AND OBJECTIVES OF ACTION

Study Authority and Purpose

This study was conducted under authority of Section 206 of the Water Resources Development Act of 1996 (Public Law 104-305), as amended, and is part of the Continuing Authority Program. The study to investigate aquatic ecosystem restoration was requested by the Town of Saxis through a letter of intent dated 19 February 1998.

A Section 206 Preliminary Restoration Plan was prepared in September 1998 to address the project's potential environmental benefits and outline future progress. Based on expected benefits, Federal approval indicates approval to progress to the feasibility phase.

The purpose of this Final Environmental Assessment (EA) is to evaluate the environmental impacts associated with various alternatives and the proposed plan for the aquatic ecosystem restoration along the Saxis Island shoreline and to determine if these impacts are severe enough to require preparation of an EIS. The evaluations are based on Federal, state, and local statutory requirements and an assessment of Corps of Engineers environmental, engineering, and economic criteria.

Public Concerns and Planning Objectives

The Town of Saxis' shoreline, which fronts the Chesapeake Bay, is eroding at a severe rate. With a rate of 3 feet per year considered severe, the 4.9 feet per year long-term erosion rate reported by Hobbs et al. (1975) indicates that the Town of Saxis has a severe erosion problem. As evidenced in the Saxis Town Plan (Saxis Planning Commission, 1997), Saxis recognizes the importance of maintaining the integrity of state waters and the Chesapeake Bay for the citizens of the Commonwealth and Saxis. The Town indicates that restoration of critical habitats such as the grass beds is essential for fostering increased fish and shellfish production in the area. While Saxis used to be economically dependent on the harvesting of blue crabs, fish, and oyster from the Bay, that situation is now changing due to the decline in the Bay water quality and fisheries (Saxis Planning Commission, 1997).

The Norfolk District Engineer is responsible for conducting the overall study in cooperation with the Executive Committee comprised of representatives of Technical Services Division, Planning Branch, and the Mayor, Town of Saxis. An Advisory Committee was also formed comprised of field-level representatives from the Town of Saxis; the Norfolk District; applicable state and Federal agencies; and the Virginia Institute of Marine Science (VIMS). This Advisory Committee determined that the appropriate aquatic ecosystem restoration project, as proposed at Saxis, is in harmony with the ongoing cooperative efforts of the state and local governments, and will produce the primary benefit of aquatic ecosystem restoration. The US Fish and Wildlife Service (USFWS) prepared a planning aid report that assisted Norfolk District in determining the environmental benefits of the proposed plan.

This project is in concert with the goals set forth by the Commonwealth's Chesapeake Bay Preservation Act, Chesapeake Bay Agreement, and various management plans. For example, the blue crab fishery management plan, adopted in 1997 as part of the Bay Program, contained specific recommendations to bolster underwater grass beds, which are important to the survival of juvenile blue crabs, serving as critical nursery areas. In connection with the Bay Program's water quality improvement and habitat protection focus, all of the Bay Program's fishery management plans have taken on a

broader scope to include specific habitat protection and restoration goals. In the spirit of the Commonwealth of Virginia's enactment of the Chesapeake Bay Preservation Act of 1988 (10.1-2100, et seq., of the Code of Virginia), the aquatic ecosystem restoration project as proposed at Saxis is in harmony with the ongoing cooperative efforts of the state and local governments and will produce the primary benefit of aquatic ecosystem restoration.

Public Involvement

Coordination has occurred between representatives of the Norfolk District Corps of Engineers and the local sponsor, as well as with those Federal, state, and local agencies that have regulatory authority within the project area. Data has been obtained through previous and ongoing studies conducted by VIMS in the project area. Coordination with representatives from the USFWS and the Department of Agriculture, Consumer Protection Services, was vital in determining avoidance of potential impacts to the Federally-endangered northeastern beach tiger beetle (*Cincidela dorsalis dorsalis*).

The Final Feasibility Study and Final EA will be made available to the public and will be coordinated with appropriate Federal, State, and local agencies.

3.0 ALTERNATIVE PLANS

Plans Considered in Detail

In the evaluation of possible restoration of aquatic and wetland habitats along the Saxis shoreline, seven plans emerged for consideration. The first two plans involved the construction of either 8 or 16 stone breakwaters with no associated fill. The third and fourth plans involved the construction of either 8 or 16 stone breakwaters with fill placed for salient formation. The fifth and sixth plans involved the construction of a series of 8 or 16 stone breakwaters and placement of sand in a tombolo formation, and the final option considered was the no-action alternative.

Each plan was thoroughly analyzed with respect to environmental benefits provided and the cost associated for each increment of benefit. The resulting analysis indicated that four plans are cost effective, while the remaining plans all provided the same amount or less of environmental benefits for more cost. Therefore, those plans were no longer considered. The economic analysis identified one plan as the "best buy" plan, and this plan (eight breakwaters with attached sand tombolos) has become the US Army Corps of Engineers (USACE) preferred plan.

The no-action plan was also evaluated. The no action plan would allow the current severe erosion rate (up to 4.9 ft./year) of wetlands, beach, and nearshore lands to continue unabated. This would eventually result in the total loss of the current beach area and associated habitat at Saxis Island. A small beach or mudflat would likely remain along whatever shoreline configuration is present. Nearby waters would be impacted by increased sediment loads and turbidity. It would also cause the extirpation of the local

population of the Federally-threatened beach tiger beetle. As very few environmental benefits could be ascribed to allowing the current conditions at Saxis to continue for the next 25 years, the no-action plan was also eliminated from further evaluation.

Selected Plan

The VIMS developed a shoreline management plan for the Town of Saxis that involved an environmental restoration component. The selected plan is based upon the recommendation made in that report (Hardaway, et al, 1999a) and involves the placement of eight segmented offshore breakwaters along the approximately 6,000 feet of intertidal shoreline located on the western boundary of the Town of Saxis, VA. The 8 breakwater option was preferred over the 16 breakwater option primarily due to the high probability that the 16 breakwaters would provide a higher degree of shoreline protection than is actually desired. The result of implementing the 16 breakwater design would likely result in a decrease of open beach habitat over time, due to the lack of wave energy entering the system. The 16-breakwater option, if implemented, would allow vegetation to colonize the open beach over time. Therefore, the 8-breakwater plan was preferred. Each breakwater will be made from stone, and these headland breakwaters, each of a 300-foot crest length, will be placed about 200 feet from the existing MLLW shoreline and placed 450 feet apart. Relatively large tombolos will be created in the lee of these breakwaters, which will provide for the creation of shrub mix and high and low marsh grass habitat. The project area will be designed to maintain significant acreage of open beach habitat, and the acreage of open beach habitat will increase from the without project acreage of 0.8 acre to 8.8 acres, post construction of the preferred plan. At the end of a 25-year period, we anticipate the beach to have stabilized at 8.4 acres. Additionally, SAV establishment will likely occur where the wave energy is dissipated, and 110,000 cubic yards (CY) of sand will be placed behind the breakwaters. This sand will be of similar grain size and composition to the sand present on the beach, and the dredged material will only be utilized for the project if it meets these criteria. After construction and the bottom conditions have stabilized, the part of the project may involve direct seeding of SAV in these areas or transplanting a number of SAV plants. A +6-foot MLLW berm will be created as well to address 25-year storm event, although the entire proposed system as designed would withstand a 100-year storm event, with possible need for replacement of sand and vegetation within the system. This berm should protect the restored habitat and allow sufficient sheltering from wave energy for SAV to colonize the area, other water quality parameters permitting. A considerable amount of SAV is nearby (along the shore of several areas in the Pocomoke Sound), and SAV propagules should settle within the sheltered area created by the MLLW berm. The aerial extent of the proposed aquatic ecosystem of salt marsh and SAV lies within a 32 acre footprint adjacent to 6,000 feet of shoreline. The placement of the breakwaters would result in the restoration of approximately 18 acres of previously lost or degraded wetland or subaqueous habitat (Hardaway et al., 1999a).

The selected plan provides the maximum environmental benefit for the least incremental cost. It involves the placement of 8 segmented breakwaters, placement of 110,000 CY of sand as tombolos behind the breakwaters, and planting of certain

appropriate native vegetation types. Please see Tables 1 and 2 and Figures 1 and 2 for additional details. The vegetated plantings include establishment of a low and high marsh habitat, which will include *Spartina alterniflora* in the lowest portion, *Spartina patensa* in the higher portion, and American Beachgrass, *Ammophilia breviligulata*, and Bitter panicgrass, *Panicum amarum*, in the highest, only irregularly flooded portions. Approximately 8.8 acres of open beach habitat will be initially established and maintained due to sufficient levels of wave energy allowed within the restored beach system. This is anticipated to decline to 8.4 acres by year 25 of the project, due to a small amount of erosion and replacement by other habitat types. A scrub-shrub habitat will also be established, and this habitat will be planted with a variety of native species. These include Beach plum, *Prunus maritima,* Black cherry, *Prunus serotina;* Wax myrtle, *Myrica cerifer;* Yaupon holly, *Ilex vomitoria;* Inkberry, *Ilex glabra;* Red cedar, *Juniperus virginiana;* Choke cherry, *Aronia meanocarpa;* Blueberry, *Vaccinium corybosum;* Groundsel tree, *Baccharis halimifolia;* Switchgrass, *Panicum virgatum*; and Persimmon, *Diospyros virginiana.* This scrub-shrub habitat will be 3.4 acres, and increase to 3.6 acres once established by year 25 of the project post construction. The selected plan fulfills the goals of the project by restoring habitat along the Saxis shoreline for aquatic, intertidal, and coastal terrestrial species.

4.0 ENVIRONMENTAL SETTING

Geophysical Setting

The Chesapeake Bay occupies a drowned river valley excavated by the Susquehanna River and its tributaries during the late Pleistocene. Melting glacial ice caused an increase in sea level approximately 10,000 years ago, and this resulted in the formation of the Chesapeake Bay. The water depth within the Chesapeake Bay is relatively shallow and averages about 20 feet deep. The Chesapeake Bay is a large estuarine system, with semi-diurnal tides. Salinity varies considerably within the Chesapeake Bay, decreasing with distance from the Atlantic Ocean. The salinity of waters in the project area varies from between 14 and 20 parts per thousand (PPT), depending on season and precipitation.

The Eastern Shore is a narrow peninsula that forms the easternmost land area in Virginia. The State of Maryland binds it to the north, the Atlantic Ocean to the east, and the Chesapeake Bay to the south and west. The total land area is about 60 miles long and 17 miles wide for a total land area of approximately 835 square miles. The land throughout is predominantly flat, low lying terrain with many small bays, inlets, tidal creeks, and wetland areas. The elevation varies from sea level to approximately 50 feet above sea level.

The Town of Saxis is located on Saxis Island, Accomack County, VA, which is part of the Eastern Shore of Virginia. Saxis Island is a low, upland feature on the open Pocomoke Sound side of Freeschool Marsh. The small sand-ridge island faces Chesapeake Bay to the west and is joined to the Eastern Shore on the east by Freeschool Marsh, an extensive, 5,574 acre salt marsh designated as Saxis Wildlife Management

Area. Pocomoke Sound lies to the north of the island. Saxis Island is 1.5 miles long and 0.3 miles wide. Elevations on the island generally are below 5 feet, National Vertical Geographic Datum (NGVD) with no ground elevations reaching 10 feet, NGVD. Slopes are effectively 0 percent, which in combination with low elevation, make Saxis susceptible to flooding and poor drainage. Most of the town lies within the 100-year floodplain. The only areas outside the floodplain are the dredge material placement site and a small area near the intersection of Saxis Road and Lee's Circle, where the elevation is eight feet above sea level (Saxis Planning Commission, 1997). The Town of Saxis, therefore, is extremely flat, low lying and featureless. For further information, please see Figure 1.

The Town of Saxis is situated entirely within the Coastal Plain Physiographic Province. Largely unconsolidated gravels categorize this province and loams of marine and fluvial origin that were deposited by glacial melt waters during the Pleistocene epoch. Sediments may be sandy, silty, clayey, loamy or a combination, with a great deal of variation within a relatively small area. These sediments rest upon a metamorphic/ igneous basement rock and vary in thickness from a few feet at the fall line near Richmond, VA, to approximately 12,000 feet on the Virginia continental shelf. Soils are generally fertile, and wetlands, both tidally influenced and freshwater, are relatively abundant throughout the province (USACE, 1996).

All soils within the Town of Saxis are either hydric or highly permeable, with a depth to groundwater of 0-36 inches. Seven soil types are mapped in Saxis, including Bojac Sandy Loam, Chincoteague Silt Loam, Dragston Fine Sandy Loam, Magotha Fine Sandy Loam, Munden Sandy Loam, Nimmo Sandy Loam, and Udorthents and Udipsamments Soils (fill and spoil areas). Most of the soils have restricted land uses due to their hydric characteristics.

Saxis' shoreline is characterized as a low marsh with a narrow beach, with the beach overlying a marsh substrate along most of the shoreline. An unpublished dissertation by Rosen (1976) of VIMS classifies Saxis' shoreline as being a predominantly marsh shore along the southern half and an impermeable beach along the northern half with marsh shore recurring across North End Point. Impermeable beaches are defined as being a type of beach composed of a sand veneer overlying impermeable, pre-Holocene sediments having high clay content (Hardaway et al., 1999a).

Sediment analysis along the Saxis shoreline by Hardaway et al. (1999a) indicates a fairly typical model of estuarine beach sediments in the Chesapeake Bay (Hardway et al., 1991). The coarsest sands are found where turbulence is greatest, typically at the base of the subaerial beach where sand is deposited abruptly, thereby creating a toe. Offshore, the sand becomes finer. Coarser particles also collect on the berm crest. The sediment analysis of the Saxis shoreline indicate that the midbeach and toe contain the most gravel, while offshore sediments are much finer, containing significant percentages of silt and clay. The sample with the largest percentage of the finest particles was taken just offshore of the eroding drudge spoil containment area. The amount of silt and clay

decreases away from this profile to the south, which indicates possible offshore and some northerly transport of eroded fine material (Hardaway et al., 1999a).

The VIMS Shoreline Management Plan with Habitat Enhancement study (Hardaway et al., 1999b) describes the nearshore environment within the study area to be relatively shallow with no bars, which indicates a general lack of sand available in the littoral system. However, from 1986 to 1998, a subaqueous bar grew over 600 feet off of North End Spit, nearly closing off the embayment in the lee of the spit at the time of the report. Presently, the bar has closed off the embayment. This bar is likely the result of the eroding spoil placement area located adjacent to the shoreline. According to historical records researched during the VIMS study, some SAV beds and sands were visible in aerial photos from 1955 and 1960 but had disappeared by 1965 (Orth and Moore, 1984).

Saxis' shoreline has experienced a historical rate of erosion of 4.9 feet per year over the years 1851 to 1942. More recent rates reflect anthropogenic influences, including the Federal navigation project at Starlings Creek. Dredged material associated with the Starlings Creek Federal navigation project was placed along the shoreline in 1965 and 1974. In 1961, 1966, 1970, and from 1979 to the present (2001), the dredged material has been placed in two upland placement sites at Saxis. The placement of the spoil along the shoreline likely contributed to the decrease in erosion rates to approximately 1.2 feet per year during the period 1942-1968. During this time, the distal end of North End Point Spit prograded 400 feet at a rate of 15 feet per year. However, between 1968-1986, rates of shoreline erosion had increased to 1.7 feet per year and from 1986 to 1998 rates rose to approximately 3.8 feet per year.

A barge that grounded several years ago nearly in the middle of the town's shoreline acted as a detached breakwater, with deposition of sand in the lee of the structure. The resulting sand salient disrupts the longshore transport system that has widened the beach to the south. The impact to the north is the opposite, where the beach becomes narrower, and the underlying marsh peat substrate is intermittently exposed, although the entire shoreline may lose its beach temporarily during storms. During this time, a subaqueous sandbar has developed more than 600 feet off the distal end of North End Point spit closing off the embayment in the lee of the spit. A site visit on 11 July 2000 revealed that the barge has been removed.

From south to north along the Saxis shoreline, man made structures include the Federal bulkhead project adjacent to Starlings Creek, a broken concrete revetment adjacent to the bulkhead, a gabion sill, an area of dredge spoil containment next to the shoreline, the grounded barge, and an area of concrete well casings at the northernmost end of the project study area. The broken concrete revetment, gabion sill, and concrete well casings were installed prior to 1985. Additionally, two outfalls and two drainage ditches were noted during the Shoreline Management Plan with Habitat Enhancement study (Hardaway et al., 1999a). Slightly north of the immediate study area is the North Point Spit, which includes a dredge cut as well as a groinfield and bulkhead.

Hydrologic Resources

The surface water of the Eastern Shore as a whole is important to the economics and recreation of the region, but due to lack of perennial freshwater flow the surface water cannot be used as a potable water source. Therefore, the focus on surface water quality is in the context of supporting healthy habitat suitable for shellfish, finfish, and other wildlife. Water quality is monitored by the Virginia Department of Health, Division of Shellfish Monitoring, as well as the Virginia Department of Environmental Quality (VDEQ). The Virginia Marine Resources Commission (VMRC) maintains catch data for clams for the Greater Saxis Ecosystem, although no shellfish were found during the VIMS study. During a Comprehensive Water Resource Reconnaissance Study conducted by USACE in 1996, correspondence with the Commonwealth of Virginia, Eastern Shore Health District indicates that the Saxis community has very limited areas of soil capable of treating and disposing sewage. Moreover, shellfish beds in Starlings Creek and areas of Pocomoke Sound north of the study area have been condemned. No freshwater streams or natural water bodies exist within Saxis. Pocomoke Sound, Starling Creek, and Freeschool Marsh surround the town. Saxis lies entirely within the Chesapeake Bay watershed.

Groundwater is relied upon exclusively for potable water needs. The aquifer system beneath the Eastern Shore consists primarily of sediment of varied permeability, which includes a generally unconfined surficial aquifer (the Columbia aquifer), underlying confined aquifers, and intervening confining units. The confining units are characterized as "leaky," whereby they inhibit, but do not prevent, the movement of water between aquifers. The only fresh groundwater is found in the surficial aquifer, and the uppermost confined aquifers, including the Yorktown-Eastover aquifers. No public water supply system is reported for the Town of Saxis (USACE, 1996). Drinking water for Saxis' 367 residents is obtained from private wells (Saxis Planning Commission, 1997). Threats to groundwater quality include saltwater intrusion, septic tank effluent, and agricultural sources.

Physical Setting

The climate of the Eastern Shore of Virginia is classified as modified continental with mild winters and warm, humid summers. The Chesapeake Bay and Atlantic Ocean that bound the Eastern Shore are slow to react to atmospheric changes, contributing greatly to the humid summers and mild winters. The average annual temperature over the northern half of the Eastern Shore is approximately 58 degrees Fahrenheit (°F) with 103 °F and –5 °F representing extremes. The warmest month, July, averages temperatures of 78 °F, and the coolest month, January, average 39 °F. Average annual precipitation is approximately 42 ½ inches and is fairly evenly distributed throughout the year. Snowfall is infrequent, generally occurring in light falls, which normally melt within 24 hours (USACE, 1996). The mean tidal range, in the project area, is approximately 2.3 feet.

Prevailing winds are from the south to southwest at an average annual velocity of about 10 miles per hour (USACE, 1996). The Town of Saxis is subject to severe coastal storms, such as hurricanes and northeasters. A study of tracks of all tropical storms for which there is a record indicate that once a year on average, a tropical storm of hurricane force passes within 250 miles of the area and poses a threat to Saxis. While hurricane season officially lasts from May to November, nearly 80 percent of the storms occur during the months of August, September and October, with 40 percent occurring within September alone (USACE, 1996).

Most recently, Hurricane Floyd caused significant financial damage to various structures in Saxis, and the shoreline was further degraded by the September 1999 storm. Northeasters are also cyclonic storms, but they originate with little warning along the middle and northern Atlantic coast. Accompanying winds are not of hurricane force but are persistent. While northeasters can occur at any time of year, they are more common in the winter months. The orientation of Saxis makes winds from the northeast "off shore," so they are not as damaging to the Bayside town as winds from the northwest (USACE, 1996).

5.0 ENVIRONMENTAL RESOURCES

Biological Resources

The flora and fauna found in the study area correspond to that of a typical, non-vegetated bay beach ecosystem, which has been developed and manipulated by the placement of dredge spoil. During the Shoreline Management Plan with Habitat Enhancement study prepared by VIMS, major vegetated communities were characterized. The vegetation along the shoreline is dominated by common reed (*Phragmites australis*), with stands of emergent marsh, beach, scrub-shrub, and old field communities also found. Characteristic vegetation of these communities is found in Table 2.

Currently, no SAV beds are reported, by VIMS' most recent SAV inventory, to exist along the Saxis shoreline. However, review of historical photography from 1851 to 1998 indicates that they were present, along with extensive intertidal marshes, but both communities had disappeared by 1965.

Avian fauna was recorded during winter, spring, and summer surveys. Observations indicate that a diverse assemblage of birds, including year-round residents, wintering birds, migrants, and summer nesting birds, make use of the study area and surrounding areas. As described by Hardaway et al (1999a), with the exception of the narrow beach and non-vegetated intertidal sand community, Saxis' shoreline contains little favorable bird habitat. Phragmites, the dominant community, provides little functional habitat for the vast majority of locally-common birds, such as the willet, killdeer, dunlin, and spotted sandpiper, as well as those species using the Atlantic flyway such as the American black duck, pintail, black scoter, and canvasback. Additionally, the scarcity of scrub shrub habitat limits the use of the area by colonial wading birds, such as great blue heron, great egret, snowy egret, and little blue heron.

Marine resources are extremely important to the economy of Saxis, as evidenced by the community's economic dependence on oystering, crabbing, and fishing (Saxis Planning Commission, 1997). Recent sampling by VIMS included filter feeders (anchovies and menhaden), omnivores (Atlantic silversides), and other fishes (summer flounder and croaker). Anchovies are the dominant species in the spring, with anchovies and silversides as co-dominant in the summer. Relative abundance of summer flounder and Atlantic Croaker were greater during the spring sampling, and relative abundance of Atlantic menhaden, and blue crabs were greater during the summer sampling. No species collected was considered unusual or unique to the ecosystem. However, no killifishes were collected, and the absence of species, such as the sheepshead minnow, banded killifish, striped killifish, and the mummichog, was not expected. Killifishes are known to spawn within areas containing aquatic vegetation (SAV beds or intertidal marshes), and either attach their eggs to aquatic plants or bury them in quiescent waters. The study area shoreline does not provide much suitable habitat for killifishes; only a few areas of low marsh outcrops are present along the shoreline. However, while large numbers were not expected, neither was the complete absence. It may be surmised that due to the proximity of good habitat elsewhere in the Greater Saxis Ecosystem, killifishes may be utilizing peripheral areas. Since historical aerial photographs of Saxis indicate that the shoreline was once fronted by vegetated, intertidal marsh, and SAV beds, killifishes and other absent species endemic to this kind of habitat, such as the mosquitofish *(Gambusia holbrooki)*, may have been present. Hardaway et al (1999a) contend that killifishes are excellent prey for wading birds, and forage fishes and their absence may influence the behavior or colonial waders along this reach of shoreline.

During the recent survey conducted by VIMS, no live clams or oysters were collected, with only sparse cultch observed at a few locations. Hard clams, *Mercenaria mercenaria,* prefer the shallow, saline-filled waters of the Chesapeake Bay. This complete absence was unexpected as VMRC has catch data for the Greater Saxis Ecosystem (Hardaway, et al, 1999a). Such absence may indicate lack of suitable habitat as conditions along the Saxis shoreline have degraded.

Virginia Department of Health records indicate that the project area is bounded to the south by 48 acres of condemned shellfish grounds in Starlings Creek and bounded to the north by 1665 acres of condemned shellfish grounds in the Pocomoke Sound. These grounds have been condemned due to high coliform bacteria counts, probably caused by leaking septic systems within the Town of Saxis. The hydric soils of the local area are unsuitable for septic tank filter fields. Public funds are not available to install a wastewater treatment facility, so this situation is likely to continue (Saxis Planning Commission, 1997). It is anticipated that the lease for the 48 acres of condemned shellfish grounds within Starlings Creek will not be renewed due to the contamination. These shellfish grounds would then convert to VMRC regulated open bottom. Offshore areas of the Saxis coastline are not condemned. VMRC indicates the presence of public clamming grounds off the Saxis shoreline as well as three small private leases (VMRC, 1999).

Documentation of raccoon, deer, and fox tracks indicate usage of the study area by these mammals. Observations of horseshoe crab corpses, toads and muskrats were also recorded (Hardaway et al, 1999a).

Threatened and Endangered Species

Species of concern located in the project area include the Federally-threatened Northeastern beach tiger beetle, *Cincindela dorsalis dorsalis* (Gowan and Knisley, 2001). Sandy intertidal areas are foraging areas for tiger beetles, which require approximately 2-3 meters of beach above mean high water (MHW). They feed, mate, and bask at the water's edge during the summer. Foraging occurs in the damp sand of the intertidal zone; prey species include lice, fleas, and flies. Adults also regularly scavenge dead crabs, fish, and other sea life (New York State Department of Environmental Conservation (NYSDEC), 1999). A survey conducted by Dr. C. Barry Knisley of Randolph-Macon College on 11 July 2000 indicated the presence of a small population of adults (three were collected) and the presence of marginal habitat. The shoreline north of the dredged material placement site to the project boundary did not provide suitable habitat, with the shoreline south of the disposal area to the hardened shoreline providing minimal habitat. A survey in October 2000 by Dr. Knisley for larval northeastern beach tiger beetles was negative (Gowen and Knisley, 2001; Knisley, 2000). The larvae live in vertical burrows from 4-14 inches deep, depending on stage of larval development, located in the upper intertidal to high drift zone, and are regularly covered during high tide. This is important to their survival, as larvae lack a hard shell and are subject to desiccation (NYSDEC, 1999).

Several species of Federally-listed marine turtles may forage in the project area. The most common is the Federally-threatened loggerhead turtle (*Caretta caretta caretta*). The loggerhead is an oceanic and estuarine species that reaches its northern nesting limit along the barrier beaches of the Delmarva Peninsula and feeds within the barrier bays and the Chesapeake Bay on a wide variety of benthic organisms, including blue and horseshoe crabs. It is present in the Chesapeake Bay from spring through fall. Other marine turtles that may be found in the region include the endangered Atlantic ridley (*Lepidochelys kempii*) and the threatened green turtle (*Chelonia mydas*). These may feed in Virginia waters during the summer months; however, their occurrence is rare (USFWS, 1994). None of these sea turtles is known to nest on beaches in the project area, though they may be found in nearby waters.

The Virginia Department of Conservation and Recreation (VDCR), Division of Natural Heritage (DNH) maintains a Biological and Conservation Data (BCD) System for occurrences of natural heritage resources within the project area. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations. Correspondence from DNH indicates that while natural heritage resources exist in the project vicinity, due to the scope of the activity and distance to the resources, no adverse impacts to those resources would be anticipated (VDCR, 1999).

The Virginia Department of Game and Inland Fisheries (VDGIF) indicates the presence of the Federally-threatened bald eagle (*Haliaeetus leucocephalus leucocephalus*) and the state-threatened Henslow's sparrow (*Ammodramus henslowii susurrans*) in the area (VDGIF, 2000). It is important to note, however, that the bald eagle has no nest within 2 miles of the project area, though it may forage nearby.

Coastal Zone Resources

In accordance with the Coastal Zone Management Act of 1972, as amended, and the approved Coastal Management Program of the Commonwealth of Virginia, the proposed project has been evaluated for consistency with coastal development policies. VDEQ serves as the lead agency for Virginia's networked coastal zone management program. Acquisition of appropriate permits will ensure compliance with the Coastal Zone Management Act. Permits have not been applied for at the time of the preparation of this Final EA but will be obtained prior to construction. Permits that will be applied for and obtained prior to construction, via the Joint Permit Application (JPA) process include the following: a VDEQ Water Protection Permit pursuant to Section 401 of the Clean Water Act and a VMRC permit for encroaching on state bottom pursuant to Title 28.2 and 62.1 of the Code of Virginia. This Final EA and a joint permit application will be coordinated with VDEQ, VMRC, and other state and local agencies to determine final consistency.

Resource Protection Areas

The Chesapeake Bay Preservation Act establishes a program to protect and improve the waters of the Chesapeake Bay by reducing nonpoint source pollution. Under this authority of this act, the Town of Saxis has adopted a Chesapeake Bay Preservation Area as part of their zoning ordinance, which requires development in the town to adhere to certain development standards. As directed by guidelines set forth in the Chesapeake Bay Preservation Act, the town has mapped Resource Protection Areas (RPA's), Resource Management Areas (RMA's), and Intensively Developed Areas (IDA's). The RPA's consist of the most ecologically sensitive lands, including shorelines and wetlands, which have important value to the water quality of the Bay. RPA's also include a 100-foot buffer landward of these features. The buffer is intended to slow runoff, prevent erosion, and filter nonpoint source pollution. The RPA's in Saxis are the minimum areas required under the Bay Act regulations and include all lands 100 feet landward of the Pocomoke Sound tidal shoreline. Also included in Saxis' RPA's are the tidal wetlands as mapped on the National Wetlands Inventory Maps, along with their associated 100-foot buffers. Within RPA's, only water dependent uses, such as marinas and commercial fishing facilities may be constructed. While redevelopment of existing uses is allowed within RPA's, new development is not. The proposed project will be constructed along the Pocomoke Sound shoreline, within the RPA, but as the access roads will be deconstructed after they are no longer needed, they will not be in violation of any city land use ordinances. Preliminary coordination with the Chesapeake Bay Local Assistance Department (CBLAD) indicates that approved shoreline erosion control projects are conditionally exempt from the typical Resource Protection Area buffer

standards, provided that the activities are conducted in a manner that minimizes impacted to water quality and encroachment within the 100 foot RPA buffer (CBLAD, 1999).

National Wildlife Refuges and Parks

No Federal refuges or parks are located within, or in close proximity to, the study area. The Town of Saxis borders Freeschool Marsh, which is part of the Saxis Wildlife Management Area, a predominantly marshland community comprising 5,574 acres administered by the VDGIF. The area was purchased directly by hunters, fishermen, and boaters through the sale of hunting and fishing licenses and through taxes from firearms and ammunition sales. The marsh serves as a black duck breeding and wintering area as well as a Canada goose wintering area. In addition to black ducks, other puddle ducks that utilize the area include mallard, widgeon, pintail, and teal. Adjacent open water provides habitat for sea ducks, canvasback, redhead, scaup, goldeneye, bufflehead, and mergansers. Other birds in the area include grebes, loons, herons, egrets, shorebirds, and songbirds. Saltwater fishing opportunities include those for striped bass, flounder, gray and speckled trout, croaker, bluefish, black drum, and channel bass. The area supports populations of deer, rabbit, muskrat, red and gray fox, raccoon, opossum, mink, and river otter. At prescribed times, hunting and trapping are allowed by permit.

Wild and Scenic Rivers and Scenic Byways

No wild and scenic rivers are present in the study area. VDCR indicates that the project is not anticipated to impact any existing or planned recreational facilities nor any streams on the National Park Service Nationwide Inventory, Final List of Rivers, potential Scenic Rivers, or existing or potential Scenic Byways (VDCR, 1999).

Hazardous, Toxic and Radiological Wastes Investigations

A database search undertaken by VDEQ, Office of Waste Programs, resulted in no records indicating the presence of hazardous waste notifiers, solid waste management facilities, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, or environmental incidents reported for the Town of Saxis (VDEQ, 1999). Potential sources of pollution identified by the Saxis Town Plan include failing septic systems, spills from above ground storage tanks, the two underground storage tanks documented for the town, and pollution associated with boats (Saxis Planning Commission, 1997).

Cultural/Historical Resources

Prior to incorporation in 1959, the Town of Saxis was known as Saxis Island, which was derived from an earlier name, Sykes Island. In 1666 Englishmen patented Saxis, one of who was Robert Sykes. After changing hands several times, the property was acquired by William Anderson, who established a tenant farmer to raise cattle and prepare dried beef, hides, butter, and cheese. Cattle continued to be the mainstay of Sykes Island for the next 150 years. By 1800, four families inhabited Sykes Island,

bringing the population up to 35. The first school on the island was a Methodist Sunday School founded in 1851. At this time, Sykes Island was so remote that the only communication and commerce conducted with the mainland Eastern Shore was by boat.

By the late 1800's, the population increased, cattle farming declined, and seafood became the island's main livelihood. By 1844, the community was large enough for the establishment of a post office, and a village road was laid out. In 1896, Sykes Island became known as Saxis Island. A "corduroy" or "washboard" road was constructed across the marsh, connecting Saxis to the mainland, although communication still took place mostly by boat. The current causeway connecting Saxis to the mainland was laid out in 1925. The channel at Starling's Creek harbor was dug in 1920, which then made Saxis accessible to larger boats and a larger seafood market. Today, seafood continues to be the main commodity for the town (Saxis Planning Commission, 1997). There are no historical resources in or near the proposed project area.

Socio-Economic Resources

The Town of Saxis, which is part of Accomack County, was incorporated in 1959. It covers about one-third of a square mile, primarily along Pocomoke Sound. In 2000, the town's population was 337, an 8 percent decline from 1990 and the continuation of a trend of population decline that began in 1960 (US Census Bureau [USCB], 1999). As the population of Saxis has been decreasing, it has also been getting older with the out-migration of younger people and a declining birth rate. Accomack County, by contrast, has increased since 1970, with a 2000 Census population of 38,305 and an average annual growth rate of 1.9 percent since 1990.

The economy of Saxis is based primarily on the seafood industry, especially blue crabs, which are caught in the waters off Saxis and processed by the seafood companies located in the town. Many of the crabs caught between April and November are peeler crabs, which are held in floats until they shed and are sold as soft crabs. Much of the economic activity of the community is concentrated in the harbor area adjacent to Starlings Creek. This is the location for both the boats, which are berthed at the harbor, and the seafood companies that pack crabs and other seafood primarily for the shipping to the northeast.

Data from the 1990 census show the importance of the seafood industry to the residents of the town. Twenty-six percent of the employed residents of the town were working in the agriculture, forestry, and fisheries industry, which would be predominantly fisheries for Saxis. This percentage compares to a figure of 9 percent for Accomack County as a whole. Wholesale and retail trade combined provided 38 percent of the employment for Saxis, compared to 25 percent for Accomack County. Manufacturing and services provided much of the remaining employment for the town and the county as well. Figures for 1998 for Accomack County show slight declines in agricultural, forestry, and fisheries; manufacturing; and construction employment since 1990 and increases in the trade and services sectors with governmental employment stable (Bureau of Economic Analysis [BEA], 1999).

Income levels in Saxis in 1990, as measured by per capita income, were 16 percent below those of the county and 44 percent below the state average (USCB,1999). Estimates for 1998 show Accomack County with a per capita income that was 68 percent of the state average and 70 percent of the national average (BEA,1999), indicating an area significantly less prosperous than the rest of the state.

Housing in Saxis is predominantly owner-occupied (86 percent) and single family, as of 2000. As of 1990, 83 percent of the units were single family, 15 percent were manufactured or mobile homes, and only 1 percent multi-family. Most of the housing is old, having been built before 1920. The average value of the owner-occupied housing in Saxis was approximately half the value of owner-occupied housing in Accomack County.

Land use in Saxis is predominantly residential with commercial uses, which are associated with the seafood industry, concentrated in the harbor area. Public and semi-public uses include three churches, a park, a basketball court, and a disposal area for dredged material from the Starlings Creek channel. There are also several vacant parcels within the town limits, but various constraints prevent their development. No significant land use changes are anticipated in the near future due to the developed nature of the town and the physical constraints, such as hydric soils and a shallow water table, that limit development of the vacant land. Most of the future development will be in the area of redevelopment rather than new development. The town's plan, which was adopted in 1997, shows minor changes. These include the creation of a separate category for waterfront commercial (which encompasses commercial, public use, and vacant land at the western end of the town), and a category for parks and open space (which encompasses most of the vacant and public use land).

The main road that connects the town to Route 13 and the rest of the Eastern Shore is Route 695, a rural road about 11 miles long. Virginia Department of Transportation (VDOT) maintains most of the town's streets, and many of these are in need of repair.

Historical Resources

Although numerous archaeological sites have been found on the Eastern Shore, none have been recorded in the Town of Saxis. The closest site to Saxis that has been recorded is located along the edge of the Freeschool Marsh.

Air Quality

The project area is wholly within a region that is in compliance with the National Ambient Air Quality Standards (NAAQS).

6.0 ENVIRONMENTAL IMPACTS

Impacts to significant resources related to the following activities will be evaluated in this section, including (1) Breakwater and tombolo construction; and (2) road and staging area construction.

SAV, Wetlands, and Aquatic Resources

Due to lack of SAV in the area, there will be no adverse impacts to existing resources. Moreover, there will be a positive impact due to the restoration component of the project whereby approximately 13.2 acres (35,000 square feet) of potential SAV habitat will be constructed. Areal estimates of other habitats created include 8.8 acres of beach, 1.9 acres of tidal marsh, 1.7 acres of upper berm (dunes), 3.4 acres of scrub shrub, and 2.5 acres of breakwater (hard substrate) habitat. At the end of 25 years, it is expected that there will be 8.4 acres of beach, 13.2 acres of SAV, 2.1 acres of tidal marsh, 1.9 acres of dunes, and 3.6 acres of scrub-shrub.

Headland breakwaters have been used extensively over the last 15 years at various sites around the Chesapeake Bay for erosion control and enhancement. Evaluation of breakwater installations by Hardaway et al (1991) indicates that a stable beach platform can exist with subtidal attachments. The advantage to a subtidal attachment is that wetland habitat is increased in the breakwater's lee while beach stability remains uncompromised.

Construction of the breakwaters will directly impact 114,500 square feet (2.5 acres) of benthic habitat due to direct impacts, such as crushing and smothering, and indirect impacts from change of substrate. However, the breakwaters themselves will provide attachment sites for a wide variety of estuarine invertebrates, as well as foraging habitat for more motile aquatic life.. Although of lesser habitat value than natural marine habitats typical of the coastal plan, rock structures such as breakwaters do provide hard settling substrate and crevices. Over time, the proposed breakwaters will become substrate to various organisms that are important for supporting base-level food chains. The crevices also will provide harborage of varying dimensions for prey species. Additionally, rock structures generally attract mobile aquatic fauna, which subsequently makes these areas attractive for foraging wading birds. Evaluation by VIMS indicates that once in place and fully functional, the breakwaters will compliment and interact well with the natural-based restoration components of the project (Hardaway et al., 1999a).

Construction of the tombolos and associated beach/dune habitats will involve the placement of material on and seaward of the existing Saxis shoreline. The effect of the placement of this material is minimal when material placed on the beach is similar (in grain size and other physical characteristics) to that which already comprises the beach. The placement of material on the beach will result in some loss of beach organisms by burial and nearshore organisms by increased turbidity effects. However, liquefaction of indigenous sediments often occurs during deposition, which could allow for motile species (amphipods, decapods, etc.) to escape burial. Nearshore turbidity impacts are

directly related to the quantity of fines (silt and clay) in the nourishment material. It is assumed that the beach-fill will consist of beach quality sand of similar grain size and composition of indigenous beach sands; therefore turbidity impacts will be short-lived and spatially-limited to the vicinity of the dredge outfall pipe.

In general, though, the beach will repopulate relatively quickly. Several environmental studies of beach nourishment indicate that there are no detrimental long-term changes in the beach fauna as a result of beach nourishment. A study by the Norfolk District Corps of Engineers in 1987 along the Virginia Beach shoreline (USACE, 1992) supported the findings of other separate and independent studies. The study was based upon population changes of the mole crab (*Emerita talpoica*) and concluded that the greatest influencing factor on beach fauna populations appears to be not the introduction of additional material onto the beach, but the composition of the introduced material. The effects of the deposited sediments, when similar in composition (grain size and other physical characteristics) to existing beach material (whether indigenous or introduced by an earlier nourishment or construction event), do not appear to have the potential to reduce the numbers of species or individuals of beach infauna (USACE, 1992).

The beach/shoreface profile will be slightly altered due to the proposed project. Beach zones can be defined based on the relationship between faunal composition and water levels (i.e., above high tide, intertidal, and subtidal). Altering the slope of the profile would alter the proportion of surface available for each zone; hence, altering the proportion of fauna typifying each zone (Thompson, 1973). Ultimately, beach slope is established and reestablished by a number of variables including wave period, wave amplitude, water table height, and composition of the material. Introduction of new material comparable to existing material, regardless of material orientation at the time of deposition, also minimizes changes in beach slope.

Following initial placement of beach-fill, there will be an increase in longshore sediment transport away from the filled beach. This movement will probably have beneficial impacts on downdrift beaches.

Breakwater Construction

Potential adverse effects associated with breakwater construction and post-construction include increased turbidity, direct encounters with falling boulders, and substrate changes. Increased turbidity has the potential to lower dissolved oxygen, but due to the dynamic nature of the surf zone and nearshore, these effects will be minor and short-lived. Placement of breakwater boulders could adversely affect fish throughout the water column by direct encounters with falling boulders and could adversely affect benthic fauna by burial. Only those benthic organisms that are unable to avoid burial from the placement of boulders will be impacted.

A permanent substrate change will occur with the construction of breakwaters from a relatively soft sandy bottom to a hard, impenetrable rock substrate. The adverse effects will only impact those benthic areas that are under the footprint of the breakwaters. Several studies of ecosystem changes due to breakwater/jetty construction

have reported that there is a net biological productivity increase due to the presence of hard substrate (Van Dolah et al., 1987, Manny et al, 1985). Hard substrate is a limited habitat along the mid-Atlantic coast; therefore, rapid colonization is expected by opportunistic species. Cursory examination of existing nearby jetties and breakwaters support sessile species such as oysters, mussels, barnacles, anemones, hydroids, bryozoans, and algae. Other species that utilize breakwaters and jetties are those found nestled in between the boulders themselves, which provide refuge from predators and/or foraging areas. Such species include the blue crab and Atlantic starfish.

With this new habitat type and subsequent colonization by new species in the study area, it is anticipated that all levels of the food chain will benefit. Avian fauna will likely utilize the exposed portions of the breakwaters as resting areas and utilize surrounding waters as a food source. It is common to see coastal birds (i.e. terns, skimmers, and gulls) feed adjacent to rock structures in the Mid-Atlantic region. It is anticipated that net benefits will accrue to the biota in the study area with the placement of breakwaters.

The breakwaters will alter the existing longshore transport in the local area. Also to be considered is a 200-foot community fishing pier proposed by the Town of Saxis, as well as a jetty proposed by the Town of Saxis and USACE in the vicinity of Starlings Creek. Overall, the impacts to the longshore transport have been evaluated and the additional sand added to the system by the proposed project should provide a small increase to longshore sand transport.

Many positive impacts are expected from the restoration and stabilization of the Saxis shoreline. The reestablishment of almost an acre, and up to 13.2 acres, of SAV beds will provide excellent habitat for juvenile fishes and shellfish. Reestablishment of the marsh habitat will restore habitat for waterfowl and other birds, mammals, and invertebrates. The open beach will provide critically needed habitat for the Federally-threatened northeastern beach tiger beetle. Dunes (upper berm) will provide natural stabilization to the beach system, enhance the aesthetics of the project, and provide habitat for typical dune species. Scrub-shub habitat will provide feeding and nesting habitat to a wide variety of small birds and mammals. The stoppage of erosion will increase local water quality. The breakwaters will provide attachment sites for sessile invertebrates and feeding areas for other aquatic life.

Road and Staging Areas

Access roads are proposed to facilitate the construction of the breakwaters, the placement of sand behind the structures, and the planting of SAV and marsh grasses. A small amount of scrub-shrub or urban lawn habitat will be disturbed during the construction and use of the roads. After project completion, roads will be dismantled and the areas returned to former land use.

The proposed project will result in approximately 32 acres of newly-constructed habitats. Although there will be some conversion of aquatic habitats to upland habitats, no net loss of habitat will occur.

Construction of the proposed project will impact 17.8 acres of public oyster ground offshore the Saxis coastline. However, this acreage is not currently productive and is highly likely to remain so. Only sand is found in the area, and there is no hard bottom, or "cultch" that provides oyster habitat. The survey by VIMS (Hardaway et al., 1999b) noted the complete absence of oysters and clams, a condition that might be attributed to the continually degraded nature of the habitat. The proposed project may restore the Saxis shoreline to a more suitable habitat for shellfish. VMRC indicates the presence of three small, private leases in the project vicinity. There are no anticipated impacts to these private areas.

Water Quality

Construction of the breakwaters will create temporary increase in turbidity in the immediate study area. However, such increase in turbidity will be of short duration and is not anticipated to cause any long-term negative effects or to be in violation of water quality standards.

Sand and materials for the construction of the breakwaters will be acquired from upland sites. All materials will be coarse-grained sands, with no chemical contamination expected. No impacts associated with acquisition of the material are anticipated.

Positive impacts to water quality are expected, due to the erosion control aspect of the project. In addition, the marsh habitats should uptake nutrients from the soils and indirectly the water column, thus further enhancing water quality. Sedimentation rates will drop significantly in the local area.

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act require Federal action agencies to consult with the National Marine Fisheries Service (NMFS) regarding the potential effects of its actions on Essential Fish Habitat (EFH). EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Step 1 of the consultation process was accomplished by notifying NMFS that this Final EA was being prepared. Step 2 is the preparation of an EFH Assessment by the Federal agency proposing the action. The EFH assessment shall include: (1) a description of the proposed action (see section 1 of this EA); (2) an analysis of the effects of the action on EFH and associated species; (3) the Federal agency's views regarding the effects of the action on EFH; and (4) a discussion of proposed mitigation, if applicable. Step 3 of the consultation process is completed after NMFS reviews the Draft EA for which NMFS provides EFH Conservation Recommendations during the established comment period. The fourth and final step in the consultation process is the Federal agency's response to the EFH

Conservation Recommendations within 30 days. This response, in writing, must either describe the measures proposed by the agency to avoid, mitigate, or offset the impacts of the action on EFH pursuant to NMFS' recommendations or must explain its reasons for not following NMFS' recommendations:

The bluefish travels in schools, especially in deeper water, feeding predominantly on menhaden, herring, and mackerel. The fish has a voracious appetite and often pursues schools of small fish onto the beach, where bathers have been bitten by accident. The bluefish is most prevalent just off the coast during the summer. Most bluefish weigh from 2 to 15 pounds. Bluefish, especially juveniles, follow herring, menhaden, and other small fish into the middle and upper Chesapeake Bay. The waters of the Eastern Shore of Maryland are especially important to the juveniles. There may be late summer populations of bluefish near Smith Island, although they are unlikely to be nearshore. Frequent boat activity prevents the schools from following prey near the island, and bluefish are rarely in the area during winter months (USACE, 2001). The proposed project is unlikely to provide much in direct benefits to adult bluefish but may provide food and shelter to young juveniles.

The summer flounder, *Paralichthys dentatus*, is a flatfish that can grow as large as 37 inches in length and weight up to 26 lbs. They, like all flatfish, have both eyes on one side of their body and are typically found lying on the bottom. All are carnivorous. The summer flounder typically prefers sandy bottom areas, exhibits strong seasonal movements, and are only found in shallow Chesapeake Bay waters during the warmer months of the year and migrate offshore to the outer continental shelf during the cold weather months. However, they are also common around artificial reef structures. They spawn offshore during the fall, and the larvae migrate inshore, entering coastal and estuarine nursery areas such as the Chesapeake Bay from October to May. Young juvenile summer flounder use a wide range of habitats, from SAV beds, mud flats, and open sandy bottom areas. Juveniles tend to prefer the edges of SAV beds in estuaries, where they can hide in sand and prey on small crustaceans and fish that are typically found in SAV, such as grass shrimp (*Palaemonetes vulgaris*) and juvenile spot (*Leiostomus xanthurus).*

The proposed project will reduce the acreage of open bottom as the tombolos are constructed. However, the increase in diversity of habitat types, increases in numbers of small baitfish and benthic organisms, and sheltered water areas will likely substantially increase the value of the area for juvenile summer flounder. Effects on adult populations are likely to be smaller, as larger fish do not frequent sheltered areas as extensively or utilize habitat such as SAV beds as often as smaller juveniles. Overall, the proposed project will likely provide significant benefits to small juvenile summer flounder, and adults may frequent the more open areas to feed on the larger numbers and greater variety of food items post construction. Effects on EFH for summer flounder should be somewhat beneficial, despite the decrease in acreage of open bottom habitat.

The red drum is one of the larger members of the Sciaenid fish, weighing up to 83 pounds. They are bottom feeding fish, with the young preferring grassy (SAV) or

mud bottoms. Adults also can be found in SAV beds and on mud bottoms, but another preferred habitat is oyster reefs. These fish, as adults, feed on small fish, blue crabs, shrimp, and various benthic organisms. The increase in benthic diversity, potential food items including crabs, small finfish, and other benthic organisms, and the likely establishment of SAV beds in the sheltered areas behind the breakwaters, will likely increase the EFH for the red drum in and near the proposed project area.

The cobia is a larger fish (up to 100 pounds) that can often be found around bottom structures such as pilings and wrecks. The cobia's preferred food is small fish, squid, and crabs. It has also been known to spawn within the Chesapeake Bay, which serves as a nursery ground for the young of the year cobia. The enhancement of the oyster grounds with three-dimensional reefs and two-dimensional areas should increase the preferred structure habitat for the cobia, as well as provide more potential food items than the present open bottom habitat. Cobia EFH is likely to increase with the proposed project, especially for juveniles.

The king and Spanish mackerel are quite similar in lifestyle, although the Spanish mackerel is small (up to 20 pounds) compared to the king mackerel (up to 90 pounds). Both mackerels are primarily open water schooling fish that feed on smaller fish and squid. The proposed project will not likely provide a significant benefit to these open water predators, but will not adversely impact them either. It is possible the project will cause an increase in small baitfish near the project site, which could serve as additional food sources for the mackerel in deeper waters.

There are two species of sharks that have EFH within the proposed project area. The dusky shark is a large shark (up to 11.9 feet) that feeds on various fishes and smaller sharks. The three-dimensional reef habitat will provide shelter to a greater number of small fishes and sharks than open water, and it is likely the EFH for this shark will increase upon implementation of the proposed project. The sandbar shark is a medium-sized shark (up to 8 feet) and constitutes approximately two-thirds of the directed commercial shark catch on the East Coast. Females of this species enter the Chesapeake Bay and use it as a pupping ground, and the young sharks use the Chesapeake Bay as a nursery area. The adults and young sharks feed on small fish, crustaceans (primarily blue crabs in the Chesapeake Bay), summer flounder, and small Scienids. The proposed project would likely provide additional food for adult sharks and food and shelter to shark pups. Overall benefits to various shark species that have EFH in the project area should be positive due to increased quantity and diversity of food items, and shelter provided by the breakwaters and potentially SAV.

All of these fish that have EFH within the proposed project area are mobile and will likely vacate the area during the brief construction period (approximately 60 days). The fish should return soon afterwards.

Threatened and Endangered Species

Reports of occurrence of the Federally-threatened tiger beetles have resulted in the need to survey to project area. Dr. C. Barry Knisley performed a survey to identify the presence of adult and larval tiger beetles in July and October 2000, respectively. According to the results of the survey, a small population of adult beetles utilizes a small area of the beach by the Dredged Material Management Area. However, the larval survey was negative. Therefore, in order to protect the small population of beetles, a buffer zone will be established around this area. During the time of year when adults are present (May-September), no activities will be permitted within the buffer zone. The objective of this study, however, to stabilize the eroding shoreline of Saxis will in fact prove highly beneficial to the tiger beetle by stabilizing remaining habitat and creating 1.9 acres of dune habitat and 8.8 acres of open, unvegetated beaches. This habitat will allow more adults to colonize the area and is likely to provide the proper conditions for larval survival. Adult tiger beetles tend to lay their eggs at the base of dunes. The potential for the tiger beetle to re-establish a breeding population on the restored site is high. The tiger beetle populations in Virginia are more thoroughly examined in a 2001 report by USFWS titled "A Population Viability Analysis for Northeastern Tiger Beetles in the Chesapeake Bay Region" (Gowan and Knisley, 2001)

Several species of sea turtle, including the Federally-endangered Atlantic Ridley turtle, *Lepidochelys kempii*, and Federally-threatened loggerhead turtle, *Caretta caretta caretta*, and green turtle, *Chelonia mydas,* could potentially occur within the proposed project area. However, sea turtles are sensitive to human activity and are highly mobile so it is expected any sea turtles within the proposed project area would swim out of the local area during construction. Upon project completion, the newly established sheltered shallow water habitat, which should populate with SAV, would provide good forage for these marine turtles. Green turtles eat SAV itself, while the loggerhead and Kemp's Ridley sea turtles forage on invertebrates, which will be more diverse and numerous in the local area post-construction. Overall, positive benefits to the rare and transitory sea turtles that might utilize the restored habitats on or near Saxis Island are expected.

Noise, Traffic and Air Quality

Minor effects include increased noise levels, traffic, and air pollution in the project area. All of these effects would occur only during the actual period of construction. Increased noise levels will be temporary in nature and correspond to construction vehicles, beach nourishment activities, and barge noise associated with construction of stone breakwaters. Traffic will increase as vehicles utilize the access roads during construction. Any increases in air emissions would originate from the operation of heavy equipment, trucks, and barges at the site. Since the region is in compliance with the National Ambient Air Quality Standards, a Clean Air Act conformity determination is not required.

Cumulative Impacts

The cumulative impact assessment is the evaluation of the effects that other past, present, or reasonably foreseeable future actions, alternatives, or plans might have on the environment when considered along with the proposed project's impacts. Cumulative impacts can be either additive or interactive. Additive impacts are impacts of a similar nature that can collectively have a profound effect on a given resource due to the collective magnitude of the effect. Interactive impacts are impacts that accrue as a result of assorted similar or dissimilar actions, alternatives, or plans that tend to have similar effects, relevant to the resource in question.

Past Actions

Past actions include the development of a harbor of refuge within nearby Starlings Creek (about 700 feet south of the proposed project), which included placement of a tongue-in-groove bulkhead along the inside margin of the harbor; placement of associated piers, pilings, and support buildings for seafood processing; and dredging of a navigation channel from open waters of Pocomoke Sound into the harbor of refuge. In addition, a fishing pier was constructed outside the harbor of refuge, and it extends landward from about 500 feet south of the proposed project into waters of the Pocomoke Sound. The Town of Saxis was developed landward of the proposed project. A small dredged material disposal site lies within Saxis, and it has been heavily colonized by the invasive plant *Phragmites australis,* the common reed. None of these impacts are considered a problem at this time, though if unchecked, the common reed could potentially colonize any sites that become disturbed. Due to the proposed project's being an ecosystem restoration project, it will actually counter some of these impacts by increasing local wetlands, open beach, dunes, scrub-shrub, and probably SAV. It is not expected, therefore, that the proposed project would have any cumulative impacts to the natural resources surrounding the Town of Saxis.

Present and reasonably foreseeable future actions

No present actions are taking place in the Town of Saxis or local area that would result in any cumulative effects. Planning is currently underway for a navigation project (Section 107) on the south side of the opening of Starlings Creek to Pocomoke Sound (just offshore of Starlings Island). This project is considering placement of a nearshore breakwater with attached spur that would mimic the former shoreline configuration. Presently, the shoreline has eroded and the harbor of refuge for Saxis is experiencing increased wave energy, which is damaging boats and harbor structures and facilities. Wetland restoration would likely be implemented behind the nearshore breakwater. While this would be a restoration of the original shoreline configuration, it would replace most, but not all, of what were formerly wetlands with hardened structure. But, it is not primarily for ecosystem restoration. Due to the proposed project's being for ecosystem restoration, it would actually help or fully offset for future negative impacts to natural resources of the area if they were not mitigated. Since any future impacts would be mitigated for, the project would enhance the natural resources for the foreseeable future.

No Action

Under a no action scenario, no aquatic ecosystem restoration project would be implemented along the currently eroding Saxis Island western shoreline. The present shoreline would continue to erode, adding sediments to the waters of the Chesapeake Bay, resulting in further declines in water quality. In addition, all the environmental benefits resulting from the proposed project would not be accrued to the Saxis Island and Chesapeake Bay ecosystem.

7.0 ENVIRONMENTAL STATUTES

Coordination with the USFWS has yielded no formal consultation requirements pursuant to Section 7 of the Endangered Species Act. Coordination with USFWS personnel indicate that adherence to the protective measures described above will serve to avoid any impacts to the tiger beetle. USFWS does not indicate that the recommended plan would adversely impact any endangered species or its habitat as specified by the Endangered Species Act of 1973, as amended (Ruddy, 2001).

The proposed project has been evaluated under Section 176 (C) (1) of the Clean Air Act Amendments of 1990. Since this region is in compliance with the National Ambient Air Quality Standards, a conformity determination for this proposed project was not required.

A Section 404 (b) (1) Evaluation (Public Law 92-500, as amended) has been prepared for this project and appears at the end of this assessment. The evaluation describes the impact to water quality as required by the Clean Water Act. Water quality may be temporarily impacted by construction, but all necessary precautions would be taken to minimize this impact. State Water Quality Certification under Section 401 of the Clean Water Act, as amended, has been applied for and will be obtained from VDEQ prior to construction.

The relationship of the proposed ecosystem restoration project at Saxis, VA, to various environmental requirements and protection statutes is summarized in the following narrative:

COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

1. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: Submission of this EA to VDEQ's Air Division and to the Regional Administrator of the US Environmental Protection Agency (USEPA) for review pursuant to Sections 176(c) and 309 of the Clean Air Act signifies compliance.

2. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972 and Water Quality Act of 1987), Public Law 100-4, 33 U.S.C. 1251 et seq.

Compliance: A Section 404(b) (1) Evaluation and Compliance Review has been incorporated into this report. An application has been filed for a Virginia Water Protection Permit pursuant to Sections 401 and 404 of the Clean Water Act.

3. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the USFWS has not yielded any formal consultation requirements pursuant to Section 7 of the Endangered Species Act.

4. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Coordination with the National Park Service (NPS) and the Virginia Department of Conservation and Recreation (VDCR), relative to the Federal and state comprehensive outdoor recreation plans, signifies compliance with this act.

5. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with USFWS and VDGIF signifies compliance with this act.

6. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C., 4601-4 et seq.

Compliance: Submission of this EA to the NPS and the VDCR relative to the Federal and state comprehensive outdoor recreation plans signifies compliance with this act.

7. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: Coordination with the Department of Historic Resources and agency concurrence with the findings of this EA signifies no impact.

8. National Environmental Policy Act (NEPA) of 1969, as amended, 42 U.S.C. 432 ET seq.

Compliance: Preparation of this EA and public coordination and comment will signify partial compliance with NEPA. Full compliance is noted with the signing and issuing of the Finding of No Significant Impact (FONSI).

9. Watershed Protection and Flood Prevention Act, as amended, 16 U.S.C. 1001 et seq.

Compliance: No requirements for Corps activities.

10. Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271 et seq.

Compliance: Project has been evaluated in reference to this act. The proposed project would not adversely impact any component of the Virginia Scenic Rivers System.

Coordination with the NPS and the VDCR, relative to the Virginia Scenic Rivers System, signifies compliance with this act.

11. CERCLA, 42 U.S.C. 9601-9675.

Compliance: The project has been evaluated in reference to this act. Investigations have not identified any hazardous substances on terrestrial or subaqueous lands necessary for project construction, operation, and maintenance. Project is in compliance with this act following state and Federal agency concurrence with the findings of this EA.

Executive Orders

1. Executive Order 11988, Floodplain Management, 24 May 1977, as amended by Executive Order 12148, 20 July 1979.

Compliance: The proposed project will not stimulate development in the flood plain. Circulation of this report for public review fulfills the requirement of Executive Order 11988, Section 2(a)(2).

2. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: The proposed project will not have any adverse impact on wetlands. Circulation of this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

3. Executive Order 12898, Environmental Justice in Minority Population and Low-Income Populations, 11 February 1994.

Compliance: No significant impacts are expected to occur to any minority or low-income communities within the project area. This EA will be made available for comment to the individuals who have an interest or may be affected by the proposed project.

The following table summarizes effects of the proposed project on environmental resources having national, state, or local significance.

SIGNIFICANT EQ (ENVIRONMENTAL QUALITY) EFFECTS

Significant resources	Effects on EQ attributes
SAV	Proposed project will directly benefit SAV by improving water quality, creating sheltered shallow water habitat that is conducive to SAV colonization, and may enable SAV to increase its coverage in currently unvegetated areas that had historic SAV beds.

Water Quality	Temporary turbidity increases during project construction would not be in violation of Section 401 of the Clean Water Act. Long-term improvements expected due to decreased erosion, run-off, and vegetative uptake of nutrients.
Benthic Habitat	Permanent loss of infaunal benthos in footprint of breakwaters; however, this is offset by the increased surface area of the breakwaters for benthic organism attachment, establishment of sheltered shallow water habitat, and SAV. Increased diversity of benthic habitat. Overall Benthic Index of Biotic Integrity (BIBI) should increase significantly as a result of project implementation.
Oyster Grounds	A small amount of acreage of currently unproductive oyster grounds will be lost. Due to the high probability of these grounds remaining unproductive, this is not considered a significant impact.
Cultural	No historic or archeological sites affected; no disturbance.

8.0 CONCLUSIONS

The conclusions of this EA are based on an evaluation of the effects that the proposed action would have on the human environment, as well as local area ecosystems including the land, air, and aquatic systems of Saxis Beach, Saxis Island, and the nearshore waters of Pocomoke Sound.

The historic shoreline of Saxis Beach will be, for the most part, restored, with the addition of the eight segmented breakwaters that will be necessary to develop and protect the newly restored habitats. The bottom type will be restored from its present shallow open water, unvegetated status to a beach that will include sheltered and unsheltered shallow water habitat, potential SAV habitat, estuarine marsh, open beach, and scrub-shrub habitat types. A conversion of open bottom to these habitats will occur during construction. The wider beach and additional habitat types reflect closely the historic condition of the area. While the existing resident infaunal benthic community may be adversely affected, overall productivity, species diversity and numbers, BIBI, and water quality are expected to increase. SAV will likely re-colonize the sheltered shallow water habitat created. Therefore, although adverse short-term impacts will occur to some fauna inhabiting the present substrate within the project area due to burial by the placement of beach sand and breakwater stone, long-term benefits associated with restoring Saxis Beach greatly outweigh these impacts.

The conclusion of this assessment finds that the proposed action would not have a significant adverse effect on the environment and therefore does not require the preparation of an Environmental Impact Statement (EIS).

9.0 COORDINATION

This Final EA was circulated as a draft for a 30-day review and comment period with the following State and Federal agencies and local interests. Their comments and the Corps responses appear in Appendix A, Comment/Response, in the Final EA.

NMFS

NPS

USEPA

USFWS

VDGIF

VDCR, Division of Soil and Water Conservation

VDEQ, Office of Environmental Impact Review

VDEQ, Water Division

Virginia Department of Health

Virginia Department of Historic Resources

VDOT

VIMS

VMRC

Accomack-Northampton Planning District Commission

County of Northampton

County of Accomack

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11.0 TABLES

TABLE 1. ALTERNATIVE EVALUATION

PROJECT ALTERNATIVE	PROJECT OBJECTIVES					TOTAL SCORE
	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/Improve Water Quality	Increase Sheltered Shallow Water	Avoid Down Drift Shore Starvation	
	Rating X Weight Factor (1.0) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.3) = Product Score	
16 BW w tombolo	8 X 1.0 = 8	10 X 0.7 = 7	10 X 0.7 = 7	4 X 0.7 = 2.8	9 X 0.3 =2.7	27.5
8 BW w tombolo	10 X 1.0 = 10	9 X 0.7 = 6.3	9 X 0.7 = 6.3	4 X 0.7 = 2.8	10 X 0.3 =3	28.4
16 BW w salient	5 X 1.0 =5	8 X 0.7 = 5.6	8 X 0.7 = 5.6	7 X 0.7 = 4.9	6 X 0.3 = 1.8	22.9
8 BW w salient	7 X 1.0 = 7	7 X 0.7 = 4.9	7 X 0.7 = 4.9	7 X 0.7 =4.9	7 X 0.3 = 2.1	23.8
16 BW w/o fill	3 X 1.0 = 3	6 X 0.7 = 4.2	6 X 0.7 = 4.2	10 X 0.7 = 7.0	1 X 0.3 = 0.3	18.7
8 BW w/o fill	4 X 1.0 = 4	5 X 0.7 = 3.5	5 X 0.7 = 3.5	10 X 0.7 = 7.0	2 X 0.3 = 0.6	18.6
No Action	1 X 1.0 = 1	1 X 0.7 = 0.7	1 X 0.7 = 0.7	1 X 0.7 = 0.7	10 X 0.3 = 3	6.1

16 BW w tombolo = 16 breakwaters attached to the shore with sand tombolos
8 BW w tombolo = 8 breakwaters attached to the shore with sand tombolos
16 BW w salient = 16 breakwaters detached from shore, a sand extension (salient) will be placed behind the breakwaters extending from the restored shoreline partway out to the breakwater. There will be open shallow water between the salient and breakwater.
8 BW w salient = 8 breakwaters with sand salients placed behind them along the shoreline.
16 BW w/o fill = 16 breakwaters with no additional sand placed on Saxis Beach.
8 BW w/o fill = 8 breakwaters with no additional sand placed on Saxis Beach.

TABLE 2. TYPICAL PLANT SPECIES CHARACTERISTIC OF THE MAJOR VEGETATED COMMUNITY TYPES AND THEIR AERIAL COVERAGE ALONG THE SAXIS SHORELINE.

Community Type	Typical Species	Areal Coverage
Phragmites Dominated	Common reed (*Phragmites australis)* Groundsel tree (*Baccharis halimifolia)*	867,000 square feet (19.9 acres)
Marsh	Smooth Cordgrass (*Spartina alterniflora*) Saltmeadow hay (*S. patens*) Marsh elder (*Iva frutescens*)	401,000 square feet (9.2 acres)
Beach	American beachgrass (*Ammophila breviligulata*) Bitter panicum (*Panicum amarum*) Seaside goldenrod (*Solidago sempervirens*)	234,000 square feet (5.4 acres)
Scrub Shrub	White mulberry (*Morus alba*) Black locust (*Robinia pseudoacacia*) Black cherry (*Prunus serotina*) Hackberry (*Celtis occidentalis*) Wax myrtle (*Myrica cerifera*) Groundsel tree (*Baccharis halimifolia*)	154,000 square feet (3.5 acres)
Old Field	Pokeweed (*Phytolacca americana*) Horseweed (*Erigeron canadensis*) Dog fennel (*eupatorium capillifolium*) Blackberry (*Rubus argutus*)	16,000 square feet (0.4 acre)
Dune		5,000 square feet (0.1 acre)

TABLE 3. COMMONLY OCCURRING FISH SPECIES OCCURRING WITHIN THE OPEN WATERS OF TANGIER AND POCOMOKE SOUND PROJECT AREAS.

COMMON NAME	SCIENTIFIC NAME
American shad	*Alosa sapidissima*
American Eel	*Anguilla rostrata*
Alewife	*Alosa pseudoharengus*
Atlantic sturgeon	*Acipenser oxyrhynchus*
Atlantic sharpnose shark	*Rhizopriodon terraenovae*
Atlantic croaker	*Micropogonias undulatus*
Black sea bass	*Centropristus striata*
Bluefish	*Potomatomus saltatrix*
Bay anchovy	*Anchoa mitchilli*
Blueback herring	*Alosa aestivalis*
Dusky shark	*Charcharinus obscurus*
Grey Trout	*Cynoscion nebulosus*
Speckled Trout	*Cynoscion nebulosus*
Menhaden	*Brevoortia tryrannus*
Rockfish (Striped Bass)	*Morone saxatilis*
Spot	*Leiostomus xanthurus*
Summer Flounder	*Paralichthys dentatus*
White Perch	*Morone americana*
Windowpane flounder	*Scopthalmus aquosus*
Winter flounder	*Pseudopleuronectes americanus*
Scup	*Stenotomus chrysops*
King mackerel	*Scomberomorus cavalla*
Spanish mackerel	*Scomberomorus maculatus*
Cobia	*Rachycentron canadum*
Red drum	*Sciaenops occelatus*
Silver perch	*Bairdiella Chrysoura*
Sand tiger shark	*Odontaspis taurus*
Sandbar shark	*Charcharinus plumbeus*
Sea lamprey	*Petromyzon marinus*

TABLE 4. THREATENED AND ENDANGERED SPECIES AND SPECIES OF SPECIAL CONCERN OCCURRING OR POTENTIALLY OCCURRING WITHIN THE TANGIER AND POCOMOKE SOUND PROJECT AREAS

STATUS	COMMON NAME	SCIENTIFIC NAME
Federally-Endangered	Atlantic hawksbill sea turtle	*Eretmochelys imbricata imbricata*
Federally-Endangered	Kemp's Ridley sea turtle	*Lepidochelys kempii*
Federally-Endangered	Leatherback sea turtle	*Dermochelys coriacea*
Federally-Threatened	Bald Eagle	*Haliaeetus leucocephalus leucocephalus*
Federally-Threatened	Green sea turtle	*Chelonia mydas*
Federally-Threatened	Loggerhead sea turtle	*Caretta caretta caretta*
Federally-Threatened	Northeastern Beach Tiger Beetle	*Cicindela dorsalis dorsalis*
Federal Species of Concern	Northern diamondback terrapin	*Malaclemys terrapin terrapin*
State Species of Concern	Gull-billed tern	*Sterna nilotica aranea*
State Species of Concern	Atlantic sturgeon	*Acipenser oxyrhynchus*
State Species of Concern	Brown pelican	*Pelecanus occidentalis carolinensis*
State Species of Concern	Caspian tern	*Sterna caspia*
State Species of Concern	Sandwich tern	*Sterna sandvicensis acuflavidus*
State Species of Concern	Forster's tern	*Sterna forsteri*
State Species of Concern	Least Tern	*Sterna antillarum*
State Species of Concern	River otter	*Lontra canadensis lataxina*

Source: Virginia Department of Game and Inland Fisheries Online Database, VDGIF, 2000.

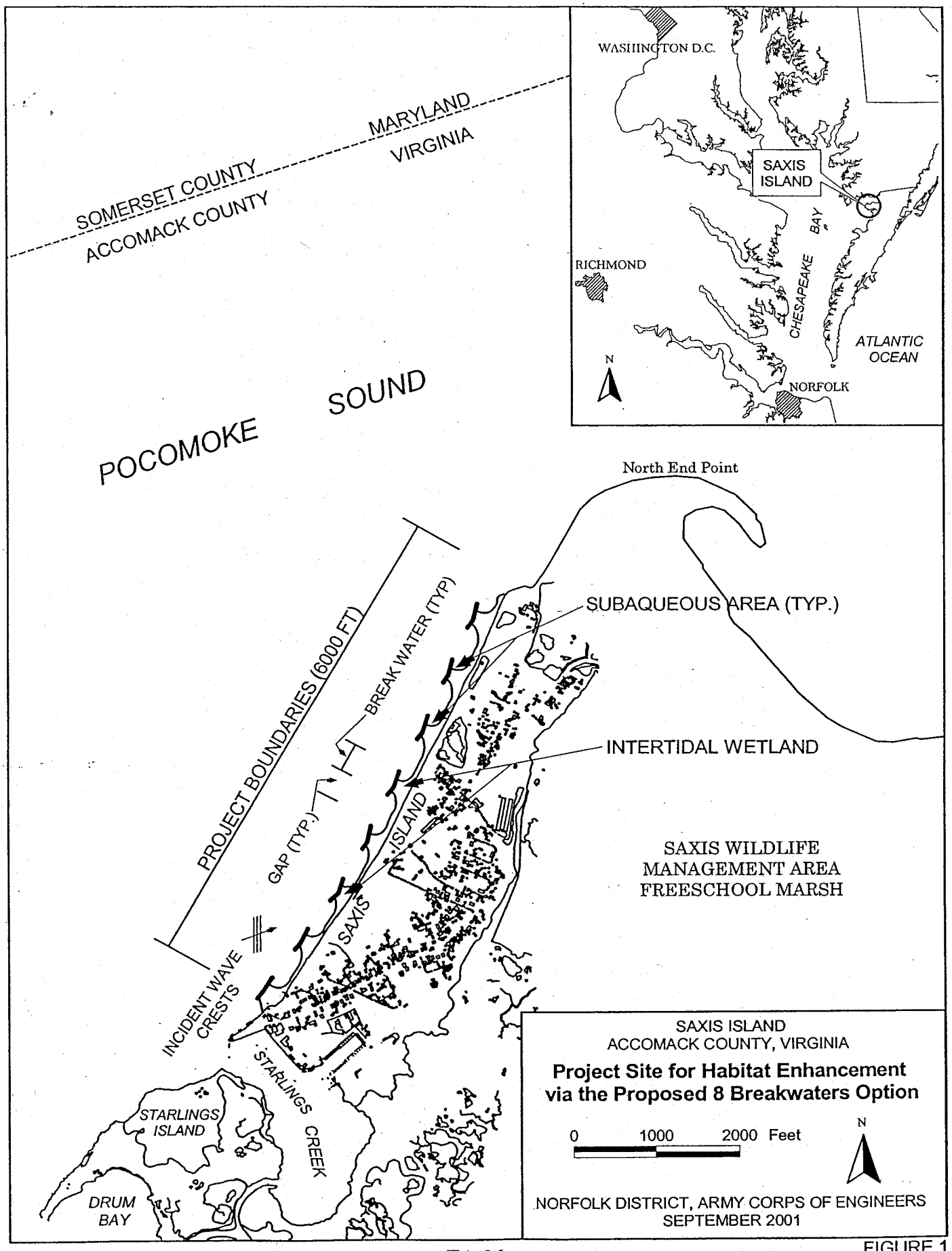
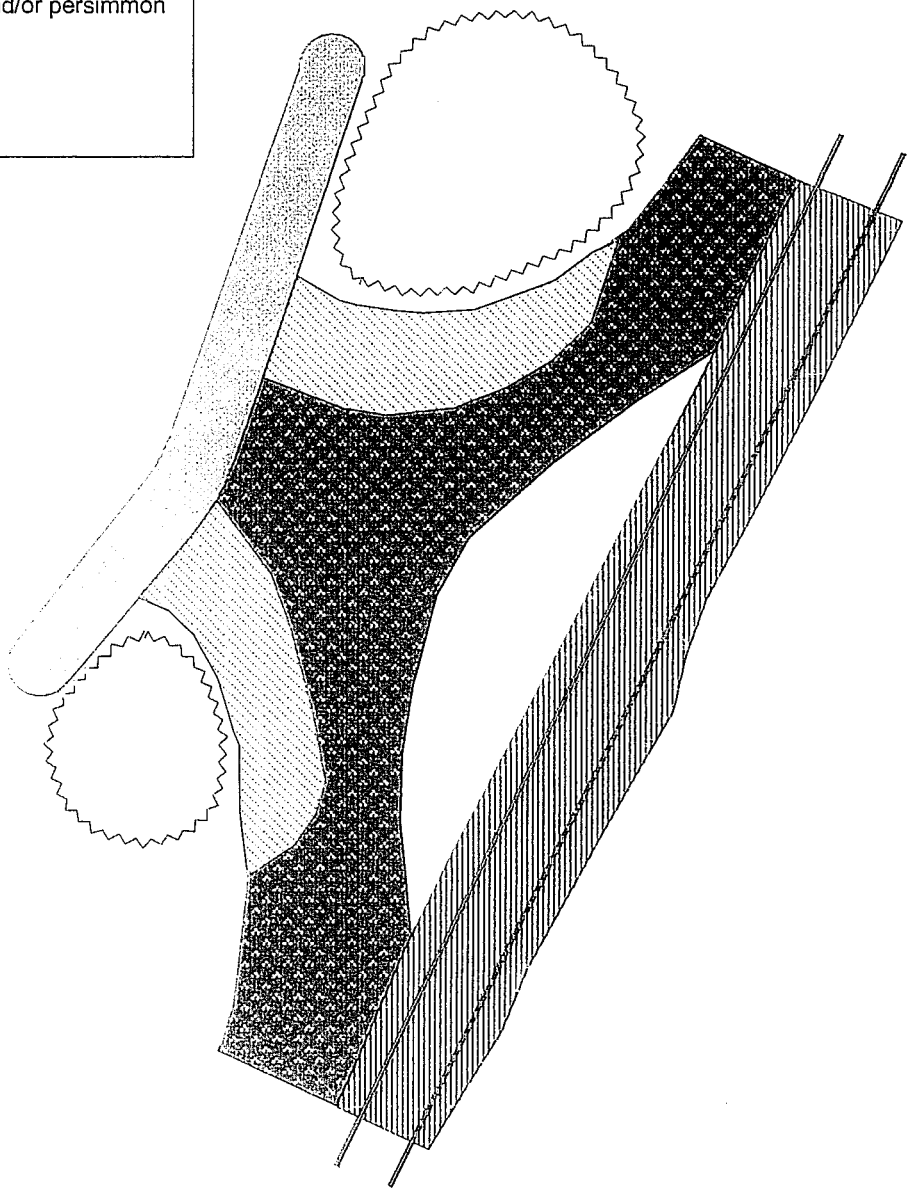

WASHINGTON D.C.
SAXIS ISLAND
BAY
CHESAPEAKE
RICHMOND
ATLANTIC OCEAN
N
NORFOLK
MARYLAND
VIRGINIA
SOMERSET COUNTY
ACCOMACK COUNTY
POCOMOKE SOUND
North End Point
SUBAQUEOUS AREA (TYP.)
INTERTIDAL WETLAND
PROJECT BOUNDARIES (6000 FT)
BREAK WATER (TYP)
GAP (TYP.)
ISLAND
SAXIS
INCIDENT WAVE CRESTS
SAXIS WILDLIFE MANAGEMENT AREA
FREESCHOOL MARSH
STARLINGS CREEK
STARLINGS ISLAND
DRUM BAY
SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Project Site for Habitat Enhancement via the Proposed 8 Breakwaters Option
0 1000 2000 Feet
N
NORFOLK DISTRICT, ARMY CORPS OF ENGINEERS
SEPTEMBER 2001

FIGURE 1

LEGEND

- Mean Low Water
- Mean High Water
- SAV (Subaqueous Vegetation)
- S. patens, Panicum omarum, and Ammophilia breviligulata (Upper Berm)
- S. alterniflora (Low Marsh)
- Scrub/Shrub Fringe - mix of beach plum, black cherry, wax myrtle, yaupon holly, inkberry, red cedar, choke cherry, blueberry, groundsel tree, switchgrass, and/or persimmon
- Beach (no vegetation)
- Breakwater

Note: Diagram Not To Scale



HABITAT	ACREAGE
SAV	4.2
Upper Berm	1.7
Low Marsh	1.9
Scrub/Shrub Fringe	3.4
Beach	8.8
Breakwaters	2.5

SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA

Preliminary Shoreline Management Plan with Habitat Enhancement via a Full Tombolo Profile with 8 Breakwaters

NORFOLK DISTRICT, ARMY CORPS OF ENGINEERS
SEPTEMBER 2001

FIGURE 2

13.0 SECTION 404(b)(1) EVALUATION

SECTION 404(b)(1) EVALUATION
Section 206 Aquatic Environmental Restoration
Saxis Island, VA

I. Project Description

a. Location – Northeastern Virginia Chesapeake Bay at beach and shallow water area at Saxis Island (Figure 1)

b. General Description – Eight segmented breakwaters with beach sand tombolos will be constructed along the eroded shoreline of Saxis Beach. A variety of habitats will be established, including open beach, dune, estuarine marsh, scrub-shrub, and SAV habitat.

c. Authority and Purpose – Project is being designed and constructed under the authority of Water Resources Development Act (WRDA) 1996, Section 206, as amended, Aquatic Ecosystem Restoration.

d. General Description of Dredged or Fill Material – The material used to construct the tombolos will be beach-quality sand of similar size as the sand on the present remnant beach. This material will be obtained from an upland source.

e. Description of the Proposed Discharge Site

1. Location (map) – See Figures.

2. Size – Approximately 32 acres.

3. Type of site – eroded beach, shallow water open bottom.

4. Type of habitat – subaqueous lands, eroded beach.

5. Timing and duration of discharge – Construction of the breakwaters, tombolos, and plantings should take 1 calendar year to complete. Construction is proposed to begin in October 2003.

f. Description of Placement Method – Stone for the revetments will be barged in and placed via equipment mounted on the barge. Sand for the tombolos will likely be placed via barge and pumped onto the sites, although it might be trucked in. All planting vegetation will be trucked in and planted by hand or land based construction equipment, such as a tree spade.

II. Factual Determination

a. Physical Substrate Determinations

1. Substrate elevation and slope – Very gentle slope for the restored beach, to allow wave action to maintain the restored beach habitat in an unvegetated state. Constructed dunes will have appropriate higher slopes for such mounded structures.

2. Sediment type – Predominately beach quality sand.

3. Dredged/fill material movement – Sand will be obtained from an upland, offsite source. No material present on site will be removed by dredging.

4. Physical effects on benthos – Loss of most present benthos on proposed revetment sites, some benthos losses on tombolo sites, rapid recovery and overall increase in BIBI expected.

5. Other effects – Minor and short-term changes.

6. Actions taken to minimize impacts – Best Management Practices (BMP) will be used by all construction equipment to minimize turbidity increases to local waters during the construction phase. Temporary roads constructed to transport vegetation, and possibly sand, to the site will be removed and planted with appropriate native vegetation after construction is completed.

b. Water Circulation, Fluctuation, and Salinity Determinations

1. Water. Consider effects on:

a. Salinity – No effect.

b. Water chemistry – Minor and temporary effects on dissolved oxygen (DO), total suspended solids (TSS), and biological oxygen demand (BOD) during construction.

c. Clarity – Minor and temporary turbidity increases may be caused by rock and sand deployment during construction.

d. Color – Minor and temporary change due to turbidity.

e. Odor – No change.

f. Taste – No change.

g. Dissolved gas levels – Minor and temporary reduction in DO levels.

h. Nutrients – Minor and temporary increase.

i. Eutrophication – No change.

j. Temperature – Minor or no changes expected.

k. Others as appropriate – None.

2. Current patterns and circulation.

a. Current patterns and flow – Post construction, the revetments and tombolos will decrease the wave energy in the local area, and possibly reduce the transport of sand downcurrent from the restoration site.

b. Mean velocity – No change anticipated.

c. Stratification – No change.

d. Hydrologic regime – Estuarine, no change.

3. Normal water level fluctuations – No change.

4. Salinity gradients – No change.

5. Actions that would be taken to minimize impacts – An 8-breakwater option was selected to allow sufficient wave energy to maintain the restored beach in an unvegetated condition.

c. Suspended Particulates/Turbidity Determinations

1. Expected changes in suspended particulates and turbidity levels in vicinity of construction – Minor and temporary during construction.

2. Effects (degree and duration) on chemical and physical properties of the water column – Temporary during construction.

a. Light penetration – Minor decrease during construction; temporary effect. Increase expected due to stabilization of bottom sediments and likely SAV colonization of sheltered water habitat.

b. DO – Minor decrease during construction; temporary effect.

c. Toxic metals and organics – None present; no effect.

d. Pathogens – None present; no effect.

e. Aesthetics – Minor degradation during construction.

3. Effects on biota.

a. Primary production, photosynthesis – Temporary increase in suspended solids would reduce light transmission and photosynthesis. Long-term increase expected due to reduction of TSS and increase in SAV and estuarine marsh.

b. Suspension/filter feeders – Would be temporarily affected by minor increase in suspended solids. Breakwaters will provide considerable habitat for sessile invertebrates, and numbers and diversity of suspension/filter feeders should increase post construction.

c. Visual feeders – Would be temporarily affected by minor increases in suspended solids. Long-term benefits to visual feeders, such as fish, due to greater numbers of prey items and diversity of foraging habitat.

4. Actions taken to minimize impacts – BMP will be used to minimize turbidity.

d. Contaminant Determinations – No reason to suspect presence of contaminants, clean material obtained from upland source

e. Aquatic Ecosystem and Organism Determinations

1. Effects on plankton – Would be temporarily affected by increases in suspended solids during construction phase.

2. Effects on benthos – Loss of most of existing benthos at construction sites. Oysters will repopulate along with other epifauna.

3. Effects on nekton – Would be temporarily affected by increase in suspended solids and disturbance to feeding areas during construction. Fishes will benefit in the long-term by utilizing new more productive and diverse habitat.

4. Effects on aquatic food web – Would be temporarily impacted by minor loss of benthos and increase in suspended solids in water column. Post construction, benefits will be positive and significant.

5. Effects on special aquatic sites.

a. Sanctuaries and Refuges – None effected, three-dimensional reefs will be sanctuaries.

b. Wetlands – Will increase estuarine marsh, and SAV acreage.

c. Mudflats – No effect.

d. Vegetated shallows – Long-term benefits to local SAV populations, none at sites presently.

e. Riffle and pool complexes – N/A.

6. Threatened and endangered species – No impact.

7. Other wildlife – Resident wildlife (including aquatic life) may be disturbed at the revetment and habitat sites during construction. They will recolonize the area rapidly post construction.

8. Actions to minimize impacts – None.

f. Proposed Disposal Site Determinations

1. Mixing zone determinations.

a. Depth of water – all construction will be taking place in shallow water (< 5 feet deep).

b. Current velocity – reduction in current velocity in project area post construction.

c. Degree of turbulence – Negligible.

d. Stratification – Negligible.

e. Discharge vessel speed and direction – N/A – sites are not near any navigation channels.

f. Rate of discharge – N/A.

g. Dredged material characteristics – N/A (Sand obtained from upland source).

h. Number of discharge actions per unit time – N/A.

2. Determination of compliance with applicable water quality standards – All applicable water quality standards will be complied with.

3. Potential effects on human use characteristic.

a. Municipal and private water supply – proposed project would not affect municipal or private water supply.

b. Recreational and commercial fisheries – Short-term and minor turbidity increases as well as minor impacts to benthos from construction would minimally affect fisheries. Recreational and commercial fishing vessels may benefit from the fish attracted to he restored habitat and beneficial effects on EFH.

c. Water-related recreation – No impact.

d. Aesthetics – Positive impacts due to restoration of wider, open beach habitat.

e. Parks, national and historical monuments, national seashores, wilderness areas, etc. – None affected.

g. Determination of Cumulative Effects on the Aquatic Ecosystem – The proposed project involves construction of eight segmented breakwaters with attached sand tombolos and planting of appropriate native vegetation. TSS should decrease in the local aquatic ecosystem, and productivity and diversity, both BIBI and habitat type, should increase. Overall benefits to the aquatic ecosystem should be significant.

h. Determination of Secondary Effects on the Aquatic Ecosystem – Sand transport in the longshore transport system may be somewhat slower downcurrent of the project site.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

1. The evaluation of the proposed oyster habitat restoration project on Saxis Island, VA, was made consistent with 404(b)(1) Guidelines.

2. The proposed plan was selected because of its ability to meet the needs expressed by the USFWS, because of impacts associated with other alternatives, and because the environmental benefits associated with the recommended plan were comparable to, or greater than, benefits associated with other alternatives. There were several alternatives evaluated in the accompanying Decision document and EA. The recommended plan was selected based on its acceptability from an environmental, social, and economic perspective.

3. The planned construction of the eight segmented breakwaters with attached tombolos and associated vegetation will not violate any applicable state water quality standards. The Corps will submit the permit application for this project through the JPA process. There would be a short-term increase in suspended solids in the water column during construction. Construction

activities would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

4. Use of the selected sites for construction would not harm any endangered species or their critical habitat. EFH for marine life should be enhanced.

5. The proposed construction would not result in significant adverse effects on human health and welfare, including municipal and private water supplies; recreational and commercial fishing; plankton; fish; shellfish; wildlife; and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected. Effects on aquatic ecosystem diversity, BIBI, productivity, and stability would be limited and localized during the construction period; all will be enhanced by implementing the proposed project. Positive impacts to the aquatic ecosystem will be realized. Significant negative impacts to recreational, aesthetic, and economic values would not occur.

6. Appropriate steps, including use of similar sand to that already present on the beach, and use of BMP would be taken to minimize potential adverse impacts to aquatic systems resulting from construction activities.

7. On the basis of the guidelines, the proposed sites for construction of eight breakwaters with attached tombolos and associated vegetation are specified as complying with the inclusion of appropriate and practical conditions to minimize pollution and other adverse effects to the aquatic ecosystem.

APPENDIX A

USFWS PLANNING AID REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Dri
Annapolis, MD 21401

OCT 0 3 2001

Colonel David L. Hansen
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, VA 23510-1096

Attn: David Schulte

Re: Saxis Aquatic Ecosystem Restoration Study

Dear Colonel Hansen:

Enclosed is a Planning Aid Report for the subject study. In accordance with the scope of work, it contains information on the baseline biological conditions, an assessment of the alternatives, and potential measures to reduce adverse impacts and enhance benefits. While the project alternatives will contribute in varying degrees to several environmental objectives, it is unclear whether the benefits are sufficient to justify altering an essentially natural high wave energy shoreline. If there are any questions on the report, please contact George Ruddy at (410) 573-4528 or email george_ruddy@fws.gov.

Sincerely,

John P. Wolflin
Supervisor
Chesapeake Bay Field Office

Enclosure

Saxis, Virginia Aquatic Ecosystem Restoration Study

Planning Aid Report:
Baseline Biological Conditions and Assessment of Project Alternatives

Prepared for:
U.S. Army Corps of Engineers
Norfolk District

Prepared by:
George Ruddy
Fish and Wildlife Biologist

Under Supervision of:
John P. Wolflin, Supervisor
Chesapeake Bay Field Office

September 2001

ABSTRACT

Saxis, Virginia Aquatic Ecosystem Restoration Study

Baseline Biological Conditions and Assessment of Project Alternatives

September 2001

This report provides information to assist the Norfolk District, U.S. Army Corps of Engineers in their Saxis Aquatic Ecosystem Restoration Study. The main project alternatives include construction of segmented rock breakwaters, placement of beach fill, and planting of wetland and upland vegetation along the shoreline. The report provides information on the baseline biological conditions, assessment of the project alternatives, and potential measures to reduce adverse impacts and enhance benefits. The existing shoreline is characterized by the presence of a narrow beach exposed to a long wave fetch. The beach supports a small nonbreeding population of the Federally threatened northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*). The land, which is eroding at a rate of 3 to 4 feet per year, consists of a mix of moderately altered wetlands and upland private residential grass lawns. The project alternatives will contribute in varying degrees to several environmental objectives including: 1) increase beach habitat; 2) increase habitat diversity; 3) reduce shore erosion and improve local water quality; and 4) increase sheltered shallow water habitat. There is a concern about whether the environmental benefits are sufficient to justify altering an essentially natural high wave energy shoreline.

INTRODUCTION

The Norfolk District, U.S. Army Corps of Engineers, is conducting a feasibility study to investigate the potential for implementing an aquatic ecosystem restoration project at the Chesapeake Bay (Pocomoke Sound) shoreline adjacent to the town of Saxis, Accomack County, Virginia. The study is being conducted under the authority of section 206 of the Water Resource Development Act of 1996. The primary project alternatives involve the installation of offshore segmented breakwaters, placement of sand fill material, and creation of tidal marsh, dune, and shrub habitat. This report provides information on the baseline environmental conditions, an evaluation of the benefits to aquatic resources, and potential measures to enhance environmental benefits and to reduce adverse impacts. It is provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*) and Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

BASELINE CONDITIONS

The study area is located on the south side of Pocomoke Sound adjacent to the town of Saxis in Accomack County, Virginia. The town of Saxis occupies a relatively narrow stretch of upland that extends for a little more than a mile along Pocomoke Sound. Outside of the town the landscape is dominated by an extensive estuarine wetland known as Freeschool Marsh (Figure 1). Much of this pristine marsh is included within the Saxis Wildlife Management Area operated by the Virginia Department of Game and Inland Fisheries (Figure 2).

Pocomoke Sound experiences a semi-diurnal tide with a mean range of 2.3 feet (U.S. Department of Commerce 1989). The salinity typically varies between 15 and 19 parts per thousand (Lippson 1973). This region of Pocomoke Sound has generally good water quality, although Starling Creek has been condemned for shellfish harvesting by the Virginia Department of Health because of high coliform bacteria counts. A review of the following databases of the Environmental Protection Agency did not reveal any known sources of hazardous or toxic chemicals in the Saxis area.

1) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS). This database lists sites of uncontrolled or abandoned hazardous waste sites under the Superfund Program.

2) Resource Conservation and Recovery Information System (RCRIS). This is an inventory of hazardous waste handlers.

3) Toxics Release Inventory (TRI). This is an information system about toxic chemicals that are being used, manufactured, treated, transported, or released into the environment.

In August of 1997, the Pocomoke became the focus of widespread public attention after a major fish kill was attributed to an outbreak of the toxic microorganism *Pfiesteria piscida*. Because

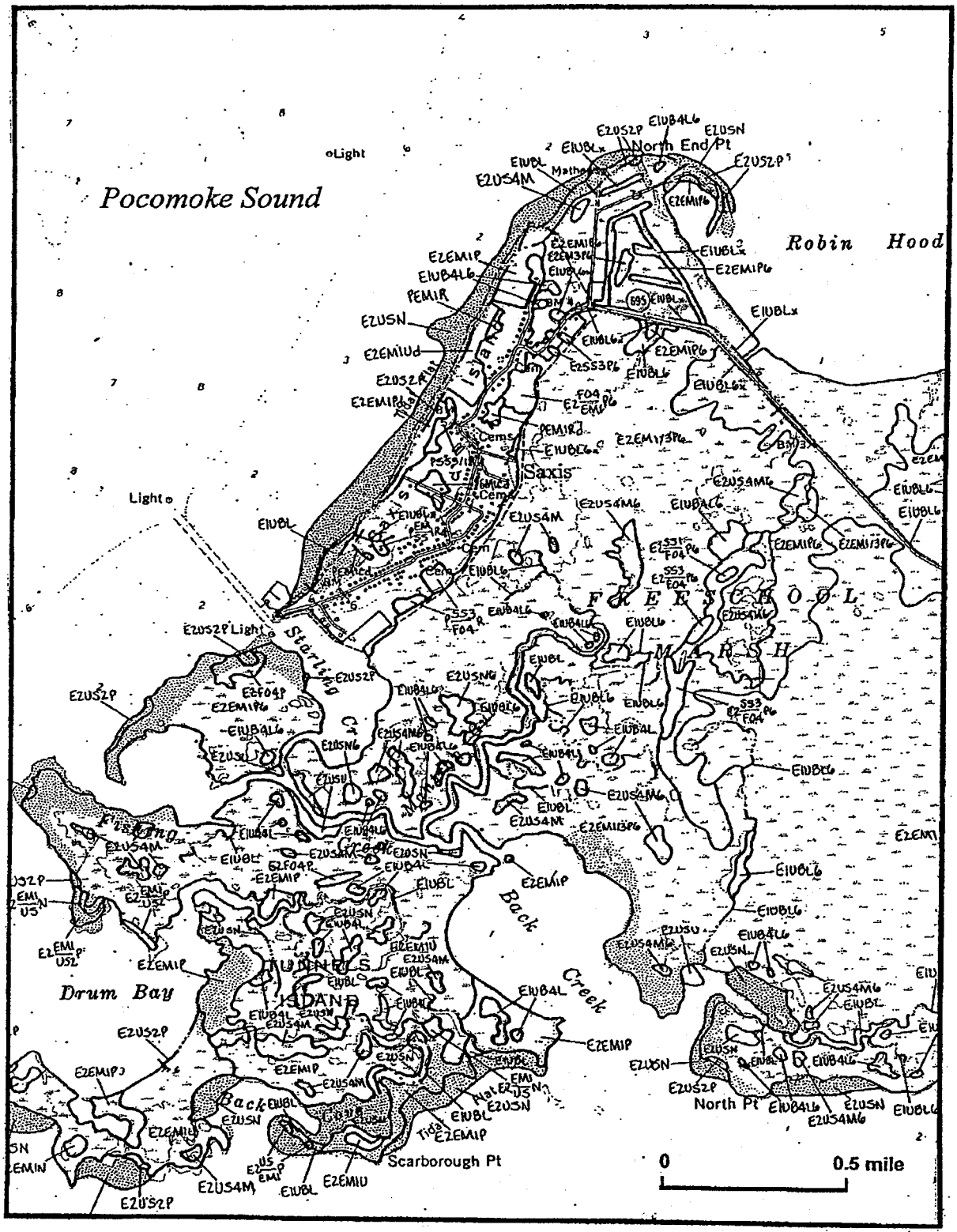


Figure 1. Wetlands delineated by the National Wetland Inventory in the vicinity of Saxis.

Legend for Figure 1.

E1UBLx	Estuarine, subtidal, unconsolidated bottom, subtidal, excavated
E1UB4L6	Estuarine, subtidal, unconsolidated bottom, organic, subtidal, oligohaline
E2US4M	Estuarine, intertidal, unconsolidated shore, organic, irregularly exposed
E2USN	Estuarine, intertidal, unconsolidated shore, regularly flooded
E2US2P	Estuarine, intertidal, unconsolidated shore, sand, irregularly flooded
E2EM1P6	Estuarine, intertidal, emergent, persistent, irregularly flooded, oligohaline
E2EM1Ud	Estuarine, intertidal, emergent, persistent, unknown water regime, partially drained/ditched
PEM1R	Palustrine, emergent, persistent, seasonal tidal
PEM1Cd	Palustrine, emergent, persistent, seasonally flooded, partially drained/ditched
PSS3/1Rd	Palustrine, scrub/shrub, broad-leaved evergreen/deciduous, seasonal tidal, partially drained/ditched

The map was produced in 1995 based on aerial photography taken in April 1988 and April 1989 at a scale of 1:40,000.

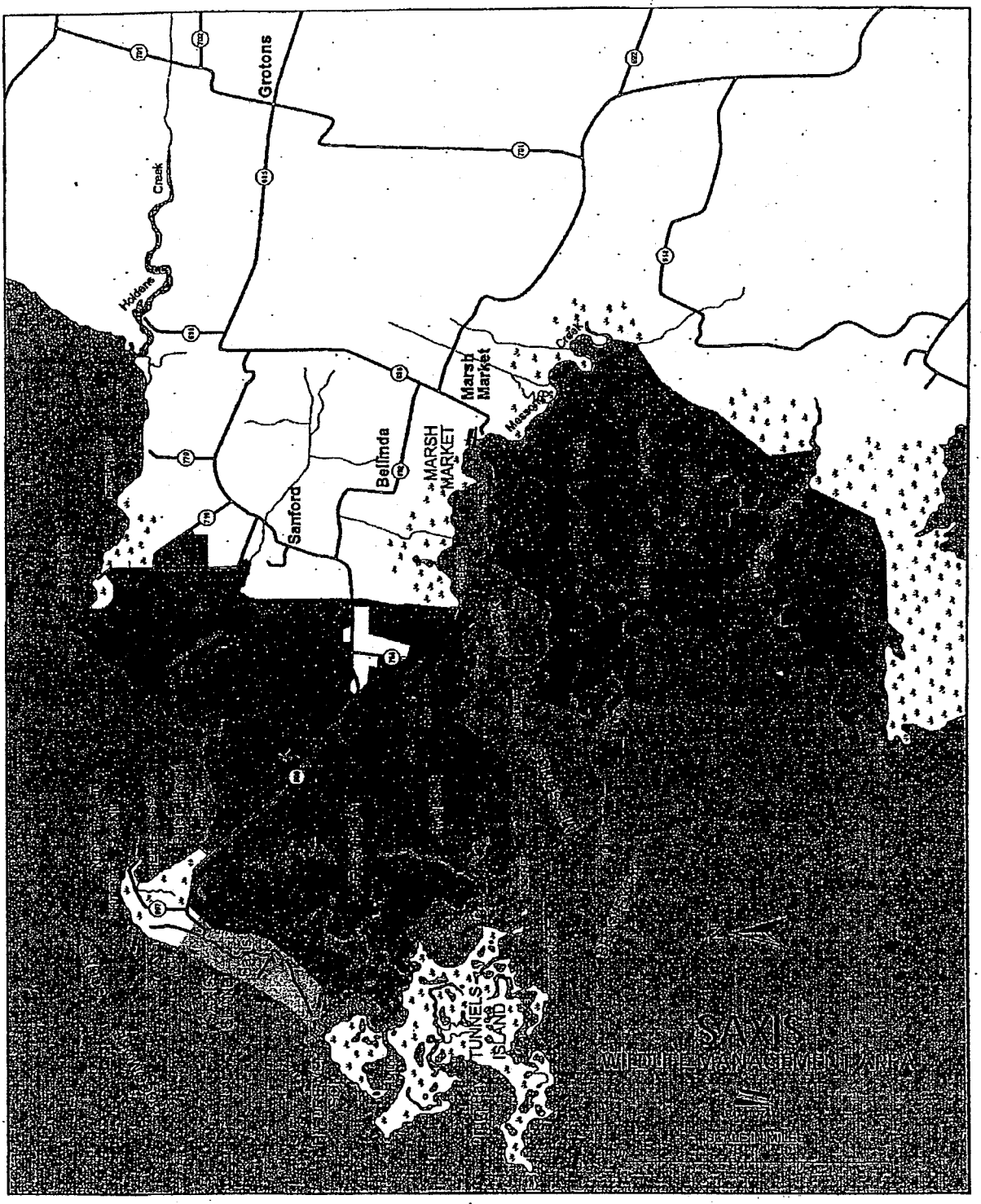


Figure 2. Location of the Saxis Wildlife management Area.

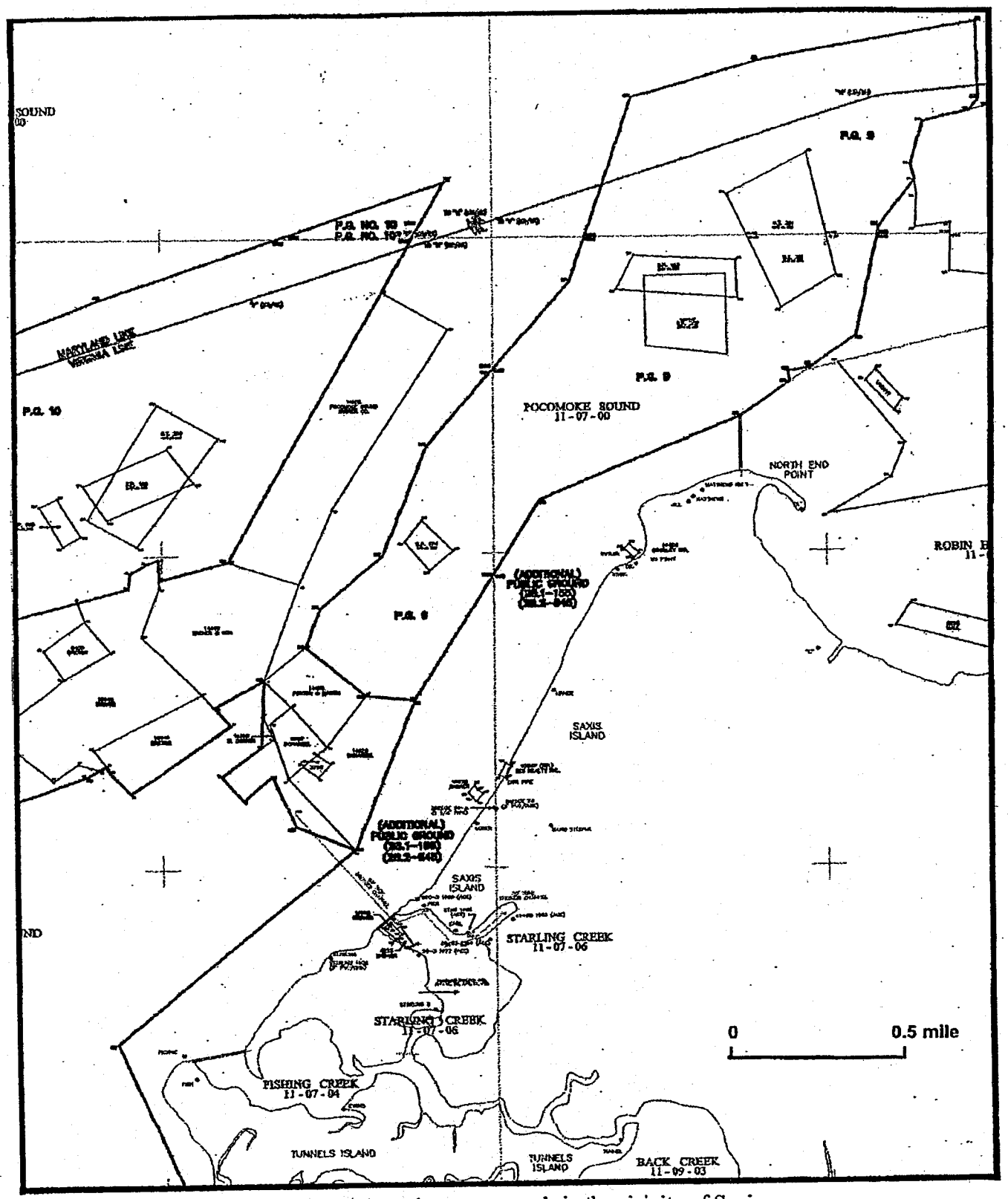


Figure 3. Location of public and leased oyster grounds in the vicinity of Saxis.

end. Some of this fringe marsh exists behind a line of concrete well casings apparently installed as a shore protection measure. Landward of the beach there is a mixture of emergent wetlands and upland residential lands. Most of the wetlands have been adversely affected by ditching, diking, filling or other human alteration. The undesirable invasive reedgrass *Phragmites australis* is the most prevalent species of vegetation. The residential land is characterized by the presence of several private homes and grass lawns with a limited amount of trees and shrubs.

Endangered Species

Recent surveys in 1999 and 2000 have documented the presence of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*), a species which is Federally listed as threatened, at the Saxis beach (Knisley and Hill 1999; Knisley 2000). While the 1999 survey found 136 adult beetles, the 2000 survey only found 5. The beetles in the 2000 survey were restricted to a small 44-yard long section of the widest beach area near the end of Dennis Lane. A survey for larval beetles conducted by Dr. Barry Knisley at the request of the Corps in fall 2000 found none. It appears that the habitat at Saxis has undergone a decline and that the narrow beach is not currently suitable for northeastern beach tiger beetle reproduction and larval development. Provided the project does not diminish the beach habitat and avoids construction disturbance to the inhabited section of beach during the period when adults may be present (May 15 to September 15), then we would expect no take and no adverse effect on the species.

Future Conditions Without the Project

The project area is undergoing a substantial amount of shoreline erosion. The long-term historical rate for the years between 1851 and 1942 was calculated to be 4.9 feet per year (Hobbs et al. 1975). A more recent survey for the years between 1986 and 1998 indicated an average erosion rate of 3.8 feet per year (Hardaway et al. 1999). The recession of the shoreline will progressively convert the adjacent lands to open estuarine water. The shoreline would probably remain similar to existing conditions, i.e., a narrow sandy beach overlying a clay and peat layer.

POTENTIAL BIOLOGICAL EFFECTS

Six project alternatives plus the no action alternative are currently under consideration. Each of the project alternatives involves construction of either 8 or 16 segmented breakwaters. The 8-breakwater option would establish a line of 300-foot long rock breakwaters with 450-foot gaps located approximately 200 feet offshore. The 16-breakwater option would add 8 100-foot long segments in the gaps and set them somewhat closer to the shore. Each of the breakwater options would have 3 beach replenishment options. The highest level of beach fill would reach all the way out to the breakwaters to form tombolos. The second beach fill option would use a more limited amount of sand to form points of accumulation (salients) that do not extend all the way out to the breakwaters. The third option would be to not add any beach fill. The project would only authorize the initial placement of sand for the beach fill. As a result, there will be erosion of the placed sand and shoreline over time, albeit at a much reduced rate.

The breakwaters will produce several ecological benefits. They will reduce the erosion of the land which is mostly composed of a mix of low density residential property and emergent wetlands that have been variably altered by human impacts. The habitat value of these lands is not especially impressive, especially considering the extensive pristine estuarine marshes which exist in this region. However, the reduction in the erosion rate will also produce a localized benefit in water quality due to the concomitant decrease in the amount of sediment released into the nearshore area. The project would establish a shrub border along the shoreline, which should enhance the value of the area for various birds.

The sheltered shallows in the lee of the breakwaters are expected to become more productive for benthic fauna. The existing shallows are exposed to high wave energy which limits the benthic fauna to species which can tolerate a shifting unstable bottom and periodic high sedimentation. We have observed this enhanced benthos effect while monitoring a similar breakwater project in Chesapeake Bay (Ruddy 1990). Knott et al. (1984) observed that species diversity of the benthic macroinvertebrate community increased in the wave-sheltered area created after construction of a jetty at Murrells Inlet, South Carolina. It is possible that the sheltered shallows may support the growth of submerged aquatic vegetation. Because submerged vegetation is almost entirely absent from Pocomoke Sound, it is uncertain whether the project will be able to improve local conditions enough to overcome the apparent regional water quality limitations for submerged aquatic plants. A survey of the distribution of submerged aquatic vegetation at breakwaters in Chesapeake Bay found both positive and negative associations that were primarily dictated by regional trends rather than by the local breakwater effects (Karrh 2000).

The breakwater itself would provide a large surface area of hard attachment substrate for sessile invertebrate organisms. The organisms which comprise this epibenthic or fouling community include those that require a hard attachment substrate and those that are associated with the organic material that accumulates on the surface (Van Dolah et al. 1984; Corey 1967). Potential colonizers would include certain algae, bryozoans, hydroids, tunicates, anemones, hooked mussels, oysters, tube building polychaetes, flatworms, barnacles, isopods and amphipods. The nooks and crannies between the rocks would provide cover for motile organisms such as predatory polychaetes, nudibranchs, grass shrimp, sand shrimp, mud crabs, clingfish, and gobies. The structure may also attract fish in a similar fashion as an artificial reef (Van Dolah et al. 1987). Although displacing natural bottom and adding an unnatural aspect to the shoreline, the structure would have the beneficial effect of increasing the habitat complexity of the area.

The breakwaters and associated beach fill would allow expanded areas of beach, regularly flooded tidal marsh, and vegetated upper berm. If the expanded beach retains a sufficient dynamic character (which is dictated by the degree of wave energy exposure), it should be beneficial for the Federally threatened northeastern beach tiger beetle. While the existing beach appears to be marginal habitat that is only suitable for nonbreeding adults due to the narrow width of the beach and the shallow depth of sand, it is likely that the expanded beach would improve the habitat for this species (Knisley 2000). The project would establish regularly flooded tidal marsh by planting saltmarsh cordgrass (*Spartina alterniflora*) in the upper half of

the intertidal zone in the lee of the breakwaters. Potential resident prominent invertebrates of this tidal marsh would include marsh periwinkles, ribbed mussels, and fiddler crabs. Blue crabs, grass shrimp, and small adult and juvenile fishes (e.g., killifish, silversides, spot) would use the fringe marsh during high tide as a source of food and refuge (Varnell et al. 1995, Hettler 1989). The preliminary plans indicate that the upper berm would be planted with a mix of saltmeadow hay (*Spartina patens*), American beachgrass (*Ammophila breviligulata*), and bitter panicgrass (*Panicum amarum*). Common reed (*Phragmites australis*) could become an unwelcome invader in this area since it is already quite common along the shoreline. The upper berm area would provide suitable nesting for diamondback terrapin. It may also be used by other reptiles (hognose snake), amphibians (Fowlers toad), small mammals (meadow vole, white-footed mouse), and birds (gulls).

Comparative Analysis of Alternatives

Each of the project alternatives would have a different mix of habitats. To evaluate the relative desirability of the alternatives, a system was set up to rate each one on how well it met specific environmental objectives. The objectives are as follows:

1. Increase beach (1.0);
2. Increase habitat diversity (0.7);
3. Reduce shore erosion/improve water quality (0.7);
4. Increase wave sheltered shallow water (0.7); and
5. Avoid down drift shore starvation (0.3).

The importance level of each objective is indicated by the weighting factor given in parentheses. The "increase beach" objective has the highest weighting factor (1.0) to emphasize the benefit of maintaining/improving habitat for the Federally threatened tiger beetle. Other reasons for giving a high weight to beach habitat are: 1) it is a relatively uncommon natural habitat in Chesapeake Bay and is declining in many areas as erosion control projects are implemented; 2) a variety of noteworthy species such as horseshoe crabs, diamondback terrapin, and shorebirds are dependent on beaches; and 3) it is the primary habitat present now and it seems better to maintain/increase its value rather than to attempt to convert it to something else. The second, third, and fourth objectives are assigned a weighting factor of 0.7. The "increase habitat diversity" objective refers to the potential for increasing the presence of 4 habitats (regularly flooded marsh, vegetated upper berm, shrub border, and breakwater). It does not include beach or shallow water which are covered under separate objectives.

The "reduce shore erosion/improve water quality" objective encompasses two environmental benefits. The first benefit is to reduce the erosion of the upland and wetland habitats along the shoreline. Approximately 65 percent of the land that would be subject to erosion without the project is wetland and the balance is upland. The wetlands vary in their habitat quality but in general appear to have mediocre value due to the prevalence of the undesirable invasive reed, *Phragmites australis,* and the effects of ditching, diking, filling, and other human alterations.

The upland is predominantly residential land characterized by grass lawns and patches of shrub/scrub vegetation. The second benefit under this objective is to improve water quality by reducing the input of sediment derived from shoreline erosion. This benefit would be primarily manifested by a localized increase in water clarity. The magnitude of this effect will be limited by the dominant effect of regional water quality factors.

The "increase sheltered shallow water" objective focuses on improving the habitat value of the nearshore shallows by reducing the wave energy. The high wave energy climate under the existing conditions tends to cause a relatively unstable bottom substrate, a high level of suspended sediments, and a physically demanding environment for nekton. A reduction in the wave energy should improve conditions for benthic invertebrates and small adult and juvenile fishes. It would also improve the potential for development of submerged aquatic vegetation.

The objective of "avoiding downdrift shoreline starvation" is intended to address the possibility that some of the alternatives, particularly the breakwaters without fill, could reduce the amount of littoral material that reaches the adjacent shoreline on the north side. This is a relatively short section of shoreline (approximately 3,000 feet), but it contains some relatively high quality beach and marsh habitats. It has a weighting factor of 0.3.

Each alternative was given a rating from 1 to 10 depending on how well it met each environmental objective over the 25-year project life. The ratings were adjusted by multiplying them by the weighting factor of each objective. The results and the total score for each alternative is shown in Table 1. All the alternatives scored significantly higher than the no action alternative. The two breakwater alternatives with the highest levels of beach fill (tombolo formation) received the highest total scores. These alternatives have the highest ratings in expanding the beach, increasing habitat diversity, reducing shore erosion, and avoiding downdrift shore erosion. However, they are notably less effective in creating sheltered shallow water habitat. The 8-breakwater alternative scored slightly higher than the 16-breakwater alternative primarily because the greater wave protection provided by the latter reduced the amount of beach habitat by facilitating vegetative growth.

Additional Project Considerations

The project alternatives will achieve varying degrees of environmental benefits. We have some concern about whether the benefits of even the highest rated alternatives are sufficient to justify the alteration of an essentially natural shoreline. There are two aspects of the project that detract from its potential benefits. One is the limited value of the landside habitats that would be protected from erosion. The other centers around the fact that the shoreline is under the control of private individual land owners. As a result, there is no ready way to control human disturbance or to establish other management measures to sustain the habitat values after the project is constructed. For example, it is possible that the expanded beach would encourage greater human use and thereby reduce the potential habitat value. The Federally threatened tiger beetle would be particularly vulnerable to increased human disturbance on the beach.

Table 1. Alternatives evaluation

PROJECT ALTERNATIVE	ENVIRONMENTAL OBJECTIVES					TOTAL SCORE
	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/Improve Water Quality	Increase Sheltered Shallow Water	Avoid Downdrift Shore Starvation	
	Rating X Weight Factor (1.0) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.7) = Product Score	Rating X Weight Factor (0.3) = Product Score	
16 BW w tombolo	8 X 1.0 = 8	10 X 0.7 = 7	10 X 0.7 = 7	4 X 0.7 = 2.8	9 X 0.3 =2.7	27.5
8 BW w tombolo	10 X 1.0 = 10	9 X 0.7 = 6.3	9 X 0.7 = 6.3	4 X 0.7 = 2.8	10 X 0.3 =3	28.4
16 BW w salient	5 X 1.0 =5	8 X 0.7 = 5.6	8 X 0.7 = 5.6	7 X 0.7 = 4.9	6 X 0.3 = 1.8	22.9
8 BW w salient	7 X 1.0 = 7	7 X 0.7 = 4.9	7 X 0.7 = 4.9	7 X 0.7 =4.9	7 X 0.3 = 2.1	23.8
16 BW w/o fill	3 X 1.0 = 3	6 X 0.7 = 4.2	6 X 0.7 = 4.2	10 X 0.7 = 7.0	1 X 0.3 = 0.3	18.7
8 BW w/o fill	4 X 1.0 = 4	5 X 0.7 = 3.5	5 X 0.7 = 3.5	10 X 0.7 = 7.0	2 X 0.3 = 0.6	18.6
No Action	1 X 1.0 = 1	1 X 0.7 = 0.7	1 X 0.7 = 0.7	1 X 0.7 = 0.7	10 X 0.3 = 3	6.1

Phragmites could spread from the adjacent lands and degrade the new habitats that are created by the project. We do have a concern that the use of environmental improvement measures on naturally occurring, high erosion shorelines will become a common practice. Even though the physical limitations of high erosion shorelines preclude establishment of some desirable habitats, some organisms and communities are dependent on these areas. Widespread modification of high energy/high erosion shorelines would reduce bay-wide habitat complexity and could possibly have unforeseen consequences on shoreline dynamics. There is already substantial impetus to implement shore erosion control projects to protect landside real estate. Over time natural shorelines, including eroding shorelines, will likely become less common. We doubt that it will prove beneficial over the long term to accelerate this process.

POTENTIAL MEASURES TO REDUCE ADVERSE IMPACTS AND ENHANCE ENVIRONMENTAL BENEFITS

The quality of the beach fill material is an important factor affecting the impact associated with siltation on adjacent areas. The material should be composed of good clean sand with a low silt/clay content.

The population of adult northeastern beach tiger beetles that exists along the shoreline could be adversely affected if project construction occurs during the period when they are on the beach. Therefore, to eliminate this impact we recommend that construction take place within the period of September 15 to May 15 when the adult beetles are not present. Based on the summer 2000 survey by Dr. Knisley, the beetles are confined to a small 40-meter section of the widest beach. Therefore, the construction time of year restriction needs only to apply to this section plus an appropriate buffer.

To enhance the possibility that submerged aquatic vegetation will colonize the shallow water area of the project, we suggest that consideration be given to bringing in some eelgrass seed or transplants. The nearest significant natural seed sources are several kilometers away in the area of Cedar Island and Great Fox Island to the northeast and at Beasley Bay to the south. While we observed some eelgrass that had washed ashore during our field inspection, it would be helpful to jump start the colonization. However, since the suitability of the area for submerged aquatic vegetation is uncertain, we suggest that the planting area be limited in scope. It would be advisable to wait several months to a year to allow the substrate to equilibrate to the new conditions.

Wetland vegetation plantings (both emergent and submerged plants) are quite susceptible to predation while they are becoming established. Approximately 30 resident Canada geese were observed resting along the northern end of the shoreline during our site inspection. We suggest that steps be taken to keep waterfowl out of the project area for about a year after planting. Bird hazing and installation of exclosures are potential measures to consider.

Since *Phragmites* is common along the shoreline, there is a good chance that it will invade the new shoreline habitats that are established by the project. We suggest that the project include a plan that would monitor this and implement control measures if needed. It would also be good if the existing stands of *Phragmites* along the shoreline were treated with herbicide prior to construction of the project. Keep in mind that this is a tenacious species that will likely recover over time from a single herbicide treatment.

Since the results of the project are by no means certain, a monitoring plan should be established. The plan should monitor the habitats which are created, the shoreline erosion rate, and the population of tiger beetles. This information will be useful in the design of future projects.

Among the action alternatives currently under consideration, we favor the ones with 8 breakwaters and sand fill since they are most likely to have a dynamic, but persistent beach. These alternatives have the best potential to improve habitat for the northeastern beach tiger beetle.

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Virginia Institute of Marine Science SAV web page; www.vims.edu/bio/sav/

APPENDIX B

PERTINENT CORRESPONDENCE

COMMONWEALTH of VIRGINIA

Department of Historic Resources
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September 30, 2002

Mr. Mark T. Mansfield
Chief, Planning Branch
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Re: Aquatic Ecosystem Restoration Project, Saxis Island
Accomack County Virginia
DHR File Number 2002-1317

Dear Mr. Mansfield:

Thank you for requesting our comments on the referenced project. We understand that the Corps intends to construct eight segmented offshore breakwaters on the shoreline on the western boundary of the town of Saxis.

Based on the information provided, the DHR concurs that no historic properties will be affected by the proposed project, provided that no cutting of the bank will occur. If plans are revised to include cutting of the bank, further coordination with our department will be necessary.

Thank you again for consulting with us. If I can be of any further assistance, do not hesitate to contact me at (804) 367.2323 ext. 140 or lrichards@dhr.state.va.us.

Sincerely,

Lily A. Richards
Archaeologist and Historian, Office of Review and Compliance

C. Anne Newsom, DEQ

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October 18, 2002

Mr. David Schulte
CENAO-PL-R
U.S. Army Corps of Engineers
Norfolk District
803 Front Street
Norfolk, Virginia 23510-1096

RE: Draft Environmental Assessment: Aquatic Ecosystem Restoration Project, Saxis Island, Virginia (DEQ # 02-172F).

Dear Mr. Schulte:

The Commonwealth of Virginia has completed its review of the Draft Environmental Assessment (EA) for the above referenced project. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of federal environmental documents and responding to appropriate federal officials on behalf of the Commonwealth. Also, as you are aware, pursuant to the Coastal Zone Management Act of 1972, as amended, federal actions that can have foreseeable effects on Virginia's coastal uses or resources must be conducted in a manner which is consistent, to the maximum extent practicable, with the Virginia Coastal Resources Management Program (VCP). DEQ, as the lead agency for the VCP, is responsible for coordinating Virginia's review of federal consistency determinations. The following agencies, planning district commission and locality participated in the review of this EA:

Department of Environmental Quality
Department of Conservation and Recreation
Department of Agriculture and Consumer Services
Marine Resources Commission
Chesapeake Bay Local Assistance Department
Department of Historic Resources
Department of Health
Virginia Institute of Marine Science
Accomack-Northampton Planning District Commission
Accomack County

The Department of Game and Inland Fisheries was also invited to comment.

Project Description

The U.S. Army Corps of Engineers proposes to construct eight segmented, offshore breakwaters along approximately 6,000 feet of intertidal shoreline located on the western boundary of the Town of Saxis, Virginia. Saxis is located along the Chesapeake Bay shoreline on Virginia's Eastern Shore. The areal extent of the project is approximately 32 acres.

Each breakwater is 300 feet long and would be located approximately 200 feet channelward of mean lower low water (MLLW) and placed 450 feet apart. The breakwaters would help to protect existing wetlands that are eroding at a rate of up to 4.9 feet per year. Tombolos would be created landward of each breakwater with approximately 110,000 cubic yards of sand. Since the shoreline management plan developed by the Virginia Institute of Marine Science (VIMS) for the Town of Saxis included an environmental restoration component, 1.9 acres of the tombolos would be planted with *Spartina patens*. Other habitat restoration includes low and high marsh habitat, 3.7 acres of open beach, 5.0 acres of scrub-shrub and 1.0 acres of submerged aquatic vegetation (SAV). The SAV may be planted once the bottom conditions have stabilized. In addition, a +6-foot MLLW berm would be created to address a 25-year storm event, although the entire system is designed to withstand a 100-year storm event with the possible need for replacement of sand and vegetation within the system.

In total, seven alternative plans were considered. These plans include the construction of 8 or 16 breakwaters with no associated backfill, 8 or 16 breakwaters with fill placed for salient formation, 8 or 16 breakwaters with sand in a tombolo formation and the no-action alternative. The selected plan of eight breakwaters with tombolo formations was based on a recommendation from Dr. Scott Hardaway of VIMS, College of William and Mary. In addition, the preferred alternative provides the maximum environmental benefit for the least incremental cost.

The Commonwealth of Virginia has no objection to the proposed "Finding of No Significant Impact" for this project, provided that it is carried out in accordance with all applicable federal, state and local laws and regulations. We agree that there is no need to prepare an Environmental Impact Statement for this proposal.

Environmental Impacts and Mitigation

1. ***Wetlands and Water Quality.*** The Draft EA (page 18) states that construction of the breakwaters would create a short-term increase in turbidity in the immediate area. The EA (page 4) also states that *Spartina patens* would be planted in the lowest portions of the newly created marsh areas and *Spartina alterniflora* would be planted in the higher portions. We recommend that the planting locations for these species be reversed since *Spartina alterniflora* typically thrives in the lowest portions of marshes. The Virginia Institute of Marine Science (VIMS) agrees with this recommendation. This correction should be reflected in the Final EA.

The DEQ-Tidewater Regional Office stated that the project is unlikely to have significant adverse effects on water quality, designated water uses or wetlands and they have no objection to

the proposed project. In addition, the VIMS concurs with the conclusions and recommends the plan as detailed in the EA.

2. Subaqueous Lands. The EA (page 18) states that 17.8 acres of public oyster grounds would be impacted by the project. However, a study conducted by VIMS noted the complete absence of oysters and clams in these areas. The Virginia Marine Resources Commission (VMRC) states that there are two riparian oyster ground leases within both the Public Ground and the proposed project site. Due to this and the impacts to subaqueous lands, a Joint Permit Application must be submitted to the VMRC for review (see item 1, Regulatory and Coordination Needs).

3. Chesapeake Bay Preservation Area. The EA (page 12) states that access roads for construction vehicles would be constructed in Resource Protection Areas. The construction and use of these roads would impact a small amount of scrub-shrub and urban lawn. However, the roads would be removed at the end of construction. In addition, coordination with the Chesapeake Bay Local Assistance Department (CBLAD) (see attached letter) indicates that shoreline erosion control projects are conditionally exempt from typical RPA buffer standards, provided that the activities are conducted in a manner that minimizes impacts to water quality and encroachment into the RPA. CBLAD has no further comments beyond those made in their September 20, 1999 letter to the U.S. Army Corps of Engineers.

4. Natural Heritage Resources. The Draft EA (page 21) states that Dr. Barry Knisley conducted a survey for the northeastern tiger beetle in July and October 2000. The results of the survey showed that a small population of adult beetles uses a small area of the beach; however the larval survey was negative. In order to protect this population, a buffer area will be established around the area during the May through September timeframe when adults are present. Once the project is completed, the stabilization of the Saxis shoreline will be beneficial to the tiger beetle by helping to stabilize its remaining habitat and creating 3.7 acres of new dune habitat, which may provide proper conditions for larval survival. The Department of Agriculture and Consumer Services reviewed the Draft EA commented that Table 4 should include the northeastern beach tiger beetle as a federal threatened species in the project area.

The Department of Conservation and Recreation's (DCR) Division of Natural Heritage (DNH) maintains a database of natural heritage resources in Virginia. Natural heritage resources are defined as the habitat of rare, threatened, or endangered animal and plant species, unique or exemplary natural communities, and significant geologic communities. DCR supports this restoration project and has no further comments at this time.

Also, pursuant to the Memorandum of Agreement established between DCR and the Virginia Department of Agriculture and Consumer Services (VDACS), DCR has the authority to report for VDACS on state-listed plant and insect species. The current activity will not affect any documented state-listed plant or insect species under the jurisdiction of VDACS. Please contact DCR's Division of Natural Heritage at (804) 786-7951 if a significant amount of time passes before the project is implemented.

5. Wildlife Resources. The EA (page 11) states that the Federally-threatened bald eagle (*Haliaeetus leucocephalus leucocephalus*) and the state-threatened Henslow's sparrow (*Ammodramus henslowii susurrans*) are in the project vicinity. The EA (page 22) also states that the U.S. Fish and Wildlife Service does not indicate that the preferred alternative would adversely impact any endangered species or its habitat as specified by the Endangered Species Act of 1973, as amended. Under title 29.1 of the Code of Virginia, the Department of Game and Inland Fisheries (DGIF) is the primary wildlife and freshwater fish management agency in the Commonwealth. The DGIF has full law enforcement and regulatory jurisdiction over all wildlife resources, inclusive of state and federally endangered or threatened species, but excluding listed insects. For additional information, contact Tom Wilcox of DGIF at (804) 367-8998.

6. Non-point Source Pollution Control. Executive Order 12088-Federal Compliance with Pollution Control Standards and the Sikes Act authorizes cooperation between state and federal agencies regarding the conservation of natural resources. Compliance with the state Erosion and Sediment Control and Stormwater Management programs through proper design and implementation is consistent with the mandate of these federal directives. Notwithstanding cooperation with DCR, federal agencies are responsible for ensuring compliance with the state program on regulated activities under their authority through separate agreements with contractors, training, field inspection, enforcement action, or other means that are consistent with agency policy and federal and state mandates.

7. Air Quality. During road construction, fugitive dust must be kept at a minimum by using applicable control methods outlined in 9 VAC 5-50-60 et seq. of the Regulations for the Control and Abatement of Air Pollution. These precautions include, but are not limited to, the following:

- Use, where possible, of water or chemicals for dust control;
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments resulting from soil erosion.

Please contact the DEQ-Tidewater Regional Office, (757) 518-2000, for additional information.

8. Solid and Hazardous Wastes. The EA addresses solid and hazardous waste issues. The DEQ-Waste Division did a review of its data files and did not find any sites that might impact this project. Any solid or hazardous wastes generated by this project should be reduced at the sources, re-used, or recycled. Solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations.

9. Wild and Scenic Rivers. The Department of Conservation and Recreation has indicated that the proposed project will not impact any streams on the National Park Service's Nationwide Inventory, Final List of Rivers, potential Scenic Rivers or existing or potential State Scenic Byways.

10. Historic and Archaeological Resources. The EA (page 15) states that numerous archaeological sites have been found on the Eastern Shore, however, none have been recorded in the Town of Saxis. The Department of Historic Resources (DHR) commented that, based on the information provided in the EA, the DHR concurs that no historic properties would be affected by the proposed project provided that no cutting of the bank will occur. If plans were revised to include any bank cutting, further consultation with DHR would be required.

11. Water Supply. The Department of Health states that they have no objection to the project.

12. Local Issues. The Accomack-Northampton Planning District Commission states that the project would be of great benefit to Saxis Island. Accomack County is also in full support of the project. They state that the expected long-term, positive environmental benefits from the project are much greater than any negative impacts that would result from construction activities.

Regulatory and Coordination Needs

1. Subaqueous Lands Management and Tidal Wetlands. Since the project will impact State-owned submerged lands, authorization from the VMRC will be required. Contact George Badger of the VMRC at (757) 414-0710 for information on submittal of a Joint Permit Application.

2. Erosion and Sediment Control. Virginia's Erosion and Sediment Control Law (Virginia Code 10.1-567) and Regulations (4 VAC 50-30-30 et seq.), Stormwater Management Law (Virginia Code 10.1-603.5) and Regulations (4 VAC 3-20-210 et seq.) may be applicable to access road construction. For more information, please contact the DCR's Chowan/Albemarle Watershed Office at (757) 925-2468.

3. Air Quality Regulations. This project may be subject to regulation by the DEQ. The following sections of Virginia Administrative Code may be applicable: 9 VAC 5-50-60 et seq. governing fugitive dust emissions and 9 VAC 5-40-5600 et seq. addressing open burning. For additional information, please contact the DEQ-Tidewater Regional Office at (757) 518-2000.

4. Solid and Hazardous Waste. During road construction, any soil that is suspected of contamination encountered during construction must be tested and disposed of in accordance with applicable federal, state and local laws and regulations. Should contamination be discovered, please contact the Tidewater Regional Office of the DEQ. Also, all solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations. The following state regulations may be applicable: Virginia Waste Management Act, Code of Virginia Sections 10.1-1400 et seq.; Virginia Hazardous Waste Management Regulations (9VAC 20-60); Virginia Solid Waste Management Regulations (9VAC 20-80) and Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal regulations are the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 et seq. and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Parts

107, 171.1-172.558. Contact the DEQ-Tidewater Regional Office at (757) 518-2000 concerning the location and availability of suitable waste management facilities in the project area or if free product, discolored soils, or other evidence of contaminated soils are encountered.

5. Historic and Archaeological Resources. If the plans are revised to include cutting of the bank, please contact Lily Richards of the Department of Historic Resources at (804) 367-2323, ext. 140 to ensure compliance with *Section 106 of the National Historic Preservation Act.*

6. Federal Consistency Determination. Pursuant to the Coastal Zone Management Act of 1972, as amended, federal activities with reasonable foreseeable effects on coastal uses and resources must be constructed and operated in a manner that is consistent with the Virginia Coastal Resources Management Program. In order to be consistent with the VCP, the Corps must obtain all applicable approvals listed under the Enforceable Programs of the VCP (see Attachment 1). In addition, we invite your attention to the Advisory Policies of the VCP (see Attachment 2). The information provided in the EA does not address all of the enforceable programs of the VCP and is therefore insufficient to support a consistency finding. Section 930.39 of the federal consistency regulations (15 CFR Part 930) gives content requirements for the consistency determination. The consistency determination may be provided as part of the documentation concluding the NEPA process, or independently, depending on your agency's preference. Contact Anne Newsom at (804) 698-4135 for more information.

Thank you for the opportunity to review the Environmental Assessment. Detailed comments of reviewing agencies are attached for your review. If you have any questions, please contact Anne Newsom at (804) 698-4135.

Sincerely,

Ellie L. Irons
Program Manager
Office of Environmental Impact Review

Enclosures

Cc: Martin Ferguson, WPS
Derral Jones, DCR
Ethel Eaton, DHR
William Cash-Robertson DEQ-TRO
Tom Modena, DEQ-Waste
George Badger, VMRC
Kotur S. Narasimhan, DEQ-Air
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Attachment 1

Enforceable Regulatory Programs comprising Virginia's Coastal Resources Management Program (VCP)

a. Fisheries Management - The program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational fisheries to maximize food production and recreational opportunities. This program is administered by the Marine Resources Commission (VMRC); Virginia Code §28.2-200 to §28.2-713 and the Department of Game and Inland Fisheries (DGIF); Virginia Code §29.1-100 to §29.1-570.

The State Tributyltin (TBT) Regulatory Program has been added to the Fisheries Management program. The General Assembly amended the Virginia Pesticide Use and Application Act as it related to the possession, sale, or use of marine antifoulant paints containing TBT. The use of TBT in boat paint constitutes a serious threat to important marine animal species. The TBT program monitors boating activities and boat painting activities to ensure compliance with TBT regulations promulgated pursuant to the amendment. The VMRC, DGIF, and Virginia Department of Agriculture Consumer Services (VDACS) share enforcement responsibilities; Virginia Code §3.1-249.59 to §3.1-249.62.

b. Subaqueous Lands Management - The management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects on marine and fisheries resources, tidal wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by the Department of Environmental Quality (DEQ). The program is administered by the Marine Resources Commission; Virginia Code §28.2-1200 to §28.2-1213.

c. Wetlands Management - The purpose of the wetlands management program is to preserve wetlands, prevent their despoliation, and accommodate economic development in a manner consistent with wetlands preservation.

(1) The tidal wetlands program is administered by the Marine Resources Commission; Virginia Code §28.2-1301 through §28.2-1320.

(2) The Virginia Water Protection Permit program administered by DEQ includes protection of wetlands --both tidal and non-tidal; Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

Attachment 1 continued

d. Dunes Management - Dune protection is carried out pursuant to The Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission; Virginia Code §28.2-1400 through §28.2-1420.

e. Non-point Source Pollution Control – (1) Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by the Department of Conservation and Recreation; Virginia Code §10.1-560 et.seq.).

(2) Coastal Lands Management is a state-local cooperative program administered by the Chesapeake Bay Local Assistance Department and 84 localities in Tidewater (see i) Virginia; Virginia Code §10.1-2100 –10.1-2114 and 9 VAC10-20 et seq.

f. Point Source Pollution Control - The point source program is administered by the State Water Control Board (DEQ) pursuant to Virginia Code §62.1-44.15. Point source pollution control is accomplished through the implementation of:

(1) the National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to Section 402 of the federal Clean Water Act and administered in Virginia as the Virginia Pollutant Discharge Elimination System (VPDES) permit program.

(2) The Virginia Water Protection Permit (VWPP) program administered by DEQ; Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

g. Shoreline Sanitation - The purpose of this program is to regulate the installation of septic tanks, set standards concerning soil types suitable for septic tanks, and specify minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth. This program is administered by the Department of Health (Virginia Code §32.1-164 through §32.1-165).

h. Air Pollution Control - The program implements the federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board (Virginia Code §10-1.1300 through §10.1-1320).

(i) Coastal Lands Management is a state-local cooperative program administered by the Chesapeake Bay Local Assistance Department and 84 localities in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act; Virginia Code §10.1-2100 –10.1-2114 and Chesapeake Bay Preservation Area Designation and Management Regulations; Virginia Administrative Code 9 VAC10-20 et seq.

Attachment 2

Advisory Policies for Geographic Areas of Particular Concern

a. Coastal Natural Resource Areas - These areas are vital to estuarine and marine ecosystems and/or are of great importance to areas immediately inland of the shoreline. Such areas receive special attention from the Commonwealth because of their conservation, recreational, ecological, and aesthetic values. These areas are worthy of special consideration in any planning or resources management process and include the following resources:

a) Wetlands
b) Aquatic Spawning, Nursery, and Feeding Grounds
c) Coastal Primary Sand Dunes
d) Barrier Islands
e) Significant Wildlife Habitat Areas
f) Public Recreation Areas
g) Sand and Gravel Resources
h) Underwater Historic Sites.

b. Coastal Natural Hazard Areas - This policy covers areas vulnerable to continuing and severe erosion and areas susceptible to potential damage from wind, tidal, and storm related events including flooding. New buildings and other structures should be designed and sited to minimize the potential for property damage due to storms or shoreline erosion. The areas of concern are as follows:

i) Highly Erodible Areas
ii) Coastal High Hazard Areas, including flood plains.

c. Waterfront Development Areas - These areas are vital to the Commonwealth because of the limited number of areas suitable for waterfront activities. The areas of concern are as follows:

i) Commercial Ports
ii) Commercial Fishing Piers
iii) Community Waterfronts

Although the management of such areas is the responsibility of local government and some regional authorities, designation of these areas as Waterfront Development Areas of Particular Concern (APC) under the VCRMP is encouraged. Designation will allow the use of federal CZMA funds to be used to assist planning for such areas and the implementation of such plans. The VCRMP recognizes two broad classes of priority uses for waterfront development APC:

Attachment 2 con't

i) water access dependent activities;
ii) activities significantly enhanced by the waterfront location and complementary to other existing and/or planned activities in a given waterfront area.

Advisory Policies for Shorefront Access Planning and Protection

a. Virginia Public Beaches - Approximately 25 miles of public beaches are located in the cities, counties, and towns of Virginia exclusive of public beaches on state and federal land. These public shoreline areas will be maintained to allow public access to recreational resources.

b. Virginia Outdoors Plan - Planning for coastal access is provided by the Department of Conservation and Recreation in cooperation with other state and local government agencies. The Virginia Outdoors Plan (VOP), which is published by the Department, identifies recreational facilities in the Commonwealth that provide recreational access. The VOP also serves to identify future needs of the Commonwealth in relation to the provision of recreational opportunities and shoreline access. Prior to initiating any project, consideration should be given to the proximity of the project
site to recreational resources identified in the VOP.

c. Parks, Natural Areas, and Wildlife Management Areas - Parks, Wildlife Management Areas, and Natural Areas are provided for the recreational pleasure of the citizens of the Commonwealth and the nation by local, state, and federal agencies. The recreational values of these areas should be protected and maintained.

d. Waterfront Recreational Land Acquisition - It is the policy of the Commonwealth to protect areas, properties, lands, or any estate or interest therein, of scenic beauty, recreational utility, historical interest, or unusual features which may be acquired, preserved, and maintained for the citizens of the Commonwealth.

e. Waterfront Recreational Facilities - This policy applies to the provision of boat ramps, public landings, and bridges which provide water access to the citizens of the Commonwealth. These facilities shall be designed, constructed, and maintained to provide points of water access when and where practicable.

f. Waterfront Historic Properties - The Commonwealth has a long history of settlement and development, and much of that history has involved both shorelines and near-shore areas. The protection and preservation of historic shorefront properties is primarily the responsibility of the Department of Historic Resources. Buildings, structures, and sites of historical, architectural, and/or archaeological interest are significant resources for the citizens of the Commonwealth. It is the policy of the

Attachment 2 con't

Commonwealth and the VCRMP to enhance the protection of buildings, structures, and sites of historical, architectural, and archaeological significance from damage or destruction when practicable.

Review Instructions:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for you comments. **If you use the space below, the form must be signed and dated.**

Please return your comments to:

Ms. Anne B. Newsom
Dept. of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219
Fax: (804) 698-4319

Anne B. Newsom
Environmental Program Planner

Comments:

VWP: This project does not involve a proposed surface water withdrawal project, a proposed roadway construction activity by VDOT, a proposed power plant, or a proposed revision to a Federal or State program. Therefore, the DEQ Central Office defers to the appropriate DEQ Regional Office for comments.

VPDES/VPA: No comment

Name: Martin Ferguson
Signature:
Title:
Agency: DEQ - Water Permits Support

Date: September 18, 2002

Project: 02-172F

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

INTERNAL MEMORANDUM
Tidewater Regional Office

To: Anne Newsom

CC:

From: Bill Cash-Robertson, RPM

Date: October 3, 2002

Re: Environmental Review Comments
PROJECT: 02-172F, Aquatic Ecosystem Restoration Project, Saxis Island, Virginia

---

TRO has no objection to the draft Environmental Assessment in this matter and its finding of no significant impact. Provided that the required environmental permits are obtained as described in the Environmental Assessment, this project is believed unlikely to have significant adverse effects on ambient air quality, water quality, designated water uses, wetlands, or other environmental resources.

E:\Docs\EAs\02-172F.doc

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
www.deq.state.va.us

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

MEMORANDUM

TO: Anne Newsom

FROM: Thomas Modena TJM

DATE: October 3, 2002

COPIES: Kevin Greene

SUBJECT: Environmental Assessment
US Army Corps of Engineers Saxis Island Aquatic Ecosystem Restoration Project

The Office of Remedial Programs has reviewed the Environmental Assessment for the US Army Corps of Engineers Saxis Island Aquatic Ecosystem Restoration Project, Accomack County. We have the following comments concerning the waste issues associated with this project.

Solid and hazardous waste issues and sites were adequately addressed in the report. The central office of the Waste Division did a cursory review of its data files and did not find any additional sites that might impact this project.

Any soil or sediment that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-80); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Parts 107, 171.1-172.558.

Finally, pollution prevention was not addressed in the report. VDEQ encourages all projects to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated.

If you have any questions or need further information, please let me know.

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR PROGRAM COORDINATION

ENVIRONMENTAL REVIEW REPORT APPLICABLE TO AIR QUALITY

RECEIVED
SEP 27 2002
DEQ-Office of Environmental Impact Review

TO: Anne B. Newsom **DEQ-OEIA PROJECT NUMBER: 02-172F**

PROJECT TYPE: ☐ STATE EA/EIR/FONSI X FEDERAL EAEIS ☐ SCC

☐ CONSISTENCY DETERMINATION/CERTIFICATION

PROJECT TITLE: ACQUATIC ECOSYSTEM RESTORATION PROJECT, SAXIS ISLAND, VIRGINIA

PROJECT SPONSOR: DOD/ARMY/ARMY CORP OF ENGINEERS

PROJECT LOCATION:
☐ OZONE NON-ATTANMENT AREA
☐ OZONE MAINTENANCE AREA
☐ STATE VOLATILE ORGANIC COMPOUNDS & NITROGEN OXIDES EMISSION CONTROL AREA

REGULATORY REQUIREMENTSMAY BE APPLICABLE TO: ☐ CONSTRUCTION ☐ OPERATION

STATE AIR POLLUTION CONTROL BOARD REGULATIONS THAT MAY APPLY:

1. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 E – STAGE I
2. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 F – STAGE II Vapor Recovery
3. ☐ 9 VAC 5-40-5490 et seq. – Asphalt Paving operations
4. X **9 VAC 5-40-5600 et seq. – Open Burning**
5. X **9 VAC 5-50-60 et seq. Fugitive Dust Emissions**
6. ☐ 9 VAC 5-50-130 et seq. - Odorous Emissions; Applicable to
7. ☐ 9 VAC 5-50-160 et seq. – Standards of Performance for Toxic Pollutants
8. ☐ 9 VAC 5-50-400 Subpart_____, Standards of Performance for New Stationary Sources, designates standards of performance for the
9. ☐ 9 VAC 5-80-10 et seq. of the regulations – Permits for Stationary Sources
10. ☐ 9 VAC 5-80-1700 et seq. Of the regulations – Major or Modified Sources located in PSD areas. This rule may be applicable to the
11. ☐ 9 VAC 5-80-2000 et seq. of the regulations – New and modified sources located in non-attainment areas
12. ☐ 9 VAC 5-80-800 et seq. Of the regulations – Operating Permits and exemptions. This rule may be applicable to

COMMENTS SPECIFIC TO THE PROJECT:

K.S. Narasimh

(Kotur S. Narasimhan)
Office of Air Data Analysis

September 27, 2002

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street
Richmond, Virginia 23219-2010
TDD (804) 786-2121

MEMORANDUM

DATE: 3 October 2002

TO: Anne B. Newsom, Virginia Department of Environmental Quality

FROM: Derral Jones, Planning Bureau Manager

SUBJECT: DEQ#02-72FF: Aquatic Ecosystem Restoration Project, Saxis

The Department of Conservation and Recreation (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

DCR understands that a survey for the Northeastern beach tiger beetle (*Cicindela, dorsalis dorsalis,* G4T2/S2/LT/NS) was conducted by Dr. Barry Knisley in July and October 2000. And, as a result of this survey, a buffer zone will be established to protect the population of tiger beetles that were identified, as well as time year restrictions to avoid work in these areas when adult beetles are present. DCR also understands that stabilization of the eroding shoreline of Saxis will ultimately benefit the Northeastern beach tiger beetle by stabilizing and creating additional habitat. Therefore, DCR has no additional comments at this time.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

DCR supports the efforts of this restoration project and does not anticipate any adverse impacts to existing or planned recreational facilities, streams on the National Park Service Nationwide Inventory, Final List of Rivers, potential Scenic Rivers or existing or potential State Scenic Byways. Please contact DCR for an update on this information if a significant amount of time passes before it is utilized.

Thank you for the opportunity to offer comments on this project.

If you cannot meet the deadline, please notify ANNE B.NEWSOM at 804/698-4135 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

MS. ANNE B. NEWSOM
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

Anne B. Newsom
Environmental Program Planner

COMMENTS

* Statements in the project document concerning endangered species were reviewed and compared to available information. Table 4 should include northeastern beach tiger beetle as a federal threatened species present in the project area. No additional comments are necessary in reference to endangered plant and insect species regarding this project.

(signed) (Keith R. Tignor) (date) October 1, 2002

(title) Endangered Species Coordinator

(agency) VDACS, Office of Plant and Pest Service

PROJECT #02-172F 8/98

COMMONWEALTH of VIRGINIA

W. Taylor Murphy, Jr.
Secretary of Natural Resources

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

William A. Pruitt
Commissioner

September 27, 2002

Ms. Anne B. Newsom
c/o Department. Of Environmental Quality
Office of the Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, Virginia 23219

Re: Restoration Project, Saxis Island

Dear Ms. Newsom:

You have inquired regarding the permitting requirements for a project to construct eight breakwaters and enhance the waterfront area in the Town of Saxis.

The Saxis Island project falls within Public Oyster Ground (see 28.2-645) which runs the entire length of the project, channelward of mean low water and there are 2 small riparian oyster ground leases within the Public Ground and your proposed project. Also the Town of Saxis has constructed a 200-foot long community fishing pier adjacent to County property in the wharf area.

The Marine Resources Commission requires a permit for any activities that encroach upon or over, or take use of materials from the beds of the bays, ocean, rivers and streams, or creeks which are the property of the Commonwealth. Based upon my review of the reference maps and drawings, it appears that a portion of your project will be in the Commission's jurisdiction and authorization will be required from the Marine Resources Commission.

If I may be of further assistance, please do not hesitate to contact me at (757) 414 0710.

Sincerely,

George H Badger, III
Environmental Engineer

Newsom,Anne

From: Catherine Harold [CHarold@cblad.state.va.us]
Sent: Tuesday, October 15, 2002 4:18 PM
To: Newsom,Anne
Subject: FSPR-ARMY-18-02

Anne - We have no further comments beyond those we made in a letter dated September 20, 1999 regarding this and several other shoreline erosion control projects. I will fax a copy of this letter to you. Let me know if you have any questions. - Catherine

Catherine Harold, Environmental Engineer
Chesapeake Bay Local Assistance Department
James Monroe Building, 17th Floor
101 North 14th Street
Richmond, Virginia 23219
Phone: (804) 371-7501
Fax: (804) 225-3447

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 1
To A. Newsom	From C. Harold
Co.	Co.
Dept. DEQ	Phone #
Fax # 698-4319	Fax #

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

James S. Gilmore, III
Governor
John Paul Woodley, Jr.
Secretary of Natural Resources

James Monroe Building
101 North 14th Street, 17th Floor
Richmond, Virginia 23219
FAX: (804) 225-3447

Michael D. Clower
Executive Director

(804) 225-3440
1-800-243-7229 Voice/TDD

September 20, 1999

Mr. Jorge L. Nadal - Chief of Planning
Norfolk District, Army Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

RE: Scoping letter for Five Proposed Projects [Hampton (1), Saxis (2), Gloucester (1), Lower Rappahanock (1)]. CBLAD Review No. FSPR-ARMY-05-99

Dear Mr. Nadal:

As you requested, we have reviewed the scoping letter, project location map, and brief description you provided for each of the above-referenced projects for consistency with the Chesapeake Bay Preservation Act, as implemented by the affected localities. Please note that approved Shoreline Erosion Control projects are conditionally exempt from the typical Resource Protection Area buffer standards, provided that the activities are conducted in a manner that minimizes impacts to water quality and encroachment within the 100-ft. Resource Protection Area buffer. Therefore we do not anticipate any difficulties in constructing the proposed projects while maintaining compliance with the Chesapeake Bay Preservation Act. The projects should be designed and constructed such that disturbance to the Resource Protection Area buffer is minimized, and such that total land disturbance, disturbance to indigenous vegetation within the buffer, and the total area of impervious surfaces are minimized. Examples of such minimization would include locating any material stockpiles outside of the RPA buffer, or utilizing a single point of entry through the buffer to provide access to the project site, etc.

We appreciate the opportunity to provide our comments and recommendations in this matter, and are available for further review at later stages in the project design. Should you have any questions or comments, please do not hesitate to contact us at 1-800-CHESBAY.

Sincerely,

W. Douglas Beisch, Jr.
Senior Environmental Engineer

Shepard Moon
Chief of Planning

c: Scott Crafton, CBLAD

FARMY0599 - NEPA Scoping letter for 5 projects.doc

If you cannot meet the deadline, please notify ANNE B.NEWSOM at 804/698-4135 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

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C. Use your agency stationery or the space below for your comments. IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.

Please return your comments to:

MS. ANNE B. NEWSOM
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

Anne B. Newsom
Environmental Program Planner

COMMENTS

We have reviewed, from a marine environmental perspective, The Draft Environmental Assessment titled, Aquatic Ecosystem Restoration Project, Saxis Island, VA. We concur tith the conclusions and recommended plan detailed in the subject report. We will be happy to answer any questions generated by these comments.

(signed) T.A. Barnard (date) 10/7/02

(title) Assistant Professor

(agency) VIMS - CCRM

PROJECT #02-172F 8/98

COMMONWEALTH of VIRGINIA

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 28221

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Kathleen S. Kilpatrick
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
TDD: (804) 367-2386
www.dhr.state.va.us

September 30, 2002

Mr. Mark T. Mansfield
Chief, Planning Branch
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Re: Aquatic Ecosystem Restoration Project, Saxis Island
Accomack County Virginia
DHR File Number 2002-1317

Dear Mr. Mansfield:

Thank you for requesting our comments on the referenced project. We understand that the Corps intends to construct eight segmented offshore breakwaters on the shoreline on the western boundary of the town of Saxis.

Based on the information provided, the DHR concurs that no historic properties will be affected by the proposed project, provided that no cutting of the bank will occur. If plans are revised to include cutting of the bank, further coordination with our department will be necessary.

Thank you again for consulting with us. If I can be of any further assistance, do not hesitate to contact me at (804) 367.2323 ext. 140 or lrichards@dhr.state.va.us.

Sincerely,

Lily A. Richards
Archaeologist and Historian, Office of Review and Compliance

C. Anne Newsom, DEQ

Administrative Svcs.
10 Courthouse Avenue
Petersburg, VA 23803
Tel: (804) 863-1585
Fax: (804) 863-6196

Petersburg Office
19-B Bollingbrook Street
Petersburg, VA 23803
Tel: (804) 863-1620
Fax: (804) 863-1627

Portsmouth Office
512 Court Street, 2nd Floor
Portsmouth, VA 23704
Tel: (757) 396-6709
Fax: (757) 396-6712

Roanoke Office
1030 Penmar Avenue, SE
Roanoke, VA 24013
Tel: (540) 857-7585
Fax: (540) 857-7588

Winchester Office
107 N. Kent Street, Suite 203
Winchester, VA 22601
Tel: (540) 722-3427
Fax: (540) 722-7585

If you cannot meet the deadline, please notify ANNE B.NEWSOM at 804/698-4135 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

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OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

Anne B. Newsom
Environmental Program Planner

COMMENTS

The Virginia Department of Health Division of Shellfish Sanitation and Division of Drinking Water have reviewed the draft EA, and have No Objection to the proposed project.

(signed) A. E. Douglas (date) 9-25-02

(title) acting Field Services Engineer

(agency) Virginia Department of Health

PROJECT #02-172F 8/98

A-NPDC

ACCOMACK-NORTHAMPTON PLANNING DISTRICT COMMISSION
P.O. BOX 417 • 23372 FRONT STREET • ACCOMAC, VIRGINIA 23301
(757) 787-2936 • TOLL FREE (866) 787-3001 • FAX: (757) 787-4221

September 30, 2002

Ms. Anne B. Newsom
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, 6th Floor
Richmond, VA 23219

Re: 02-172F

Dear Ms. Newsom:

The A-NPDC has reviewed the Aquatic Ecosystem Restoration Project, Saxis Island, Virginia (02-172F). We see no adverse impacts from the project and feel that it will be of great benefit to Saxis Island. Thank you for providing the opportunity to comment on this project.

Yours truly,

James M. McGowan, AICP
Director of Planning

cc: Paul F. Berge, AICP
Executive Director

COUNTY OF ACCOMACK
OFFICE OF THE COUNTY ADMINISTRATOR

23296 COURTHOUSE AVE.
ROOM 203
P. O. BOX 388
ACCOMAC, VIRGINIA 23301
(757) 787-5700
(757) 824-5444
(757) 787-2468 FAX

R. Keith Bull
County Administrator

September 17, 2002

Ms. Anne B. Newsom
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

Re: Project Number: 02-172F

Dear Ms. Newson:

Accomack County supports the Aquatic Ecosystem Restoration Project at Saxis Island. The project will protect 6,000 feet of shoreline located on the western bay front of the Town of Saxis. The project will also provide approximately 32 acres of habitat for the flora and fauna of the Saxis Island ecosystem with minimal environmental impacts. The eroding shoreline would be replaced by a more diverse and productive habitat which represents a return to a more historical condition. Accomack County believes the expected long term positive environmental effects from the breakwater and the tombolo construction are much greater than any negative impacts that would result from construction activities.

If we may provide any further comments please do not hesitate to call.

Sincerely,

R. Keith Bull
County Administrator

RKB:ssg

Post-it® Fax Note 7671	Date 9/27/02	# of pages ▶ 1
To David Schulte	From Hank Badger	
Co./Dept. A.C.E.	Co. VMRC	
Phone # (757) 441-7007	Phone # (757) 414-0710	
Fax # (757) 441-7637 7646	Fax # (757) 414-0749	

COMMONWEALTH of VIRGINIA

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

William A. Pruitt
Commissioner

September 27, 2002

U. S. Army Corps of Engineers
c/o Mr. David Schulte, CENAO-PL-R
803 Front Street
Norfolk, Virginia 23510-1096

Re: Restoration Project, Saxis Island

Dear Mr. Schulte:

You have inquired regarding the permitting requirements for a project to construct eight breakwaters and enhance the waterfront area in the Town of Saxis.

The Saxis Island project falls within Public Oyster Ground (see 28.2-645) which runs the entire length of the project, channelward of mean low water and there are 2 small riparian oyster ground leases within the Public Ground and your proposed project. Also the Town of Saxis has constructed a 200-foot long community fishing pier adjacent to County property in the wharf area.

The Marine Resources Commission requires a permit for any activities that encroach upon or over, or take use of materials from the beds of the bays, ocean, rivers and streams, or creeks which are the property of the Commonwealth. Based upon my review of the reference maps and drawings, it appears that a portion of your project will be in the Commission's jurisdiction and authorization will be required from the Marine Resources Commission.

If I may be of further assistance, please do not hesitate to contact me at (757) 414-0710.

Sincerely,

George H. Badger, III
Environmental Engineer

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

September 30, 2002

Colonel David L. Hansen
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, VA 23510-1096

Attn: David Schulte – Plng Br

Re: Saxis EA

Dear Colonel Hansen:

This responds to Mr. Mansfield's letter dated September 3, 2002, requesting comments on the draft environmental assessment entitled, "Aquatic Ecosystem Restoration Project, Saxis Island, VA." Please consider the following comments in completing the final document.

(1) General Comments

The EA contains a number of deficiencies. Although being generally characterized as an aquatic ecosystem restoration project, this is basically an erosion control project with a habitat development component. The EA fails to present a compelling need for erosion control, and does not adequately explain the ecological tradeoffs associated with the project's conversion of aquatic habitat to upland habitat. It inappropriately portrays the project as promoting restoration of the historic shoreline conditions. On the contrary, the construction of a breakwater will fundamentally alter the natural condition of the shoreline by reducing wave energy. There is little support for the EA's characterization of the nearshore aquatic environment as degraded. Furthermore, the project overlooks an opportunity to rehabilitate the vegetated wetlands along the shoreline which have been degraded by ditching, diking, filling, and the spread of *Phragmites*.

Specific Comments

(2) Page 1, Sect. 1.0. The claim that the project would result in the "restoration of 18 acres of previously lost or degraded wetland or subaqueous habitat" is unsupported. The EA notes that the project would attempt to establish 1.9 acres of tidal marsh and 1.0 acre of SAV habitat that

may have been previously present. The other habitats created by the project (beach, dune, scrub/shrub, and breakwater) did not historically occur along the shoreline, and therefore, their creation by the project should not be characterized as restoration. Thus, only a small part of the project appears to involve actual restoration.

(3) It appears that the reference to "1.9 acres of estuarine intertidal *Spartina patens"* might be an error. We suspect that *"Spartina alterniflora"* or *"Spartina* spp." would probably be more appropriate in place of *"Spartina patens."*

(4) The following statement should be clarified: "A +6 ft MLLW berm will be created as well to address 25-year storm event..." Why is this high berm needed? Normally this type of language is used in situations where there is a need for landward structures to be protected from wave damage. This would seem to be inappropriate for the present project.

(5) Page 1, Sect. 2.0. The purpose and need for the project should be more clearly stated. What are the environmental problems that the project is seeking to remedy? If erosion is deemed to be a primary problem, the EA should indicate what is being lost or affected? While not explicitly mentioned in this section, other parts of the EA indicate that wetland restoration is a primary project objective. If this is true, rehabilitation of the existing degraded *Phragmites* dominated wetlands should have been considered. Another primary objective that is mentioned in this section is the restoration of SAV. However, at best only approximately 1 acre of SAV habitat would be created. The EA should have noted that there is substantial uncertainty involved in the creation of even this small amount of habitat. For example, the report by Hardaway et al. (1999), which is a major supporting document for the project, states: "To the best of our knowledge, planting SAV in the lee of offshore breakwaters has not been attempted elsewhere. Therefore, the success of this effort cannot be reliably predicted without proper experimentation." Further, a survey reported by Karrh (2000) of the distribution of SAV at breakwaters in Chesapeake Bay found both positive and negative associations that were primarily dictated by regional trends rather than by the local breakwater effects. Because SAV is almost entirely absent from Pocomoke Sound, including its sheltered locations, it is unclear whether the project will be able to improve local conditions enough to overcome the apparent regional water quality limitations.

(6) Page 3, Last parag. The implications of the no-action plan should be better described. The EA implies that only wetlands are being affected by the shore erosion. It should also note that upland residential property (primarily grass lawn) and other habitats identified in Table 2 would be affected. It would be helpful if these losses could be quantified at least on a relative basis since the prevention of these losses will be an important effect of the project. It is not clear why continued erosion should lead to "increased" sediment loads, as opposed to staying the way it is now. The EA should discuss the effect of the eroding sediment on the biological resources in the nearby waters.

There is some reason to question whether there would be a "total loss of the current beach area" in the future if no action is taken. The report by Hardaway et al. (1999) states that aerial imagery

from 1938 showed that the "shoreline was mostly marsh with little or no beach except for the North End spit". The beach subsequently expanded as a result of placement of dredged material along the shoreline during the 1960s and 1970s. The rate of erosion was substantially lower during the period, but subsequently increased as the dredged material left the area. As the erosion has progressed to the point it is now affecting uplands including the dredged material containment site, it appears to be supplying sand to the shoreline, in contrast to the historical condition when the shoreline was dominated by tidal marsh. Consequently, it seems reasonable to expect that a narrow beach will persist along the shoreline in the future.

(7) Page 4, Parag 1. Low marsh should be added to the habitats which would be created on the tombolos.

(8) The document incorrectly states that *Spartina patens* would be established in the lower portion of the marsh habitat and that *Spartina alterniflora* would be in the upper portion. The locations of the two species should be reversed.

Since American beachgrass and bitter panicum are not wetland plants, it is inappropriate to state that they would be irregularly flooded. In this environment "irregularly flooded" would normally be used to characterize the hydroperiod of the high marsh *Spartina patens* zone.

This paragraph states that 9.5 acres of open beach would be established. This differs from information in the previous paragraph which projects a net increase of 8.0 acres (from 0.8 to 8.8 acres). A further discrepancy appears in the last paragraph of page 15 where an estimate of 3.7 acres of created beach is given. A similar inconsistency occurs with the acreage of scrub/shrub habitat. The first paragraph on page 5 states 3.4 acres would be created, while the last paragraph of page 15 states 5.0 acres. The habitat acreage estimates should be made consistent throughout the document.

(9) Page 9, Parag 4. We question the statement that "the scarcity of scrub shrub habitat limits the use of the area by colonial wading birds". We would not characterize the amount of scrub/shrub habitat as scarce since Table 2 indicates the presence of 3.5 acres of a mixed species community. Also, this type of habitat would not limit the use of the area for feeding purposes. Indeed, the observations by Hardaway et al. (1999), and our own observations during our site inspection on August 11, 2000, revealed substantial numbers of a variety of herons and egrets at the site. Scrub/shrub habitat could potentially provide nesting habitat for some wading birds, but Saxis Island would appear to have too much human disturbance and predation pressure to be a preferred location.

(10) Page 9, Parag. 5. We would discourage the use of the term "forage fishes" to characterize summer flounder and croaker, which are recreationally and commercially important species. Generally, a forage fish is one that often serves as prey. It would be more appropriate to characterized the other species mentioned here (anchovy, menhaden, and silverside) as forage fishes.

(11) Page 10, Parag. 1. While the absence of clams and oysters in the VIMS survey may indicate the lack of suitable habitat, the EA should not conclude that the habitat conditions have become degraded. [Note: we assume that clams refers to hard clams since VIMS refers to the catch data obtained from the Virginia Marine Resources Commission.] It is likely that this littoral area never provided good habitat for either species because it has only been in existence for a relatively short time since being created by the erosion of the former tidal marsh. In any case, under current conditions the site would not be expected to provide good habitat for hard clams. They prefer deeper water in this region of Chesapeake Bay where the salinity is relatively low. The scarcity of oysters along this shoreline parallels the condition throughout much of Pocomoke Sound. Important factors that limit the presence of oysters at this site include: the presence of oyster disease organisms (*Perkinsus marinus* and *Halosporidium nelsoni*), the reduced spawning stock throughout Pocomoke Sound, the lack of suitable cultch material, and the frequent disturbance of the bottom sediment by wave action. Nevertheless, during our site inspection we observed several small oysters attached to some of the well rings at the north end of the project shoreline.

(12) Page 11, Parag. 2. The literature source, USFWS 1994, that is cited for marine turtle occurrence in Virginia waters is incorrect.

(13) Page 11, Parag. 4. The statement indicating the presence of the Federally threatened bald eagle in the area needs further explanation since this sensitive species could easily be adversely affected by the construction activity. What type of "presence" does the eagle have? A nest site would be the most significant concern. What is meant by "in the area"? Our records show that an eagle nest is located east of the Freeschool Marsh, over 2 miles from the project area. A nest site located at this distance away from the project would not be affected.

(14) Page 15. Sect. 6.0. The part addressing impacts on "SAV, Wetlands, and Aquatic Resources" should identify the amount of aquatic habitat that would be lost as a result of the sand placement and discuss why this loss is justified. It should include information on the amount of public oyster ground that would be affected. This part of the EA should also characterize the amount and type of wetlands that would be prevented from eroding as a result of the project.

(15) Page 18, Parag. 2. While this paragraph states that "many positive impacts are expected from the ... stabilization of the Saxis shoreline", only two are mentioned. This gives the impression that the project has fewer benefits than may actually be the case. We suggest that this paragraph be modified in one of the following ways: 1) provide a more complete description of the benefits of the breakwaters; 2) provide language to indicate that you are only highlighting two of the many positive impacts; 3) remove the paragraph from this section.

(16) Page 18, Parag. 4. This paragraph appears to be out of place in the section on "Road and Staging Areas". It would be better to move it to the section on "SAV, Wetlands, and Aquatic Resources". The statement that "the project will result in approximately 32 acres of newly constructed habitats" appears to conflict with the total of the acreage for the individual habitats

created (page 15), and the figure of 18 acres restored stated on page 1. This apparent conflict should be resolved. The EA should give the number of acres of aquatic habitat that would be converted to upland habitats rather than simply stating "some conversion".

Page 18, Parag. 5. Like the prior paragraph, this paragraph is out of place under "Roads and Staging Areas". We suggest that it be moved to the section on "SAV Wetlands, and Aquatic Resources". As previously mentioned in our comments for page 10, paragraph 1, it is misleading to conclude the failure of the VIMS survey to find clams and oysters is an indication of the "continually degraded nature of the habitat". We would expect that similar surveys conducted along undeveloped shores in this region would have similar results. The statement that "the proposed project may restore the Saxis shoreline to a more suitable habitat for shellfish" should be accompanied by an explanation on why this would occur.

Page 18, Section on Water Quality. This section should note that the reduction in shoreline erosion resulting from the project should lead to a long-term localized improvement in such water quality factors as turbidity, sedimentation rate, and nutrient input.

(17) Page 21, Parag. 3. The statement that the project "will in fact prove highly beneficial to the tiger beetle by stabilizing remaining habitat and creating 3.7 acres of dune habitat" is incorrect on two accounts. First, the project will not, strictly speaking, stabilize the remaining tiger beetle habitat. Rather, it would displace the remaining habitat by the sand placement and planting of dune and scrub/shrub vegetation. A new enlarged area of beach would be created a short distance offshore from the existing beach. Second, the creation of dune habitat will not directly benefit the tiger beetle since this species requires open beach. Furthermore, we believe that the use of language such as "highly beneficial" gives an overly optimistic prediction. We suggest that the word "highly" be deleted. Instead of stating that it "is likely to provide the proper conditions for larval development", we suggest saying that it "may" provide the proper conditions. Instead of stating that "the potential for the tiger beetle to re-establish a breeding population on the restored site is high", we suggest substituting the word "favorable" for the word "high". While the project should improve the habitat potential for the tiger beetle, it is uncertain whether the improvement would be sufficient to result in the establishment of a breeding population. This species prefers the relatively wide beaches that occur on wave exposed shorelines. The deposition of 110,000 cubic yards of sand along this 6,000-foot shoreline will permit a wider beach, but the construction of the breakwaters will reduce the wave energy and allow wetland and upland plants to colonize. It is hoped that the wave energy which reaches the shoreline thru the breakwater gaps will be sufficient to create a dynamic, but persistent open beach. However, since this process involves a fine balance between opposing forces, the end result is far from certain. We are aware of one study that monitored the effect of constructing three offshore breakwaters on a northeastern beach tiger beetle population for a 6-year period (Knisley 2001). The study found that the beach width increased, although grasses colonized the shore behind the breakwaters and in several areas of the back beach. The beetle population showed substantial year to year variability that obscured any trend. As a result, there was no clear benefit and the author was

only able to conclude that the beetle population and its habitat were not negatively affected by the project.

(18) Page 25, Parag. 3. The section on benthic habitat effects should mention the number of acres of bottom that will be converted to upland habitats (dune and scrub/shrub). The reference to "Benthic Independent Biota Intensity" should be corrected to "Benthic Index of Biotic Integrity". It appears that the EA is implying that the overall BIBI should increase significantly due to the increased surface area of the breakwaters for benthic organism attachment. Since this index has only been applied to subtidal infaunal macroinvertebrate communities, it would be inappropriate to use it for benthos attached to the breakwater.

Page 25, Parag. 4. The EA should provide an estimate of the number of acres of oyster grounds that will be lost in lieu of stating "a small amount of acreage".

Page 25, Parag. 7. As previously mentioned (see comment for page 1, sect. 1), it is misleading to state "the historic shoreline of Saxis Beach will be, for the most part, restored" because there is no historical precedence for the beach, dune, scrub/shrub, and breakwater habitats that are being created by the project. Similarly, the statement that "the wider beach and additional habitat types reflect closely the historic condition of the area" is incorrect and should be deleted. In actuality, by reducing the wave energy, the construction of the breakwater will fundamentally alter the natural shoreline conditions.

The statement implying that the overall productivity of the benthic community will increase is questionable. While diversity and organism density may increase, it does not appear that this would be sufficient to counteract the overall loss of benthic habitat from the initial beachfill and the decreased formation of new benthic habitat over time from the reduced shore erosion.

The statement that "SAV will likely colonize the sheltered shallow water created" appears to be overly optimistic (see comment for page 1, section 2.0). It should be toned down to something like: "there is moderate potential for SAV to colonize the sheltered shallow habitat created."

(19) Page 31, Table 2. The table should show that grass lawn/residential lands also occur along the shoreline. An inconsistency with the beach and dune community types should be rectified. For the beach the table lists three plant species which are actually characteristic of dunes. However, for the dune community the table lists no plant species at all, indicating an open beach.

Thank you for the opportunity to present these comments. If there are any questions, please contact George Ruddy at (410) 573-4528.

Sincerely,

John P. Wolflin
Supervisor

Literature citations:

Hardaway, C.S., D.A. Milligan, G.R. Thomas, R.C. Brindley, L.M. Varnell, W.I. Priest, and S. Dewing, 1999. Shoreline Management Plan with Habitat Enhancement for Town of Saxis, Virginia. Technical Report of the Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

Karrh, L. 2000. Effects of Breakwaters on Submerged Aquatic Vegetation. Unpublished report of the Maryland Department of Natural Resources submitted to U.S. Army Research Laboratory, Adelphi Laboratory Center, Blossom Point Research Facility.

Knisley, C.B. 2001. Monitoring of the Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) at the Hills Bay Site (Mathews County, VA) and a Study of Potential Effects of Offshore Breakwaters, 2001. Unpublished report submitted to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

APPENDIX C

COMMENTS AND RESPONSES

APPENDIX C
COMMENT/RESPONSE SECTION
SECTION 206 AQUATIC ENVIRONMENTAL RESTORATION
SAXIS ISLAND, VIRGINIA

USFWS responses, letter dated September 30,2002:

General comments: (see letter annotation #1)

The EA is technically sound. The project is primarily for ecosystem restoration and habitat enhancement. It does include a shoreline protection component. There is a need for erosion control to successfully implement this project, otherwise the regular maintenance would be cost-prohibitive to the local sponsor. There is compelling need for this project. The current shoreline is eroding at a rate of 4.9 feet/year, and a rate of 3 feet/year is considered severe. The historic shoreline will be restored, with the addition of breakwaters deployed as needed to ensure it remains. Furthermore, USFWS has implemented a nearly identical project for the same purposes at Eastern Neck Island National Wildlife Refuge. USFWS is mistaken regarding the status of wave energy. Wave energy striking the now severely-eroded shoreline has increased as SAV, estuarine wetlands, and beach have eroded away. It has been well documented that such habitat act to attenuate wave energy. While the wave energy has remained the same in the area, it has increased on the local shoreline due to these habitat losses. The current habitat has been degraded from its historical condition. Most of the USFWS comments regard the benefits of the project, not the project impacts. The NEPA process is primarily to ensure that project impacts are properly addressed, and if necessary, mitigated for; however, USFWS has instead taken this opportunity to impugn the benefits of the project. Our planning process has determined the benefits of the project merit its construction in coordination with USFWS.

USFWS Specific comment: (see letter annotation #2)

Page 1, Sect. 1.0. USACE expects habitat enhancement to occur in a total project area consisting of 32 acres, and the EA will be changed to reflect this. USACE made no claim here regarding amount of SAV but anticipates much of the 13.2 acres of sheltered shallow water habitat will become colonized by SAV, which was previously present. Historical analysis by scientists at the Virginia Institute of Marine Science (VIMS) showed a greater abundance of dunes, saltmarsh, scrub-shrub, and SAV communities relative to the current shoreline. The location and extent of these historic communities were used to develop the restoration goals. USFWS is wrong in its assertion that "only a small part of the project appears to involve actual restoration."

USFWS Specific comment: (see letter annotation #3)

USACE will clarify which species of *Spartina* will be planted and where. This comment was made regarding the *Spartina* reference on pages 1, 4, and 18 by USFWS, as well as VDEQ and VIMS.

USFWS Specific comment: (see letter annotation #4)

The +6 ft. MLLW berm is needed for two reasons. One is to ensure the habitat restored is not removed by a severe storm event while the planted vegetation grows and better anchors the restored habitats. The second is to ensure the proposed project life is achieved.

USFWS Specific comment: (see letter annotation #5)

Page 1, Sect 2.0. USACE can expand the purpose and need section to address USFWS concerns; however, the purpose and need have been clearly explained throughout the document. USACE disagrees with USFWS assessment of potential SAV restoration. SAV is fairly common in sheltered areas of the Pocomoke Sound, as well as along the shoreline. USACE observations along the Saxis shoreline noted various SAV propagules, and USACE anticipates the sheltered shallow water habitat provided by the proposed project will allow some of these propagules to take root and colonize. If not, USACE will likely direct seed the area with eelgrass (*Zostera marina*). USACE is aware of the Karrh (2000) study. Unfortunately, as none of the breakwaters in that study were built or positioned with SAV enhancement in mind, the effects on SAV documented in that study are incidental for SAV. In a study by Dan et al., 1998, a breakwater constructed to reduce wave action in a cove for SAV enhancement proved successful, and eelgrass (*Zostera marina*) colonized the area. USACE expects a similar effect for the proposed project.

USFWS specific comment: (see letter annotation #6)

Page 3, last parag. Disagree. The no action plan has been adequately described. Due to lack of sand in the system, it is reasonable to assume that in the future, the sandy beach will no longer exist unless something is done about it. It may become replaced by a mud flat type habitat created by eroding terrestrial sediments.

USFWS specific comment: (see letter annotation #7)

Pg 4, para 1. Agree. USACE will add low marsh to the created habitats.

USFWS specific comment: (see letter annotation #8)

Initial beach created will be 8.8 acres, and over time, will decline to 8.4 acres, where it is expected to stabilize. USACE will change the document to reflect this.

USFWS specific comment: (see letter annotation #9)

Pg. 9, para 4. Disagree. Since reproduction is an important part of the life cycle of wading birds, USACE disagrees with USFWS dismissal of scrub-shrub as important to wading birds, as a number of wading bird species utilize this habitat for reproduction. USACE does not believe this habitat will go unused by wading birds.
USFWS specific comment: (see letter annotation #10)

Pg. 9, para 5. USACE will remove word "forage" from the description.

USFWS specific comment: (see letter annotation #11)

Pg. 10, para 1. USACE believes that hard clams primarily prefer shallow, saline water habitats, based on available information. There is some information available that indicates hard clams may be more abundant in SAV beds, and this can be seen by the preference of clam dredgers to operate within SAV beds unless the practice is made illegal. It is likely that hard clams will increase in abundance in the sheltered shallow water area. Oysters may benefit due to the increased amount of hard substrate (breakwaters) as attachment sites.

USFWS specific comment: (see letter annotation #12)

Pg. 11, para 2. Reference deleted.

USFWS specific comment: (see letter annotation #13)

Pg. 11, para 4. USFWS is correct that the Bald eagle nest is outside the area of effect of the project. It is near enough that adults could possibly forage in the area; therefore, USACE noted its presence in the area. USACE agrees that the Bald eagle will not be negatively affected by the proposed project.

USFWS specific comment: (see letter annotation #14)

Pg 15, Sect 6.0. USFWS should have noted that in the EA considerable information is presented on the rate of erosion in the area. It is reasonable to conclude that terrestrial nearshore habitat is what was eroded. The USACE proposed project seeks to remedy this by a combination of protection, and, yes, restoration of the terrestrial component of this local system. The oyster grounds contain no cultch, and therefore do not serve as oyster habitat. USACE will add this to the EA. An EA is primarily to address the negative impacts of a proposed project. USACE does not see the need to extensively document the benefits in the EA but do address that in the Feasibility study document.

USFWS specific comment: (see letter annotation #15)

Pg. 18, para 2. USACE does not see the need to extensively document the benefits but do address that in the Feasibility Study. The benefits of this project should be self-evident to

USFWS, as it advocates this type of project at Eastern Neck Wildlife Refuge and endorsed similar work by USACE on Smith Island, MD, in the waters of the Chesapeake Bay.

USFWS specific comment: (see letter annotation #16)

Pg. 18, para 4. Thirty-two acres of habitat will be enhanced or restored. This will be made clear throughout the document where it is vague. USACE will clarify the acres of aquatic habitat that will be converted to intertidal or upland.

USFWS specific comment: (see letter annotation #17)

Pg 21, para. 3. USACE disagrees with USFWS proposed wordsmithing to downplay the potential benefits to the tiger beetle. USACE believes the project will be beneficial to the tiger beetle. One reference notes that tiger beetles can and do lay their eggs at the base of dunes; therefore, dunes could provide positive benefits to the tiger beetle. As the restored beach will be constructed during the time of year when no tiger beetles are present, the distinction USFWS makes regarding displacing the present beach is irrelevant. USACE considered USFWS recommendations and reduced the number of breakwaters from 16 to 8 within the project footprint, despite the 16 breakwater option's being carefully designed by VIMS scientists to maintain significant areas of open beach. This accommodation was made to ensure that the open beach remain. USACE does not propose reducing the breakwaters or proposed vegetative plantings any further, as this would be likely to result in erosion of the restored habitat.

USFWS specific comment: (see letter annotation #18)

Pg. 25. USACE will change the wording describing "BIBI" and provide an exact acreage of oyster grounds impacted. See previous responses that address other USFWS recommendations and statements.

USFWS specific comment: (see letter annotation #19)

Pg. 31, table 2. USACE will combine beach and dune habitats. USACE sees no relevancy to documenting lawn and residential areas..

National Marine Fisheries Service (NMFS)
NMFS concurs with that findings of no negative impacts to Essential Fish Habitat (EFH). This coordination was done via a phone conversation.

Commonwealth of Virginia

Wetlands and Water Quality Comment: On EA page 4, Spartina patens and S. Alterniflora planting locations should be reversed. The Virginia Institute of Marine Science (VIMS) supports this recommendation.

Response: Concur. USACE will change for Final EA.

Subaqueous Lands Comment: The Virginia Marine Resources Commission (VMRC) notes that two riparian oyster leases are in the area, and the project will require a joint permit application (JPA) to address this and impacts to subaqueous lands from the proposed breakwaters.

Response: Concur. USACE will submit a JPA for the proposed project.

Chesapeake Bay Preservation Area Comment: Chesapeake Bay Local Assistance Department (CBLAD) recommends that best management practices be used during construction to minimize impacts to water quality.

Response: Concur.

Natural Heritage Resources Comment: Table 4 of the draft EA should include the Northeastern Beach Tiger Beetle as Federally Threatened. The Department of Conservation and Recreation supports this restoration project. It is believed the proposed project will not adversely affect any documented state-listed plant or insect species.

Response: Concur. USACE will add the Northeastern Beach Tiger Beetle to Table 4 of the Draft EA.

Air Quality Comment: The DEQ recommends Best Management Practices to reduce fugitive dust during construction.

Response: Concur. USACE will implement all DEQ recommendations during construction.

Historic and Archeological Resources Comment: The Department of Historic Resources (DHR) concurs that no historic properties will be affected.

Response: Agree.

CONCLUSIONS

The Corps of Engineers has the opportunity to restore extremely valuable natural habitats in and around Saxis Island. The project is strongly supported by state and local officials who have sought for years to assist the island, but have not been successful in acquiring full funding. The town of Saxis has pledged its financial support of this project as the project Sponsor.

The Saxis Island area has historically provided productive beach and dune, tidal marsh, and shallow water habitat. As natural areas in the region become increasingly scarce and degraded, Saxis Island increases in habitat value.

The Saxis Island project area has continued to erode over its lifetime, although the rate of erosion in some locations seems to have increased.

Section 206 of WRDA 1996 allows the Corps of Engineers to implement aquatic ecosystem restoration projects independent of a connection with Federal navigation project. For these environmental benefits to accrue, the town of Saxis will need to maintain the project over its 25-year life. A NER Plan was developed by the Corps of Engineers to evaluate various restoration options and to assess their expected environmental benefits in relation to the cost to implement them. This resulted in a "Best Buy" plan to provide maximum environmental benefits at the minimum cost. This plan involves the nourishment of the beach with sand of similar quality to restore it to a more historical condition; the construction of eight breakwaters to reduce, though not eliminate, wave energy striking the restored beach; the construction of tombolos from beach quality sand to attach the restored beach to the eight breakwaters; and plantings of appropriate native wetland and riparian vegetation. It is anticipated that SAV will recolonize in the area in the newly-sheltered shallow water habitat and the Federally-threatened Northeastern Tiger Beetle will increase its population and be able to successfully reproduce on the restored beach.

LOCAL COOPERATION

A non-Federal sponsor is required to provide at least 35 percent of the implementation costs of the modification. Implementation costs include preparation of this report, preparation of the plans and specifications and the construction of the project. The provision of work-in-kind can be credited against the sponsor's cost-sharing requirement. The town of Saxis will pay the full non-Federal cost share and assume the OMRR&R of all restoration features. A letter of intent to sign the project cooperation agreement is included in Appendix 4. Real estate requirements of both the local and Federal sponsors for the proposed project are detailed in Appendix 3.

As part of the recommended modifications, the town of Saxis would be required to do the following:

1. Provide to the United States all necessary lands, easements and rights-of-way, including suitable borrow and dredged material disposal areas, necessary for project construction.

2. Accomplish or arrange for accomplishment, at no cost to the Government, all relocations determined by the Government to be necessary for implementation of the project.

3. If the value of such LERRD represents less than 35 percent of the total project modification costs, provide, during the period of implementation, a cash contribution in the amount necessary to make its total contribution equal to 35 percent, presently estimated to be $929,358.

4. Hold and save the United States free from claims for damages that may result from construction and subsequent maintenance of the project, except damages due to the fault or negligence of the United States or its contractor.

5. Comply with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894; Public Law 88-352 Stat. 241, 252).

6. Execute the Assurances of Compliance pertaining to Title IV of the Civil Rights Act of 1984 (Public Law 88-352, 78 Stat. 241, 252).

7. Assure OMRR&R during the useful life of the work as required to save the project's intended purpose.

8. Reimburse the Federal Government for 35 percent of the cost for this Feasibility Study.

FINANCIAL CAPABILITY

The study sponsor is the town of Saxis. Based on coordination, the sponsor has indicated that the 35 percent share of the cost of this project would come from the appropriations provided by the town of Saxis or the Virginia Port Development Fund.

PROJECT MONITORING

The Corps of Engineers will implement a five-year monitoring program to verify appropriate project placement and to monitor project performance. It is expected that members of the Corps of Engineers and the sponsor will visit the site approximately 3 times a year for the first 5 years, and every fifth year after, to monitor and evaluate the project. A management plan will be established that entails site visits and beach profiles to assess changes at the project location. Baseline conditions will be established at the time of the monitoring with three initial surveys at 200-foot intervals for a length of about 6,000 feet. Horizontal and vertical controls will set the standard for subsequent surveys. The town of Saxis as the local sponsor will conduct any necessary repairs in the event of failure or problems. Maintenance of the beach and slope area will be conducted. Performance

monitoring costs are estimated at $4,000 annually, for a period of 5 continuous years, and every fifth year thereafter. The average annual costs over the life of the project are estimated to be $1,539 for monitoring and is cost-shared at a 65 percent Federal and 35 percent non-Federal rate.

The recommended project is not at a serious risk from wave and storm damage because the turbulent and exposed conditions at Saxis Island are not excessive for the area. The project design does not assume ongoing sacrificial erosion and is being planned to create marsh and beach ecosystems. Project OMRR&R will be conducted by the sponsor. The sponsor will determine the need for additional placement of sand as erosion occurs during the life of the project and will be responsible for implementing such improvements over the life of the project. Corrective measures will be taken if monitoring indicates that project goals and objectives are not being met.

Ecological monitoring will be conducted concurrently with other project monitoring efforts over a 5-year period following construction, and every fifth year thereafter. Ecological monitoring will include beach and intertidal surveys to evaluate the performance of the project in creating and protecting wetland and shallow aquatic habitat within and adjacent to the project. This will be accomplished by comparing the beach/intertidal profiles with aerial photography. Wildlife surveys will be conducted on the created beach/intertidal area to determine the amount of use it receives by colonial nesting birds and shorebirds. These will include field investigations and documentary research and coordination with the USFWS to document species utilization of this area. Ecological monitoring will also include salinity measurements and estimates of SAV coverage in Pocomoke sound adjacent to the project area.

SCHEDULE FOR PROJECT IMPLEMENTATION

Following approval of this report, the Norfolk District will prepare plans and specifications for the construction contract. Once this is complete, the project can proceed towards construction. At that time, the Project Cooperation Agreement between the Federal and non-Federal sponsors can be signed and executed. A construction bid advertisement will be issued and the 35 percent non-Federal share will be required. After the construction contract is awarded, construction can begin.

The tentative project schedule is:

Receive Project Approval

Complete Plans and Specifications

Execute Project Cooperation Agreement

Advertise for Construction Bids

Receive Federal and non-Federal Construction Funds

Award Construction Contract

Complete Initial Construction

Complete Monitoring Program

RECOMMENDATIONS

I have considered all potential impacts and effects in terms of the overall public interest, which includes environmental, social, and economic effects, as well, as the overall engineering feasibility of the proposed project. Bearing these considerations in mind, I recommend that, under the authority of Section 206 of the WRDA of 1996, the Corps of Engineers will restore aquatic fish and wildlife habitat at Saxis Island in accordance with the NER Plan with such modifications as in the discretion of the Commander, HQUSACE, may advise. The project will provide 32 acres of restored riparian, beach, and nearshore aquatic habitat as determined by the NER Plan, which is included within this Feasibility Study.

My recommendation is subject to the implementation policy guidance that was provided by the Office of the Assistant Secretary of the Army for Civil Works (ASA[CW]). Also, this recommendation is subject to the non-Federal sponsor's agreeing to comply with all applicable Federal laws and policies and other requirements including but not limited to:

a. Provide a contribution equal to 35 percent of the first cost of construction, including LERRD. The total estimated cost of the project is $3.24 million. The total estimated costs, less IDC and OMRR&R, is $2.66 million, of which $1,725,950 would be the Federal cost, and $929,358 would be provided by the town of Saxis.

b. Assume responsibility for the OMRR&R, currently estimated at $20,000 annually, of the project or completed functional portions of the project, including mitigation features, without cost to the Government, in a manner compatible with the project's authorized purpose, and in accordance with applicable Federal and state laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto. All vegetation plantings shall be guaranteed and replaced by the contractor for a minimum 2-year period. Due to this being an ecosystem restoration project, OMRR&R expenses are anticipated to be $1,000 annually for periodic *phragmites* removal. However, the Town of Saxis would be responsible for the OMRR&R costs of $500,000, in the case of a storm event requiring repair or replacement of the project.

c. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land that the local sponsor owns or controls for access to the project for the purpose of inspection, and if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

d. Pay all Government costs to accomplish any project betterments or other features requested by the sponsor that cost in excess of the Government-recommended plan.

e. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

f. Hold and save the Government free from all damages arising for the construction and OMRR&R of the project and any project-related betterments, except for damages due to fault or negligence of the Government or the Government's contractors.

g. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

h. Perform, or cause to be performed, any investigations for hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction and OMRR&R of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

i. Assume complete financial responsibility for all necessary clean-up and response costs of any CERCLA-regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction and OMRR&R of the project.

j. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

k. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of environmental restoration that it affords or that would hinder OMRR&R of the project.

l. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title

IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction and OMRR&R of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

m. Comply with all applicable Federal and state laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by Department of the Army," as well as Section 402 of the WRDA of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of flood plain management plans.

n. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized by statute.

Federal participation in the recommended project is endorsed provided that, prior to construction, the non-Federal sponsor will execute the final Project Cooperation Agreement with the Federal Government.

Yvonne J. Prettyman-Beek
Colonel, Corps of Engineers
District Engineer

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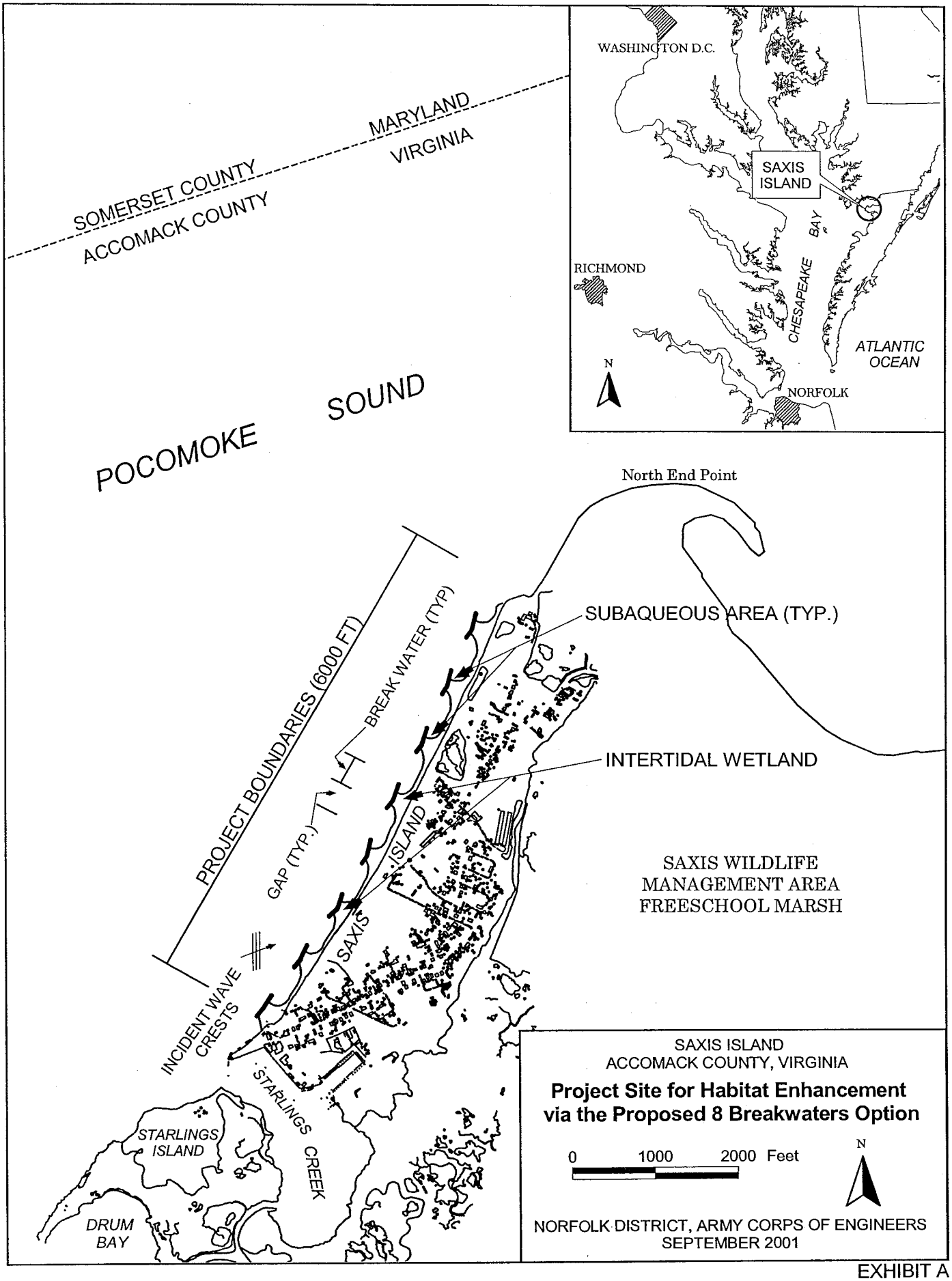

WASHINGTON D.C.
SAXIS ISLAND
BAY
CHESAPEAKE
RICHMOND
ATLANTIC OCEAN
N
NORFOLK
MARYLAND
VIRGINIA
SOMERSET COUNTY
ACCOMACK COUNTY
POCOMOKE SOUND
North End Point
SUBAQUEOUS AREA (TYP.)
INTERTIDAL WETLAND
PROJECT BOUNDARIES (6000 FT)
BREAK WATER (TYP)
GAP (TYP.)
ISLAND
SAXIS
INCIDENT WAVE CRESTS
SAXIS WILDLIFE MANAGEMENT AREA
FREESCHOOL MARSH
STARLINGS CREEK
STARLINGS ISLAND
DRUM BAY
SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Project Site for Habitat Enhancement via the Proposed 8 Breakwaters Option
0 1000 2000 Feet
N
NORFOLK DISTRICT, ARMY CORPS OF ENGINEERS
SEPTEMBER 2001

EXHIBIT A

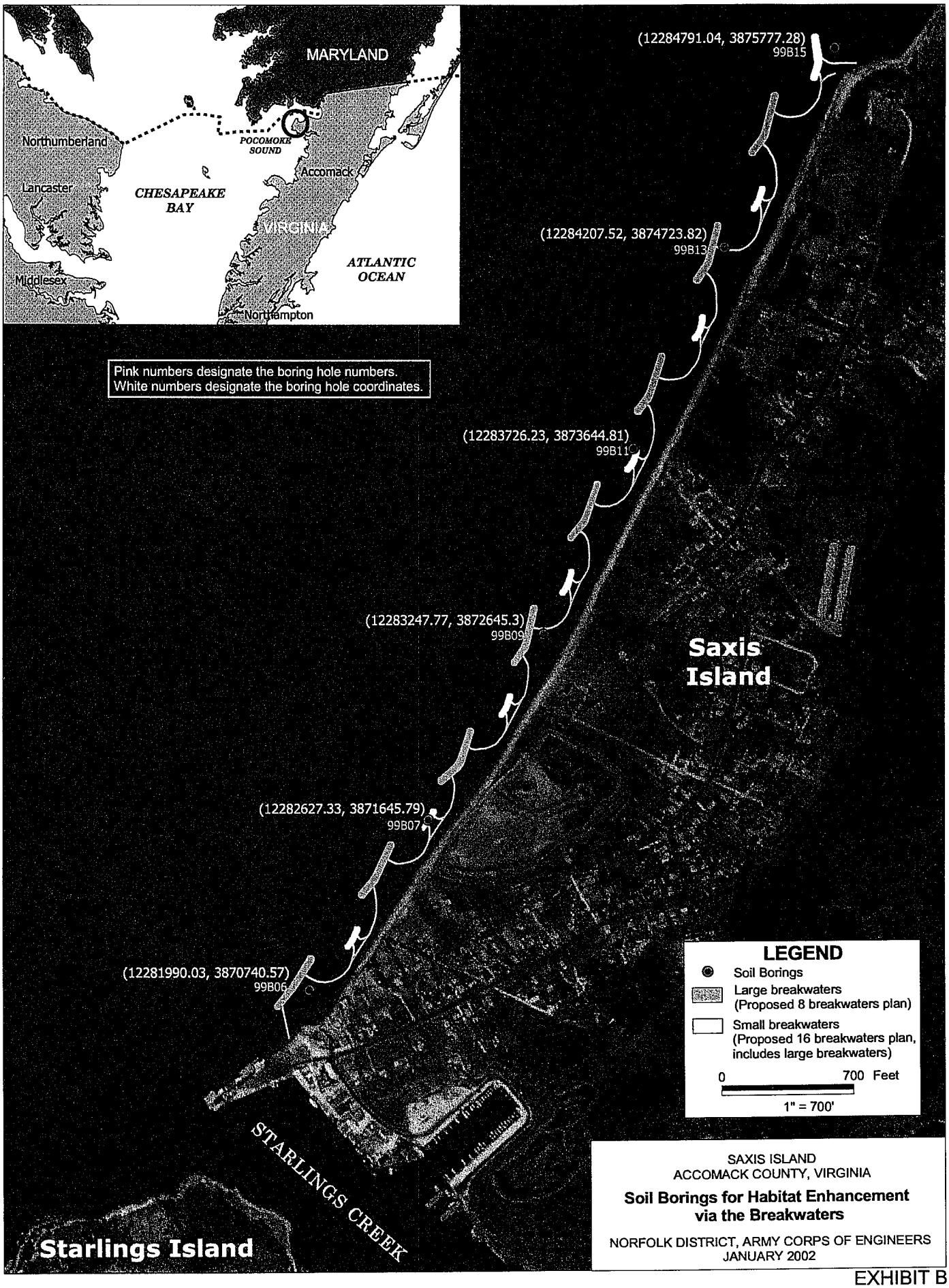
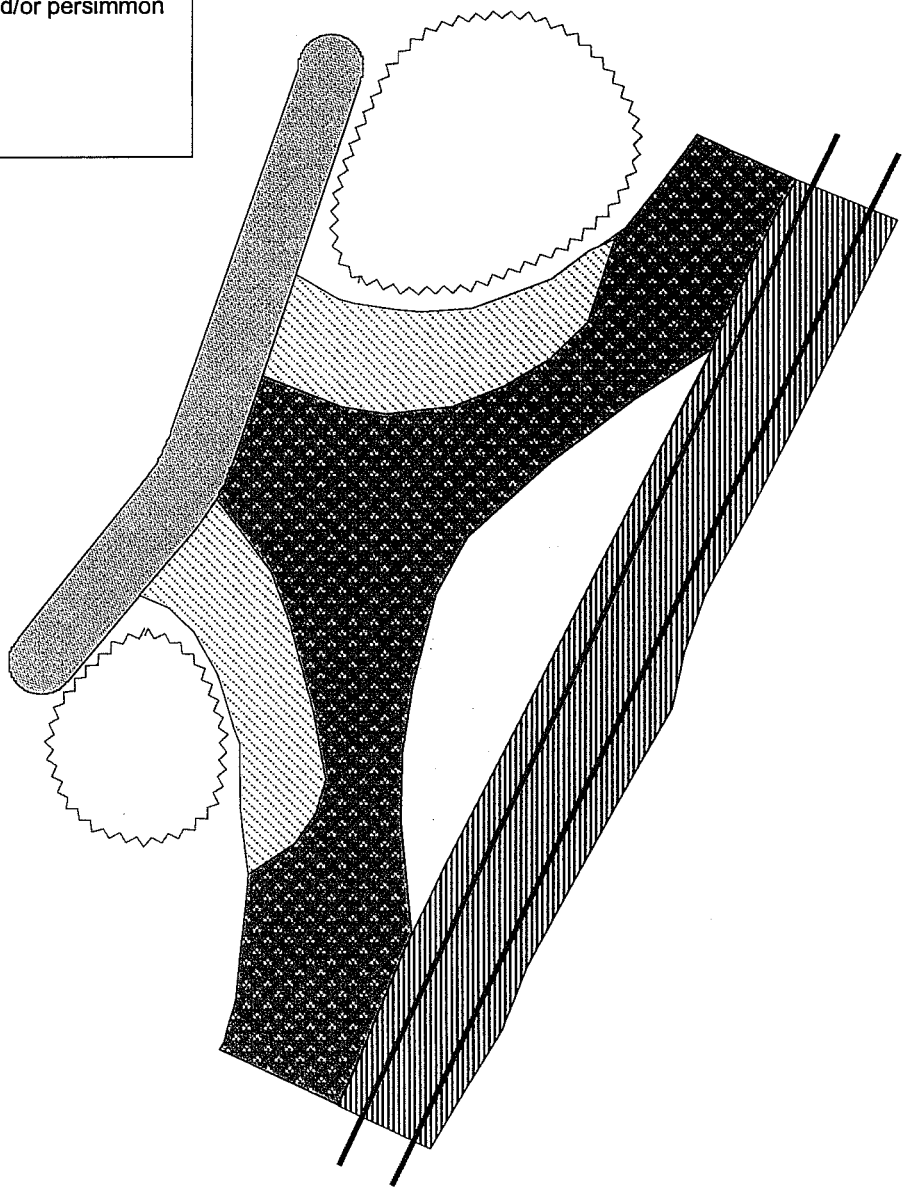

MARYLAND
Northumberland
POCOMOKE SOUND
Accomack
Lancaster
CHESAPEAKE BAY
VIRGINIA
ATLANTIC OCEAN
Middlesex
Northampton
Pink numbers designate the boring hole numbers.
White numbers designate the boring hole coordinates.
(12284791.04, 3875777.28)
99B15
(12284207.52, 3874723.82)
99B13
(12283726.23, 3873644.81)
99B11
(12283247.77, 3872645.3)
99B09
(12282627.33, 3871645.79)
99B07
(12281990.03, 3870740.57)
99B06
Saxis Island
STARLINGS CREEK
Starlings Island
LEGEND
Soil Borings
Large breakwaters
(Proposed 8 breakwaters plan)
Small breakwaters
(Proposed 16 breakwaters plan,
includes large breakwaters)
0
700 Feet
1" = 700'
SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Soil Borings for Habitat Enhancement via the Breakwaters
NORFOLK DISTRICT, ARMY CORPS OF ENGINEERS
JANUARY 2002

EXHIBIT B

LEGEND

- Mean Low Water
- Mean High Water
- SAV (Subaqueous Vegetation)
- S. patens, Panicum omarum, and Ammophilia breviligulata (Upper Berm)
- S. alterniflora (Low Marsh)
- Scrub/Shrub Fringe - mix of beach plum, black cherry, wax myrtle, yaupon holly, inkberry, red cedar, choke cherry, blueberry, groundsel tree, switchgrass, and/or persimmon
- Beach (no vegetation)
- Breakwater

Note: Diagram Not To Scale



HABITAT	ACREAGE
SAV	4.2
Upper Berm	1.7
Low Marsh	1.9
Scrub/Shrub Fringe	3.4
Beach	8.8
Breakwaters	2.5

SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA

Preliminary Shoreline Management Plan with Habitat Enhancement via a Full Tombolo Profile with 8 Breakwaters

NORFOLK DISTRICT, ARMY CORPS OF ENGINEERS
SEPTEMBER 2001

EXHIBIT C

APPENDIX 1

ENGINEERING, DESIGN, AND COST ESTIMATES

APPENDIX 1

ENGINEERING, DESIGN, AND COST ESTIMATES

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

APPENDIX 1

ENGINEERING, DESIGN, AND COST ESTIMATES

PURPOSE

The purpose of this appendix is to provide detailed information concerning the coastal engineering related aspects of the study area. More specifically, it includes discussions on surveys and mapping, geotechnical investigations, coastal structure design and cost estimating. Design data are presented for both hard structures and beachfill, including appropriate cost estimates for initial construction based on December 2001 price levels.

SURVEYS AND MAPPING

LAND MAPPING

Baseline topographic survey data were developed by stereophotogrammetric methods taken from aerial photographs flown 29 December 1995. Color orthophotos were flown in 1999. The horizontal coordinates are in US survey feet referred to the Virginia State Grid (South Zone) and are based on North American Datum 1983.

OFFSHORE PROFILE MAPPING

Bathymetric profile surveys were performed in October and November 1999 and are referenced to Mean Lower Low Water National Geodetic Vertical Datum '29 (NGVD '29), 1972 adjustment.

SUBSURFACE INVESTIGATIONS

Norfolk District conducted a subsurface investigation during November 1999. Due to the shallow water conditions, a barge-mounted tripod with a Briggs & Stratton hammer engine was used to collect the split spoon samples. Borings 99B06, 99B07, 99B09, 99B11, 99B13, and 99B15 were performed along the shoreline in the vicinity of

the proposed breakwaters. Refer to Exhibit B in the Main Report for a map showing boring locations and coordinates. Samples collected during the subsurface investigation were classified according to the Unified Soils Classification System. Selected samples were analyzed for Atterberg Limits, Gradations, and Moisture Content. Refer to Attachment 1 of this document for boring logs, grain size distribution graphs, and Atterberg Limits results. Norfolk District personnel used the information collected to perform a foundation analysis to check bearing capacity, stability, and settlement of the proposed structures.

COASTAL DESIGN

EXISTING CONDITIONS

Winds

A study of recorded and possible wind velocities, duration, and direction is necessary to determine their effect on the characteristics of waves likely to be experienced in the study area. Wind-generated waves are the primary cause of beach erosion; however, the wind itself can also cause extensive damages.

A compilation of wind velocities, durations, and directions was made from the records of the National Weather Service (then the US Weather Bureau) Station Patuxent Naval Air Station. Wind data for the 44-year period, 1945 to 1989, inclusive, are shown on Figure 1 at the end of this appendix. Destructive wave attack and elevated water levels are caused by winds that have components ranging from the north counterclockwise to the southwest. Analysis of the data indicates that the prevailing local winds were from the southern quadrants, but the velocities and total wind movement were greater from the northern quadrants. These data, along with the information available from the March 1962 storm, cover the most severe periods that have been experienced to date and are considered appropriate for this study

Waves

The configuration of the Chesapeake Bay coastline at Saxis Island is such that waves approach it from the southwest clockwise to the north. As the storm waves

approach the shoreline, their characteristics are altered by the friction of the bottom, the change in water depth, and local meteorological conditions such as wind. Further discussion concerning the development of wave conditions for design purposes is contained in a later section entitled "Design Wave Analysis."

Tides

Tides in the Chesapeake Bay are uniformly semidiurnal with the principal variations following the changes in the moon's distance and phase. The mean range of tide in the vicinity of Saxis Island is 2.3 feet, and the spring range is 2.7 feet.

COASTAL STRUCTURE ANALYSIS

Design Wave Analysis

The following paragraphs present the procedure by which the design wave was determined for this study. It is assumed for design purposes that the design wave for the stability of a structure is the maximum wave that breaks directly on the structure.

Applicable data:

Still water frequency adapted from Hunting and Guilford Creek, Accomack County Navigation Study USACE, Norfolk District 1995. (Elevations referenced to NGVD and Mean Low Water [MLW])

Frenquency	NGVD	MLW
10-year	4.3	5.2
25-year	5.0	6.0
50-year	5.6	6.6
100-year	6.3	7.3
500-year	7.8	8.8

Wave height is basically a function of wind speed, wind duration, fetch length, and water depth. For a given wind speed and water depth, a wave will be considered fully developed if both the fetch and wind duration are of sufficient magnitude, otherwise the wave is considered to be fetch or duration limited. Wave setup is defined as the superelevation of the mean water level caused by wave action alone. It is related to the transformation of the wave's kinetic energy to potential energy upon breaking.

Wave heights for preliminary designs were assumed to be produced from a 50-miles per hour wind that blew for 6 hours over the longest possible fetch. Utilizing Figure 3-29 of the Shore Protection Manual (SPM, 1984) yields a fetch limited wave with a height of 5.0 feet and a period of 5.0 seconds. An average wave setup value of about 0.2 foot was used due to the relatively shallow water in the study area.

In addition to methods outlined in the SPM to determine the wave heights, the computer program ACES was also used to verify the design wave. Input of a 6-hour duration, 50 mile-per-hour wind, using fetch-limited shallow water wave growth equations, yielded a 5.3-foot wave with a 5.2-second wave period. A wave height of 5.0 feet with a period of 5.0 seconds and direction from the west north-west was selected as the design wave based on the results of the SPM, the ACES runs, and consideration of other reports and studies.

Structure Design

The following paragraphs present the design criteria for the recommended structure. This design is in accordance with the SPM.

Uniform Armor Design:

The armor layer consists of rough, angular stone placed at random in two layers. It is assumed that the design wave for the stability of the rubble-mound terminal groin is the maximum wave that breaks directly on the structure. The weight of the armor stone is determined from the following equation from the SPM.

$$W = (w_r H^3) / (K_D [S_r - 1]^3 \cot \Theta)$$

Where:

W = armor weight in pounds (range 0.75W to 1.25W with 75 percent > W)

w_r = unit weight of armor stone (165 pounds/cubic foot)

H = design wave height (5 feet)

S_r = specific gravity of the armor unit relative to water = w_r/w_w, where w_w = unit weight of salt water (64 pounds/cubic foot) (w_r/w_w = 165/64 = 2.58)

Cot Θ = 2 (structure slope 1 vertical : 2 horizontal)

K_D = stability coefficient (3.5)

$W = ([165] [5^3]) / ([3.5] [2.58 - 1]^3 [2]) = 747$ pounds or

750 pounds (rounded) average for breaking waves on structure

Range = 560 pounds to 940 pounds with 75 percent > 750 pounds

Armor Stone Thickness:

The thickness of the armor layer (r) can be determined from the following equation from the SPM.

$$r = (nk)\,([(W) / (w_r)]^{1/3})$$

Where:

n = number of layers of stone

k = layer coefficient (1.15) (porosity)

$r = (2)\ (1.15)\ ([750] / [165])^{1/3} = 3.8$ feet

Core Stone Weight:

The weight of the core stone (CSW) is determined from the following equation from the SPM.

CSW = W/10 = 750 pounds/10 = 75 pounds

Crest Width:

Crest width (B) can be obtained from the following equation from the SPM.

$$B = nk([W] / [w_r])^{1/3}$$

Where:

n = number of stones (n = 3 is recommended)

k = layer coefficient (1.15)

W = armor weight (750 pounds)

w_r = unit weight of armor (165 pounds/cubic foot)

$B = ([3]\ [1.15])\ ([(750) / (165)]^{1/3}) = 6.0$ feet (rounded)

Structure Height:

A structure height of 6 feet NGVD was determined to be the minimum height necessary to contain the proposed beachfill and account for foundation settlement. This structure height would allow some overtopping during extreme events but would still function to reduce beach material from migrating away from the shore.

Beachfill Design

In the Plan Formulation and Evaluation process, the beach nourishment alternatives required optimization of the vegetative habitat design parameters. In developing these parameters in the Shore Protection Manual, Coastal Engineering Tech Notes (CETN), the existing conditions in the study area and accepted coastal engineering practices were reviewed. Listed below are the boundary conditions utilized to construct a logical methodology to efficiently identify the optimum plan. The necessary design parameters for beachfill include beach slope, berm elevation and width, and closure depth. The beach slope, berm elevation, and closure depth are affected by the prevailing natural processes and were based on the study area existing beach conditions. Berm width and berm elevation were varied to achieve project optimization.

Beach Slope:

Beach slopes are the result of on-site wave climate and the characteristics of the beach material. Existing beach slopes are steep in this region compared to other Chesapeake Bay shorelines. An average near shore beach slope throughout the study area of 1 V:30 H was adopted for all alternatives.

Berm Elevation:

Tides, waves, and beach slope determine the natural berm elevation. If the nourished berm is too high, scarping may occur, and if too low, ponding of water and temporary flooding may occur when a ridge forms at the seaward edge. Design berm heights for each alternative have an elevation set at the natural berm crest elevation as determined by historical profiles. The existing berm elevations in the study area vary between + 4.0 feet, North American Vertical Datum (NAVD), and + 5.0 feet, NAVD. The average berm elevation is about 4.5 feet, NAVD. It was determined that a

constructable template that closely matches the prevailing natural berm height in the study area is + 6.0 feet, NAVD. This elevation was used for all designs.

Berm Width:

The berm width for the alternatives was varied to allow full tomobolo development and salient development in the lee of the breakwaters. Construction berm template widths for the full tombolo were calculated to be 150 feet and 100 feet for the salient formation.

PROJECT MONITORING PLAN

The project monitoring plan will document beachfill performance. Periodic assessments will assist in determining renourishment quantities. The program was developed in accordance with EM-1110-2-1004, ER-1110-2-1407, CETN-II-26, and the CETN dated December 1991 entitled "Recommended Base-level Physical Monitoring of Beachfills." The following items are to be included in the project monitoring plan: pre- and post-construction monitoring, including beach profile surveys, hydrographic surveys of borrow area, sediment sampling of the beach and borrow areas, aerial photography, and tidal data collection. The field data collection will be followed up by lab and data analyses. The proposed monitoring program will begin at the initiation of pre-construction efforts and continue throughout the project life.

Beach Profiles:

PURPOSE: To quantify loss rates from project cells in order to define required renourishment quantities and document cross-shore and longshore transport patterns of the beachfill.

FREQUENCY: Two onshore/offshore surveys per year for the first, third, fifth, and seventh years and one survey per year for the second, fourth, and sixth years.

Aerial Photography:

PURPOSE: Document changes along the project site and the areas adjacent to the project site.

FREQUENCY: One flight immediately after each nourishment event and then one flight in the third, fifth, and seventh years.

Vegetative Survey:

PURPOSE: Document changes along the project site and the areas adjacent to the project site.

FREQUENCY: Twice each year for the first 5 years, then annually.

COST ESTIMATES

The cost estimates for the Feasibility Study were primarily developed using the Tri-Service Automated Cost Engineering System and previous bid experience from similar projects. The cost estimates for the selected plans are shown in Attachment 2.

Table 2. Summary wind conditions at Patuxent River NAS, Maryland from 1945-1989.

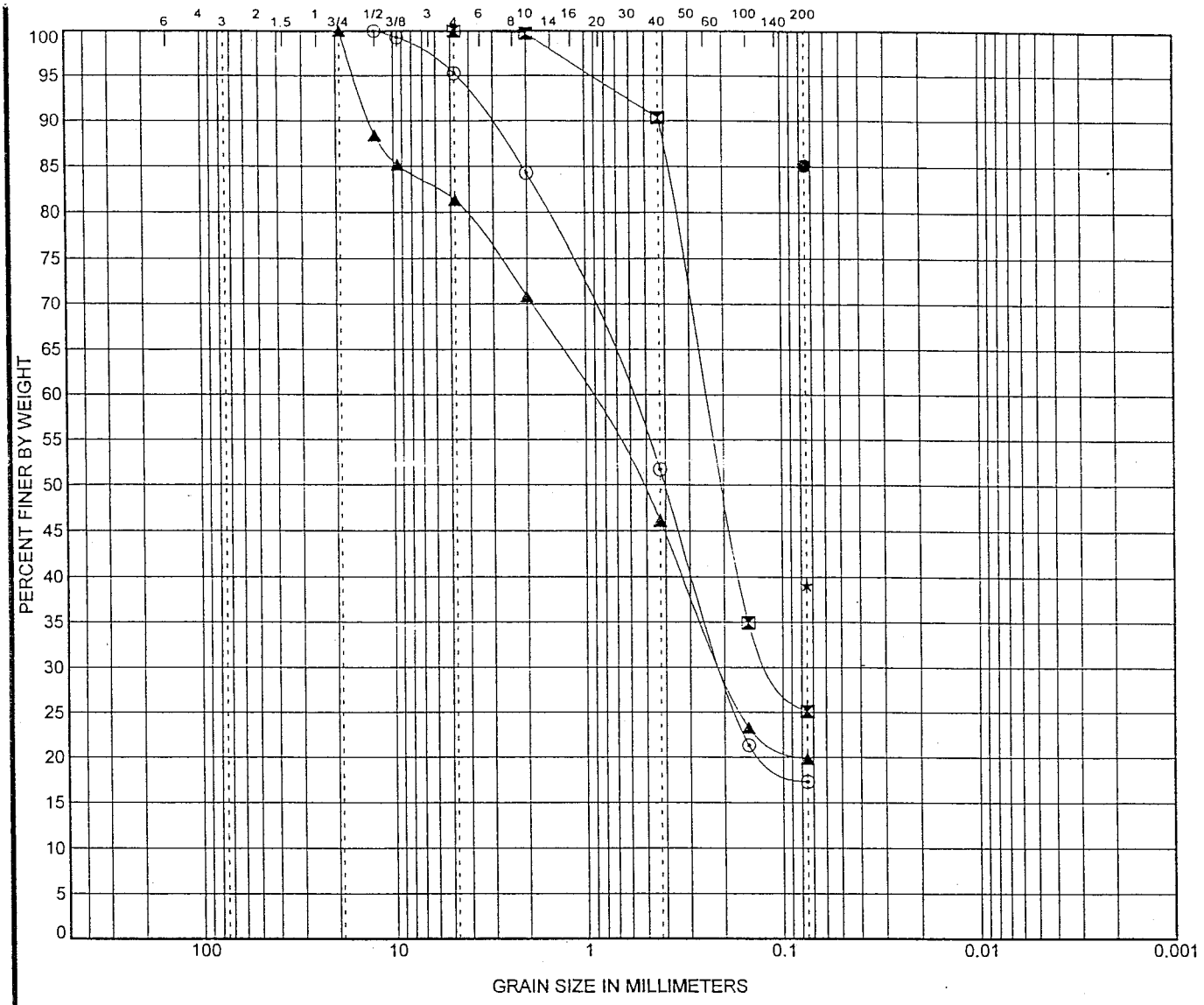
Wind Speed (mph)	Mid Range (mph)	WIND DIRECTION South SSE	Southwest SSW	West WSW	Northwest WNW	North NNW	Northeast NNE	East ENE	Southeast ESE	Total
>5	2	7323* 1.9+ 166^	5396 1.4 123	5782 1.5 131	7709 2.0 175	6938 1.8 158	4625 1.2 105	4240 1.1 96	4625 1.2 105	46638*
5-7	6	17730 4.6 403	14261 3.7 324	12720 3.3 289	15032 3.9 342	15418 4.0 350	13490 3.5 307	10407 2.7 237	12334 3.2 280	111392*
8-12	10	16959 4.4 385	18887 4.9 429	12334 3.2 280	14647 3.8 333	16188 4.2 368	13105 3.4 298	7709 2.0 175	12334 3.2 280	112163*
13-18	16	7323 1.9 166	11563 3.0 263	6167 1.6 140	12224 3.2 278	9636 2.5 219	5011 1.3 114	2698 0.7 61	5396 1.4 123	60128*
19-24	22	771 0.2 18	1542 0.4 35	771 0.2 18	4625 1.2 105	2313 0.6 53	1156 0.3 26	385 0.1 9	964 0.25 22	12527*
25-31	28	385 0.1 9	385 0.1 9	385 0.1 9	2698 0.7 61	771 0.2 18	385 0.1 9	385 0.1 9	385 0.1 9	5779*
32-38	35	193 0.05 4	193 0.05 4	385 0.1 9	578 0.15 13	385 0.1 9	385 0.1 9	385 0.1 9	385 0.1 9	2889*
39-46	43	0 0.0 0	193 0.05 4	193 0.05 4	385 0.1 9	385 0.1 9	193 0.05 4	385 0.1 9	193 0.05 4	1927*
47-54	51	193 0.05 4	0 0.0 0	0 0.0 0	193 0.05 4	0 0.0 0	0 0.0 0	0 0.0 0	193 0.05 4	579*
55-63	59	0 0.0 0	0 0.0 0	0 0.0 0	0 0.0 0	0 0.0 0	0 0.0 0	0 0.0 0	0 0.00 0	0*
<64		0 0.0 0	0 0.0 0	0 0.0 0	0 0.0 0	0 0.0 0	0 0.0 0	0 0.0 0	193 0.05 4	193*
Total		50877*	52420*	38737*	58201*	52034*	38350*	26594*	37002*	385440*

*Total Number of hours +Percent of Data Set ^Calculated Hours per Year

FIGURE 1

ATTACHMENT 1

SEDIMENT ANALYSIS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	99B01	6479 13.0	FAT CLAY CH	102	27	75		
⊠	99B01	6480 18.5	CLAYEY SAND SC	56	23	33		
▲	99B02	6481 2.0	CLAYEY SAND with GRAVEL SC	35	16	19		
★	99B03	6482 4.0	CLAYEY SAND SC	48	17	31		
⊙	99B03	6483 6.0	CLAYEY SAND SC	36	18	18		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	99B01	6479 13.0	0.075				0.0	0.0	85.1	
⊠	99B01	6480 18.5	4.75	0.24	0.106		0.0	74.9	25.1	
▲	99B02	6481 2.0	19	1.015	0.204		18.7	61.5	19.8	
★	99B03	6482 4.0	0.075				0.0	0.0	39.1	
⊙	99B03	6483 6.0	12.5	0.632	0.202		4.7	78.0	17.3	

US GRAIN SIZE GT1559BL.GPJ 1/13/00

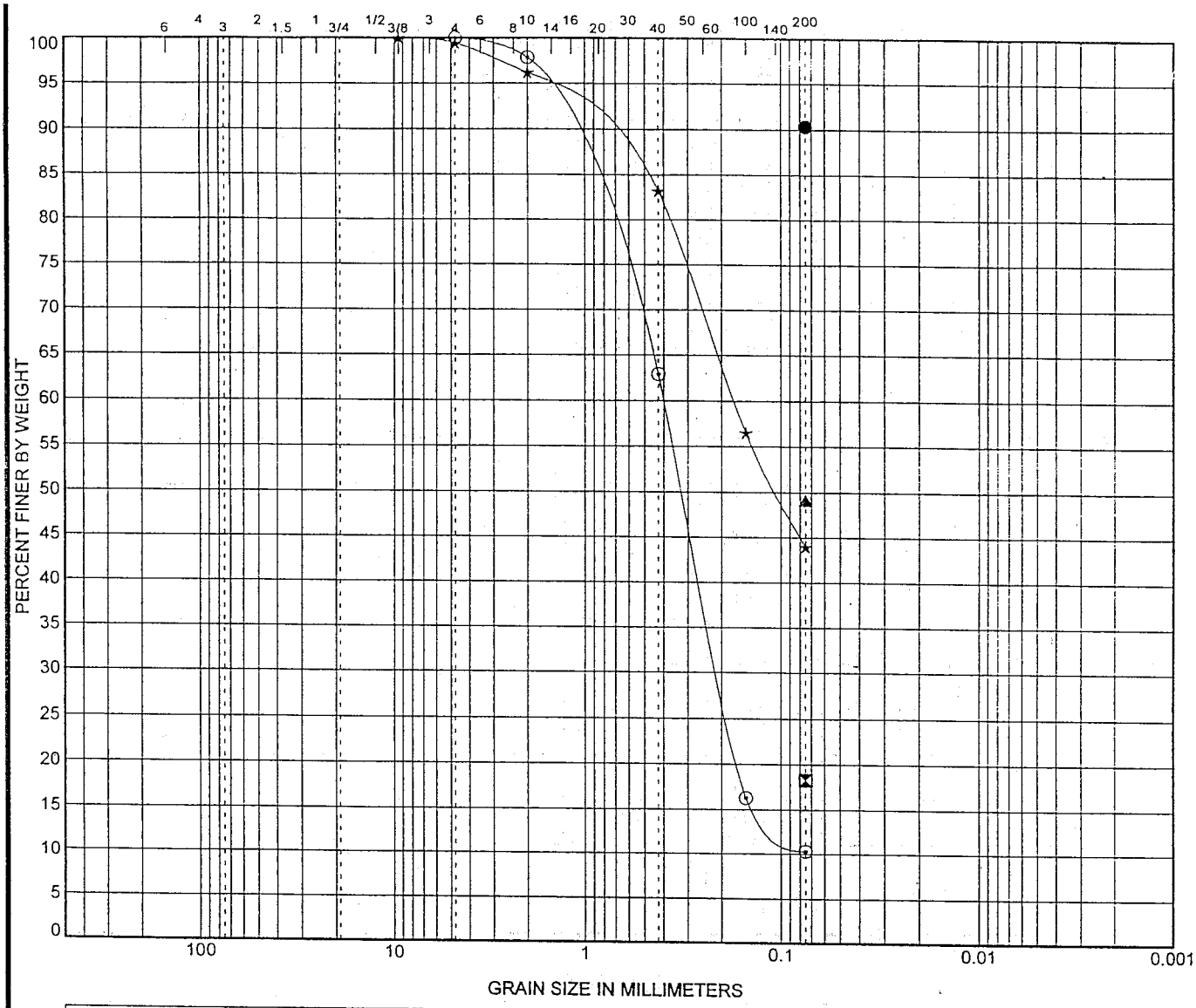
Virginia Geotechnical Services, P.C.
8211 Hermitage Road
Richmond, VA 23288
Telephone: 804-266-2199
Fax: 804-261-5569

GRAIN SIZE DISTRIBUTION

Project: Saxis Island Jetty & Breakwater

Location: Accomack County, Virginia

Number: GT1559



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	99B03	6484	13.0	FAT CLAY CH	122	44	78		
⊠	99B05	6485	2.0	CLAYEY SAND SC	27	16	11		
▲	99B05	6486	4.0	CLAYEY SAND SC	54	20	34		
★	99B05	6487	6.0	CLAYEY SAND SC	63	16	47		
⊙	99B05	6488	13.0	POORLY GRADED SAND with SILT SP-SM	NP	NP	NP	1.44	5.50

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	99B03	6484	13.0	0.075				0.0	0.0	90.3	
⊠	99B05	6485	2.0	0.075				0.0	0.0	18.3	
▲	99B05	6486	4.0	0.075				0.0	0.0	49.1	
★	99B05	6487	6.0	9.5	0.172			0.6	55.4	44.0	
⊙	99B05	6488	13.0	4.75	0.398	0.204		0.0	89.7	10.3	

US GRAIN SIZE GT1559BL.GPJ 1/13/00 MNP

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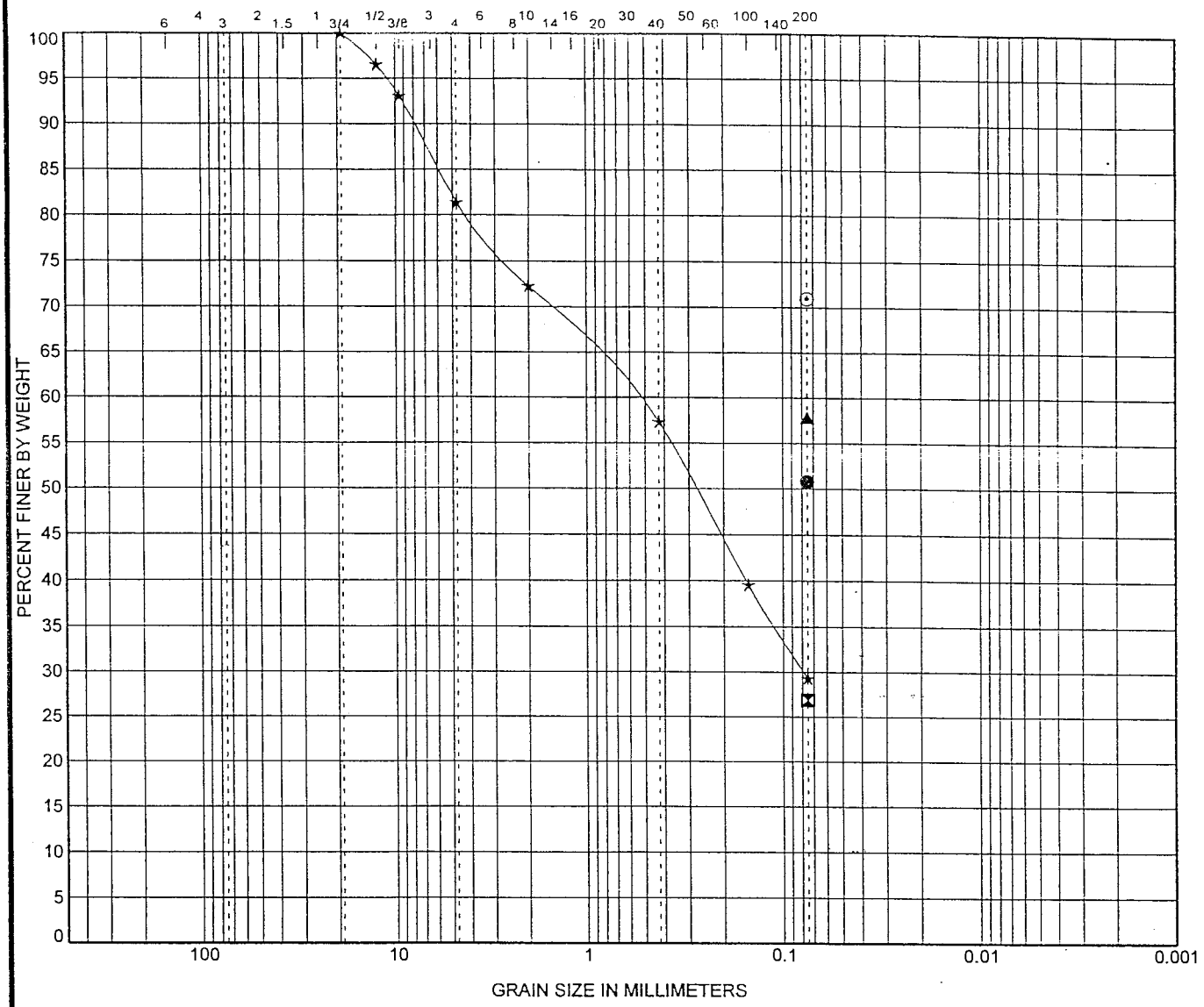

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	99B06	6489	18.0	SANDY FAT CLAY CH	56	20	36		
⊠	99B07	6490	6.0	CLAYEY SAND SC	62	23	39		
▲	99B09	6491	4.0	SANDY FAT CLAY CH	63	23	40		
★	99B09	6492	6.0	CLAYEY SAND with GRAVEL SC	60	22	38		
⊙	99B11	6493	6.0	LEAN CLAY with SAND CL	44	20	24		

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	99B06	6489	18.0	0.075				0.0	0.0	50.8	
⊠	99B07	6490	6.0	0.075				0.0	0.0	26.9	
▲	99B09	6491	4.0	0.075				0.0	0.0	57.8	
★	99B09	6492	6.0	19	0.562	0.079		18.7	52.0	29.3	
⊙	99B11	6493	6.0	0.075				0.0	0.0	71.0	

US_GRAIN_SIZE GT1559BL.GPJ 1/13/00

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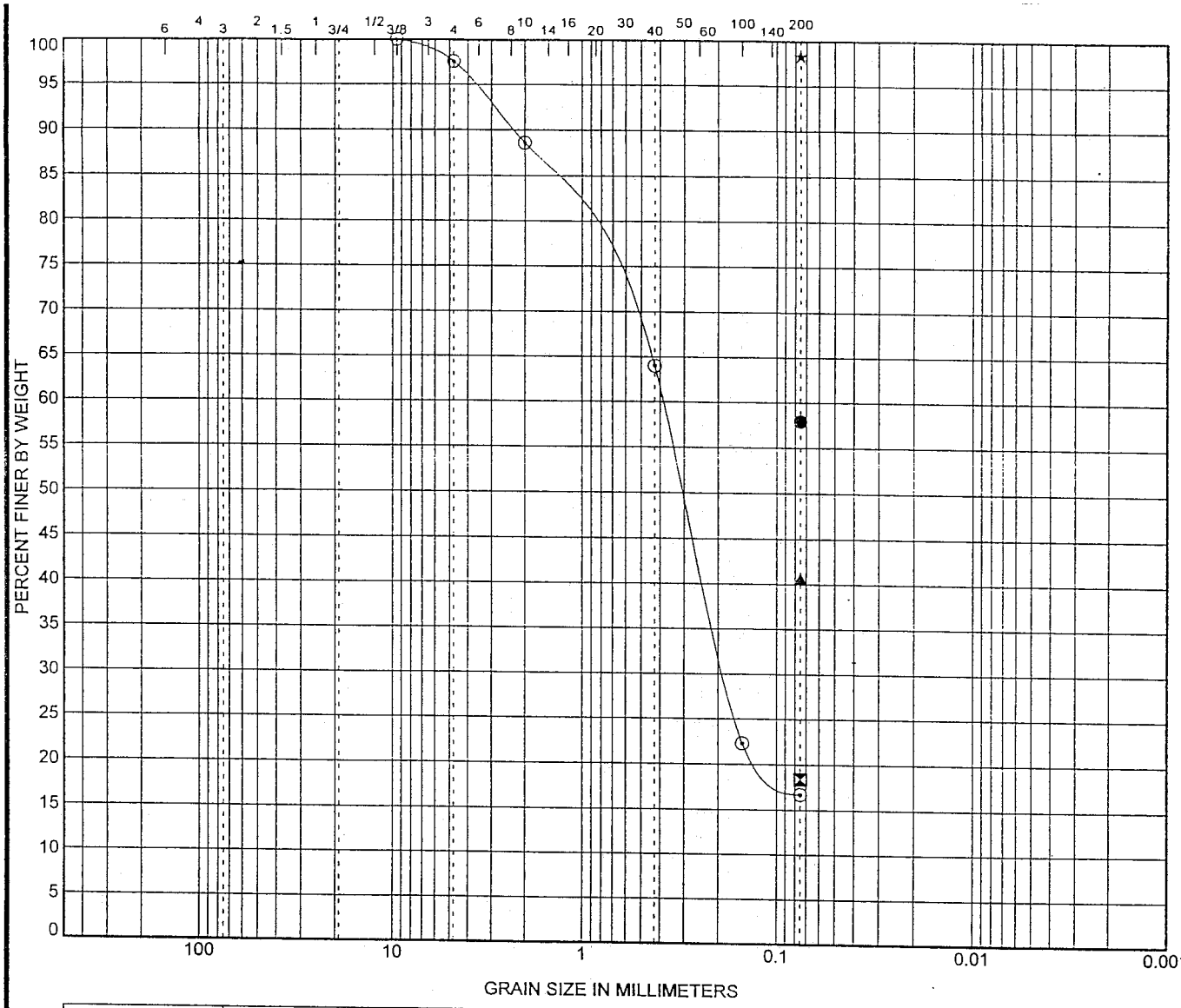
GRAIN SIZE DISTRIBUTION

Project: Saxis Island Jetty & Breakwater

Location: Accomack County, Virginia

Number: GT1559



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	99B11	6494	8.0	SANDY FAT CLAY CH	50	20	30		
⊠	99B11	6495	13.0	SILTY SAND SM	26	23	3		
▲	99B13	6496	6.0	CLAYEY SAND SC	60	26	34		
★	99B13	6497	8.0	ELASTIC SILT MH	108	46	62		
⊙	99B15	6498	13.0	CLAYEY SAND SC	42	19	23		

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	99B11	6494	8.0	0.075				0.0	0.0	57.9	
⊠	99B11	6495	13.0	0.075				0.0	0.0	18.4	
▲	99B13	6496	6.0	0.075				0.0	0.0	40.6	
★	99B13	6497	8.0	0.075				0.0	0.0	98.3	
⊙	99B15	6498	13.0	9.5	0.385	0.182		2.5	80.9	16.7	

US GRAIN SIZE GT1559BL.GPJ 1/13/00 MAP

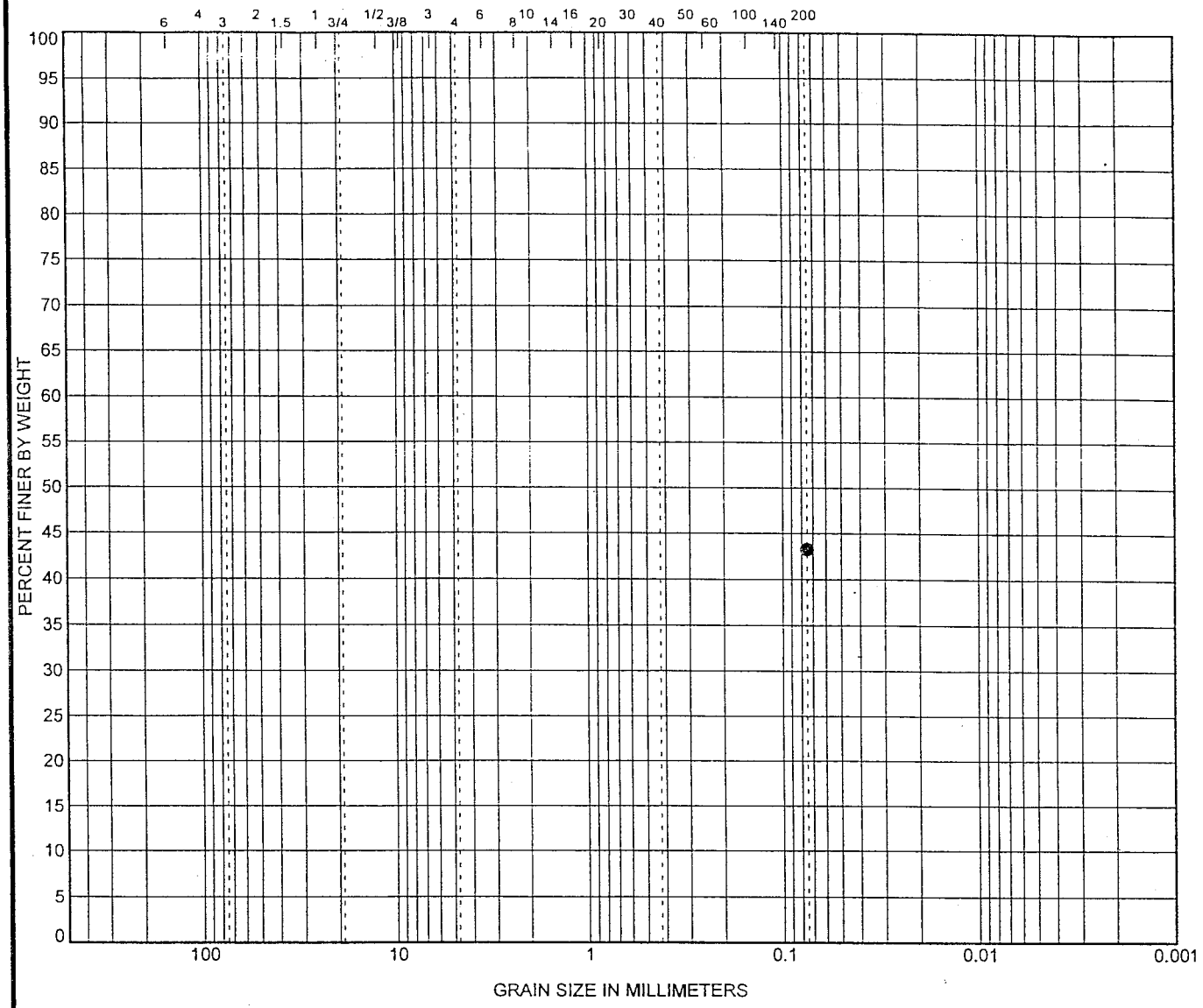
Virginia Geotechnical Services, P.C.
8211 Hermitage Road
Richmond, VA 23288
Telephone: 804-266-2199
Fax: 804-261-5569

GRAIN SIZE DISTRIBUTION

Project: Saxis Island Jetty & Breakwater

Location: Accomack County, Virginia

Number: GT1559



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	99B15 6499 18.0	CLAYEY SAND SC	46	25	21		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	99B15 6499 18.0	0.075				0.0	0.0	43.3	

US GRAIN SIZE GT1559BL.GPJ 1/13/00 LANE

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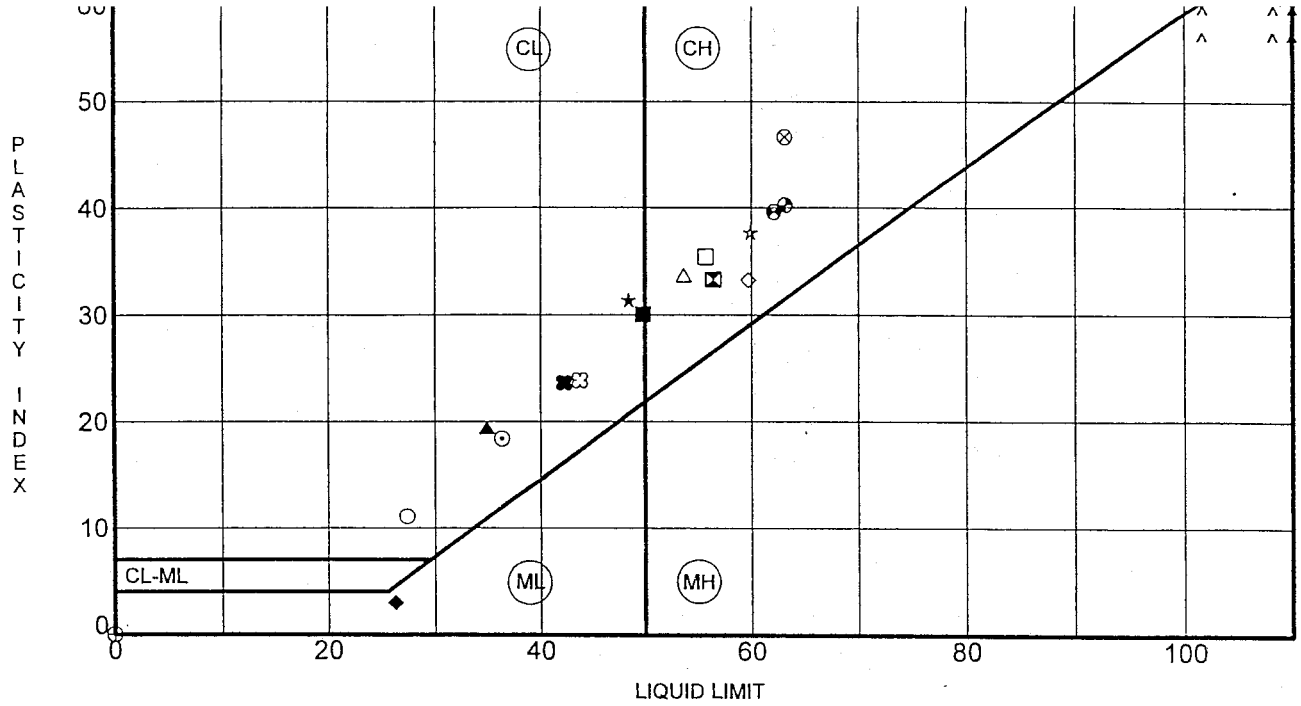
GRAIN SIZE DISTRIBUTION

Project: Saxis Island Jetty & Breakwater

Location: Accomack County, Virginia

Number: GT1559



	Specimen Identification			LL	PL	PI	Fines	MC	Classification
●	99B01	6479	13.0	102	27	75	85	62.8	FAT CLAY CH
⊠	99B01	6480	18.5	56	23	33	25	30.6	CLAYEY SAND SC
▲	99B02	6481	2.0	35	16	19	20	11.9	CLAYEY SAND with GRAVEL SC
★	99B03	6482	4.0	48	17	31	39	22.6	CLAYEY SAND SC
⊙	99B03	6483	6.0	36	18	18	17	21.5	CLAYEY SAND SC
✿	99B03	6484	13.0	122	44	78	90	72.9	FAT CLAY CH
○	99B05	6485	2.0	27	16	11	18	11.4	CLAYEY SAND SC
△	99B05	6486	4.0	54	20	34	49	25.6	CLAYEY SAND SC
⊗	99B05	6487	6.0	63	16	47	44	26.7	CLAYEY SAND SC
⊕	99B05	6488	13.0	NP	NP	NP	10	18.6	POORLY GRADED SAND with SILT SP-SM
□	99B06	6489	18.0	56	20	36	51	39.7	SANDY FAT CLAY CH
⊖	99B07	6490	6.0	62	23	39	27	36.8	CLAYEY SAND SC
◒	99B09	6491	4.0	63	23	40	58	41.7	SANDY FAT CLAY CH
☆	99B09	6492	6.0	60	22	38	29	29.1	CLAYEY SAND with GRAVEL SC
⊠	99B11	6493	6.0	44	20	24	71	32.0	LEAN CLAY with SAND CL
■	99B11	6494	8.0	50	20	30	58	33.6	SANDY FAT CLAY CH
◆	99B11	6495	13.0	26	23	3	18	22.7	SILTY SAND SM
◇	99B13	6496	6.0	60	26	34	41	37.5	CLAYEY SAND SC
✕	99B13	6497	8.0	108	46	62	98	81.4	ELASTIC SILT MH
✖	99B15	6498	13.0	42	19	23	17	28.6	CLAYEY SAND SC

US ATTERBERG LIMITS GT1559BL.GPJ 1/13/00 MAP

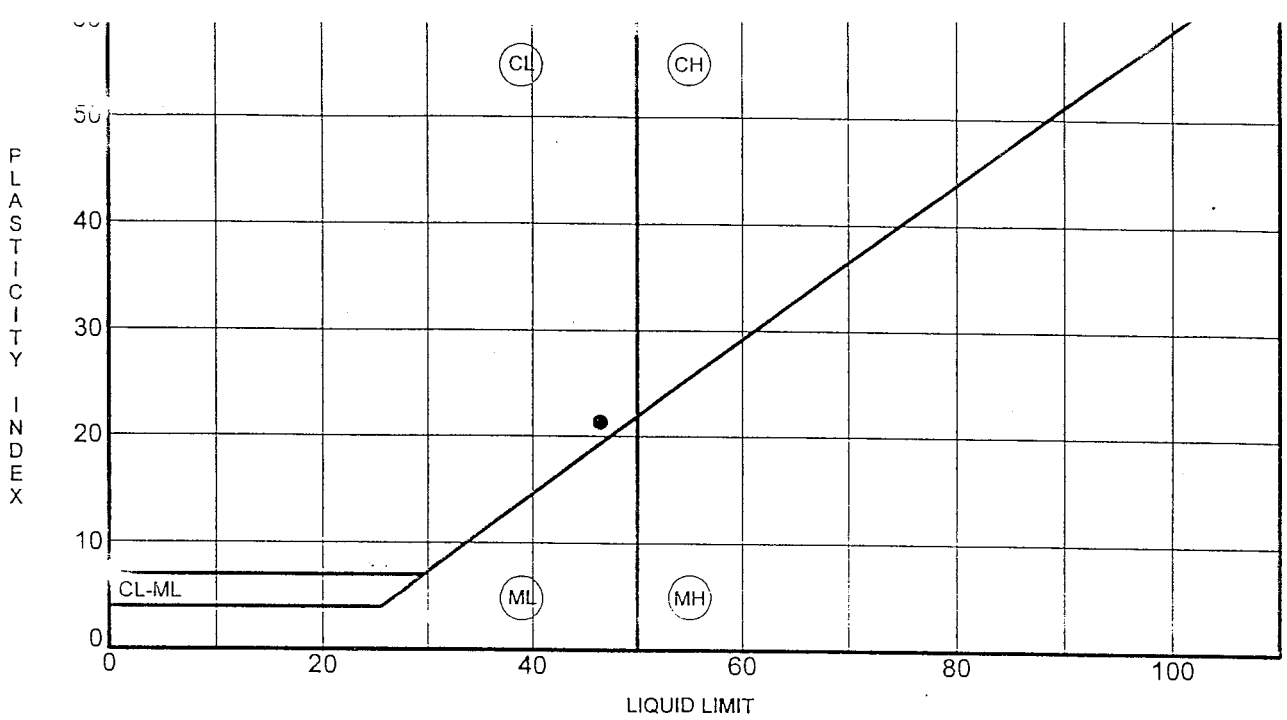
Virginia Geotechnical Services, P.C.
8211 Hermitage Road
Richmond, VA 23288
Telephone: 804-266-2199
Fax: 804-261-5569

ATTERBERG LIMITS' RESULTS

Project: Saxis Island Jetty & Breakwater

Location: Accomack County, Virginia

Number: GT1559



	Specimen Identification			LL	PL	PI	Fines	MC	Classification
●	99B15	6499	18.0	46	25	21	43	32.5	CLAYEY SAND SC

US ATTERBERG LIMITS GT1559BL.GPJ 1/13/00

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ATTERBERG LIMITS' RESULTS

Project: Saxis Island Jetty & Breakwater

Location: Accomack County, Virginia

Number: GT1559

ATTACHMENT 2

DETAILED COST ESTIMATES (MICRO-COMPUTER AIDED COST ESTIMATING SYSTEM, MCACES)

FEASIBILITY STUDY COST ESTIMATE

****** TOTAL PROJECT COST SUMMARY ******

THIS ESTIMATE IS BASED ON THE DRAFT FEASIBILITY STUDY, DATED DECEMBER 2001

PROJECT: SAXIS ISLAND ECOSYSTEM RESTORATION
LOCATION: SAXIS, ACCOMACK COUNTY, VIRGINIA

DISTRICT: NORFOLK, VIRGINIA
P.O.C.: ALAN ELLINWOOD, CHIEF, COST ENGINEERING

		MCACES EST. PREPARED: JUN FY 03 EFFECTIVE PRICING LEVEL: OCT FY 03				AUTH/BUDGET YR: FY 04 EFFECT. PRICING LEVEL: OCT FY 04				FULLY FUNDED ESTIMATE				
ACCT NUM	FEATURE DESCRIPTION	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	OMB (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FEATURE MD PT	OMB (%)	COST ($K)	CNTG ($K)	FULL ($K)
10	BREAKWATERS and SEAWALLS	1,924	289	15.0%	2,212	2.7%	1,976	296	2,272	May-05	4.1%	2,057	309	2,366
	TOTAL CONSTRUCTION COSTS	1,924	289	15.0%	2,212		1,976	296	2,272			2,057	309	2,366
01	LANDS AND DAMAGES	7	2	25.0%	9	2.7%	7	2	9	Apr-04	1.4%	7	2	9
30	PRECONSTR., ENGINEERING AND DESIGN	173	26	15.0%	199	2.7%	178	27	204	Apr-04	1.4%	180	27	207
31	CONSTRUCTION MGT (9%)	173	26	15.0%	199	2.7%	178	27	204	May-05	4.1%	185	28	213
31	MONITORING (ENVIRONMENTAL)	31	5	15.0%	36									
	TOTAL PROJECT COST	2,308	347	15.0%	$2,655		2,339	352	$2,690			2,430	365	$2,795

DISTRICT APPROVED:

CHIEF, ENGINEERING SUPPORT

CHIEF, CONSTRUCTION

CHIEF, ENGINEERING

CHIEF, OPERATIONS

CHIEF, REAL ESTATE

CHIEF, PLANNING

CHIEF, TSD

CHIEF, PPMD

PROJECT MANAGER

Saxis Island Ecosystem Restoratn
Saxis Is Ecosystem Restoration
Feasibility Study
Accomack County, Virginia

Designed By: Norfolk District-
Estimated By:

Prepared By:

Preparation Date: 06/17/03
Effective Date of Pricing: 06/17/03

Sales Tax: 4.5%

M C A C E S F O R W I N D O W S
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Release 1.2c

Saxis Island Ecosystem Restoration
Feasibility Study
Saxis Island, Accomack County, Virginia

This project involves placing wave reducers, sand fill, and new aquatic and beachside vegetation. The estimate shows seven alternatives.

** PROJECT OWNER SUMMARY - CONTRACT **

		QUANTY	UOM	CONTRACT COST	CONTING	ESCLN	TOTAL COST	UNIT COST
02	Alt 1-16 Breakwaters w/Full Tomb			2,402,880	360,432	0	2,763,312	
07	Alt 2- 8 Breakwaters w/Full Tomb			1,923,660	288,549	0	2,212,209	
10	Alt 3-16 Breakwaters w/Salient			2,248,990	337,349	0	2,586,339	
13	Alt 4-8 Breakwaters w/Salient			1,776,530	266,480	0	2,043,010	
15	Alt 5-16 Breakwaters, no Fill			1,886,420	282,963	0	2,169,383	
18	Alt 6-8 Breakwaters, no Fill			1,441,500	216,225	0	1,657,725	
20	Alt 7-N/A							

** CONTRACTOR SETTINGS **

		AMOUNT	PCT	PCT S	RISK	DIFF	SIZE	PERIOD	INVEST	ASSIST	SUBCON
AA Prime Contractor											
Prime Contractor's Field Overhead	P		15.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		1.00								
XW Utilities Sub-Contractor											
Prime Contractor's Field Overhead	P		0.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		0.00								
Prime Contractor's Bond	P		0.00								
BB Sub Contractor											
Prime Contractor's Field Overhead	P		21.00								
Prime's Home Office Expense	P		0.00								
Prime Contractor's Profit	P		10.00								
Prime Contractor's Bond	P		1.00								

02. Alt 1-16 Breakwaters w/Full Tomb

		QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
02. Alt 1-16 Breakwaters w/Full Tomb								
USR	Mob/Demob		0.00	0.00	0.00	20000	20000.00	
		1.00 LS	0	0	0	20,000	20,000	20000.00
USR	Geotextile Fabric		0.00	0.00	0.00	7.00	7.00	
		12450 SY	0	0	0	87,150	87,150	7.00
USR	Breakwater Class III RipRap		0.00	0.00	0.00	62.00	62.00	
		27000 TON	0	0	0	1674000	1,674,000	62.00
USR	Sand Tombolo		0.00	0.00	0.00	12.00	12.00	
		42300 CY	0	0	0	507,600	507,600	12.00
USR	Submerged Aquatic Vegetation (SAV)		0.00	0.00	0.00	5300.00	5300.00	
		6.70 AC	0	0	0	35,510	35,510	5300.00
USR	Alt Flor		0.00	0.00	0.00	9500.00	9500.00	
		2.40 AC	0	0	0	22,800	22,800	9500.00
USR	Patens		0.00	0.00	0.00	8400.00	8400.00	
		2.00 AC	0	0	0	16,800	16,800	8400.00
USR	Scrub Shrub		0.00	0.00	0.00	5300.00	5300.00	
		3.40 AC	0	0	0	18,020	18,020	5300.00
USR	Access Roads		0.00	0.00	0.00	4000.00	4000.00	
		1.00 LS	0	0	0	4,000	4,000	4000.00
USR	Staging Areas		0.00	0.00	0.00	2000.00	2000.00	
		1.00 LS	0	0	0	2,000	2,000	2000.00
USR	Surveys		0.00	0.00	0.00	15000	15000.00	
		1.00 LS	0	0	0	15,000	15,000	15000.00
TOTAL Alt 1-16 Breakwaters w/Full Tomb			0	0	0	2402880	2,402,880	

07. Alt 2- 8 Breakwaters w/Full Tomb

		QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
07. Alt 2- 8 Breakwaters w/Full Tomb								
USR	Mob/Demob		0.00	0.00	0.00	20000	20000.00	
		1.00 LS	0	0	0	20,000	20,000	20000.00
USR	Geotextile Fabric		0.00	0.00	0.00	7.00	7.00	
		9350.00 SY	0	0	0	65,450	65,450	7.00
USR	Breakwater Class III RipRap		0.00	0.00	0.00	62.00	62.00	
		20000 TON	0	0	0	1240000	1,240,000	62.00
USR	Sand Tombolo		0.00	0.00	0.00	12.00	12.00	
		42300 CY	0	0	0	507,600	507,600	12.00
USR	Submerged Aquatic Vegetation (SAV)		0.00	0.00	0.00	5300.00	5300.00	
		4.20 AC	0	0	0	22,260	22,260	5300.00
USR	Alt Flor		0.00	0.00	0.00	9500.00	9500.00	
		1.90 AC	0	0	0	18,050	18,050	9500.00
USR	Patens		0.00	0.00	0.00	8400.00	8400.00	
		1.70 AC	0	0	0	14,280	14,280	8400.00
USR	Scrub Shrub		0.00	0.00	0.00	5300.00	5300.00	
		3.40 AC	0	0	0	18,020	18,020	5300.00
USR	Access Roads		0.00	0.00	0.00	4000.00	4000.00	
		1.00 LS	0	0	0	4,000	4,000	4000.00
USR	Staging Areas		0.00	0.00	0.00	2000.00	2000.00	
		1.00 LS	0	0	0	2,000	2,000	2000.00
USR	Surveys		0.00	0.00	0.00	12000	12000.00	
		1.00 LS	0	0	0	12,000	12,000	12000.00
TOTAL Alt 2- 8 Breakwaters w/Full Tomb			0	0	0	1923660	1,923,660	

		QUANTY	UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
10. Alt 3-16 Breakwaters w/Salient									
USR	Mob/Demob			0.00	0.00	0.00	20000	20000.00	
		1.00	LS	0	0	0	20,000	20,000	20000.00
USR	Geotextile Fabric			0.00	0.00	0.00	7.00	7.00	
		12450	SY	0	0	0	87,150	87,150	7.00
USR	Breakwater Class III RipRap			0.00	0.00	0.00	62.00	62.00	
		27000	TON	0	0	0	1674000	1,674,000	62.00
USR	Sand Salient			0.00	0.00	0.00	12.00	12.00	
		28200	CY	0	0	0	338,400	338,400	12.00
USR	Submerged Aquatic Vegetation (SAV)			0.00	0.00	0.00	5300.00	5300.00	
		12.60	AC	0	0	0	66,780	66,780	5300.00
USR	Alt Flor			0.00	0.00	0.00	9500.00	9500.00	
		2.40	AC	0	0	0	22,800	22,800	9500.00
USR	Patens			0.00	0.00	0.00	8400.00	8400.00	
		0.10	AC	0	0	0	840	840	8400.00
USR	Scrub Shrub			0.00	0.00	0.00	5300.00	5300.00	
		3.40	AC	0	0	0	18,020	18,020	5300.00
USR	Access Roads			0.00	0.00	0.00	4000.00	4000.00	
		1.00	LS	0	0	0	4,000	4,000	4000.00
USR	Staging Areas			0.00	0.00	0.00	2000.00	2000.00	
		1.00	LS	0	0	0	2,000	2,000	2000.00
USR	Surveys			0.00	0.00	0.00	15000	15000.00	
		1.00	LS	0	0	0	15,000	15,000	15000.00
TOTAL Alt 3-16 Breakwaters w/Salient				0	0	0	2248990	2,248,990	

13. Alt 4-8 Breakwaters w/Salient

		QUANTY	UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
13. Alt 4-8 Breakwaters w/Salient									
USR	Mob/Demob			0.00	0.00	0.00	20000	20000.00	
		1.00	LS	0	0	0	20,000	20,000	20000.00
USR	Geotextile Fabric			0.00	0.00	0.00	7.00	7.00	
		9350.00	SY	0	0	0	65,450	65,450	7.00
USR	Breakwater Class III RipRap			0.00	0.00	0.00	62.00	62.00	
		20000	TON	0	0	0	1240000	1,240,000	62.00
USR	Sand Salient			0.00	0.00	0.00	12.00	12.00	
		28200	CY	0	0	0	338,400	338,400	12.00
USR	Submerged Aquatic Vegetation (SAV)			0.00	0.00	0.00	5300.00	5300.00	
		10.90	AC	0	0	0	57,770	57,770	5300.00
USR	Alt Flor			0.00	0.00	0.00	9500.00	9500.00	
		1.90	AC	0	0	0	18,050	18,050	9500.00
USR	Patens			0.00	0.00	0.00	8400.00	8400.00	
		0.10	AC	0	0	0	840	840	8400.00
USR	Scrub Shrub			0.00	0.00	0.00	5300.00	5300.00	
		3.40	AC	0	0	0	18,020	18,020	5300.00
USR	Access Roads			0.00	0.00	0.00	4000.00	4000.00	
		1.00	LS	0	0	0	4,000	4,000	4000.00
USR	Staging Areas			0.00	0.00	0.00	2000.00	2000.00	
		1.00	LS	0	0	0	2,000	2,000	2000.00
USR	Surveys			0.00	0.00	0.00	12000	12000.00	
		1.00	LS	0	0	0	12,000	12,000	12000.00
TOTAL	Alt 4-8 Breakwaters w/Salient			0	0	0	1776530	1,776,530	

15. Alt 5-16 Breakwaters, no Fill

		QUANTY	UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
15. Alt 5-16 Breakwaters, no Fill									
USR	Mob/Demob			0.00	0.00	0.00	20000	20000.00	
		1.00	LS	0	0	0	20,000	20,000	20000.00
USR	Geotextile Fabric			0.00	0.00	0.00	7.00	7.00	
		12450	SY	0	0	0	87,150	87,150	7.00
USR	Breakwater Class III RipRap			0.00	0.00	0.00	62.00	62.00	
		27000	TON	0	0	0	1674000	1,674,000	62.00
USR	Submerged Aquatic Vegetation (SAV)			0.00	0.00	0.00	5300.00	5300.00	
		15.90	AC	0	0	0	84,270	84,270	5300.00
USR	Access Roads			0.00	0.00	0.00	4000.00	4000.00	
		1.00	LS	0	0	0	4,000	4,000	4000.00
USR	Staging Areas			0.00	0.00	0.00	2000.00	2000.00	
		1.00	LS	0	0	0	2,000	2,000	2000.00
USR	Surveys			0.00	0.00	0.00	15000	15000.00	
		1.00	LS	0	0	0	15,000	15,000	15000.00
TOTAL Alt 5-16 Breakwaters, no Fill				0	0	0	1886420	1,886,420	

18. Alt 6-8 Breakwaters, no Fill

		QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
18. Alt 6-8 Breakwaters, no Fill								
USR	Mob/Demob		0.00	0.00	0.00	20000	20000.00	
		1.00 LS	0	0	0	20,000	20,000	20000.00
USR	Geotextile Fabric		0.00	0.00	0.00	7.00	7.00	
		9350.00 SY	0	0	0	65,450	65,450	7.00
USR	Breakwater Class III RipRap		0.00	0.00	0.00	62.00	62.00	
		20000 TON	0	0	0	1240000	1,240,000	62.00
USR	Submerged Aquatic Vegetation (SAV)		0.00	0.00	0.00	5300.00	5300.00	
		18.50 AC	0	0	0	98,050	98,050	5300.00
USR	Access Roads		0.00	0.00	0.00	4000.00	4000.00	
		1.00 LS	0	0	0	4,000	4,000	4000.00
USR	Staging Areas		0.00	0.00	0.00	2000.00	2000.00	
		1.00 LS	0	0	0	2,000	2,000	2000.00
USR	Surveys		0.00	0.00	0.00	12000	12000.00	
		1.00 LS	0	0	0	12,000	12,000	12000.00
TOTAL Alt 6-8 Breakwaters, no Fill			0	0	0	1441500	1,441,500	

20. Alt 7-N/A

	QUANTY	UOM	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
20. Alt 7-N/A								
TOTAL Alt 7-N/A			0	0	0	0	0	
TOTAL Saxis Island Ecosystem Restoratn	1.00	EA	0	0	011679980		11,679,980	11679980

APPENDIX 2

ECONOMICS AND BENEFITS ANALYSIS

APPENDIX 2

ECONOMICS AND BENEFITS ANALYSIS

TABLE OF CONTENTS

APPENDIX 2

ECONOMICS AND BENEFITS ANALYSIS

AVERAGE ANNUAL BENEFITS ANALYSIS

The following tables (1 through 7) show how the environmental benefits were derived. A growth or decay rate was assigned to each environmental benefit, for each of the seven alternatives. These rates were derived by researching the literature and determining when the habitat would attain its full environmental potential. These rates were then inputted into the function: $Q(t) = Q_o * e^{k*t}$, where Q_o is the initial quantity of the benefit; k is the growth or decay rate; and t is time. Depending on the structure that was built, the habitats would change over time, providing varying environmental benefits. The quantity at time t was found for each environmental benefit, for all seven alternatives. This was done each year for twenty-five years, and also for the initial year zero. The benefits from each year were then totaled and divided by twenty-six, in order to derive the average annual benefit, for each benefit, for each alternative.

Table 1. AVERAGE ANNUAL ENVIRONMENTAL BENEFITS
SIXTEEN BREAKWATER WITH TOMBOLO FILL

Year	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/ Improve Water Quality	Increase Sheltered Shallow Water Habitat	Avoid Down Drift Shore Starvation
0	0.003	4.95	0.128	2.807	2.094
1	0.006676623	5.203791927	0.190953561	2.806719314	2.201361676
2	0.014859097	5.470596044	0.284869239	2.806438656	2.314227902
3	0.033069529	5.751079502	0.424974966	2.806158026	2.432880904
4	0.073597591	6.045943653	0.63398815	2.805877425	2.557617376
5	0.16379445	6.355925813	0.945799181	2.805596851	2.688749223
6	0.364531253	6.527929473	1.410966577	2.805316305	2.692228737
7	0.811279222	6.560650855	2.104914787	2.805035788	2.692767236
8	1.805535114	6.593536255	3.140163865	2.804755298	2.693305844
9	4.018292293	6.626586493	4.684574009	2.804474836	2.693844559
10	8.942873961	6.659802396	6.988563204	2.804194403	2.694383382
11	8.231160799	6.693184794	7	2.803913998	2.694922312
12	8.173743867	6.726734522	7	2.80363362	2.695461351
13	8.11672745	6.760452419	7	2.803353271	2.696000497
14	8.060108754	6.794339328	7	2.80307295	2.696539751
15	8.003885006	6.828396096	7	2.802792656	2.697079113
16	7.948053449	6.862623574	7	2.802512391	2.697618582
17	7.892611349	6.897022618	7	2.802232154	2.69815816
18	7.837555988	6.931594087	7	2.801951945	2.698697846
19	7.782884669	6.966338847	7	2.801671763	2.699237639
20	7.728594713	7.001257766	7	2.80139161	2.699777541
21	7.674683459	7.036351717	7	2.801111485	2.70031755
22	7.621148267	7.071621576	7	2.800831388	2.700857668
23	7.567986512	7.107068227	7	2.800551319	2.701397893
24	7.51519559	7.142692555	7	2.800271278	2.701938227
25	7.462772915	7.17849545	7	2.799991265	2.702478669
SUM	133.8546219	170.744016	125.9377675	72.89084999	68.23584964
SUM / 26	5.148254689	6.567077538	4.84376029	2.803494231	2.624455755
TOTAL AVERAGE ANNUAL BENEFITS FOR 16 BW TOMBOLO = 21.9870425					

Table 2. AVERAGE ANNUAL ENVIRONMENTAL BENEFITS
EIGHT BREAKWATER WITH TOMBOLO FILL

Year	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/ Improve Water Quality	Increase Sheltered Shallow Water Habitat	Avoid Down Drift Shore Starvation
0	0.003	4.45	0.19	2.792	2.332
1	0.006676623	4.678156379	0.269622834	2.792279214	2.451564197
2	0.014859097	4.918010585	0.382613014	2.792558456	2.577258581
3	0.033069529	5.17016238	0.542953712	2.792837726	2.709397454
4	0.073597591	5.435242274	0.770487994	2.793117023	2.848311232
5	0.16379445	5.713913104	1.093374508	2.793396349	2.994347272
6	0.364531253	5.873590844	1.551572283	2.793675703	2.995796939
7	0.811279222	5.90303234	2.201785877	2.793955084	2.996096534
8	1.805535114	5.932621413	3.124482887	2.794234494	2.996396158
9	4.018292293	5.962358801	4.43385227	2.794513931	2.996695813
10	8.942873961	5.992245249	6.291935872	2.794793396	2.996995497
11	9.731179108	6.022281504	6.3	2.79507289	2.997295212
12	9.799536333	6.052468315	6.3	2.795352411	2.997594957
13	9.868373737	6.082806439	6.3	2.79563196	2.997894731
14	9.937694694	6.113296633	6.3	2.795911537	2.998194535
15	10.0075026	6.14393966	6.3	2.796191143	2.99849437
16	10.07780087	6.174736286	6.3	2.796470776	2.998794234
17	10.14859296	6.20568728	6.3	2.796750437	2.999094129
18	10.21988234	6.236793417	6.3	2.797030126	2.999394053
19	10.29167248	6.268055474	6.3	2.797309843	2.999694008
20	10.36396693	6.299474233	6.3	2.797589588	2.999993992
21	10.43676921	6.331050479	6.3	2.797869361	3.000294006
22	10.51008289	6.362785002	6.3	2.798149162	3.000594051
23	10.58391157	6.394678594	6.3	2.798428991	3.000894125
24	10.65825886	6.426732054	6.3	2.798708847	3.00119423
25	10.73312841	6.458946182	6.3	2.798988732	3.001494364
SUM	169.6058621	153.6030649	115.3526813	72.68281718	75.88577467
SUM / 26	6.52330239	5.907810189	4.436641587	2.795492968	2.918683641
TOTAL AVERAGE ANNUAL BENEFITS FOR 8 BW TOMBOLO = 22.58193078					

Table 3. AVERAGE ANNUAL ENVIRONMENTAL BENEFITS
SIXTEEN BREAKWATER WITH SALIENT FILL

Year	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/ Improve Water Quality	Increase Sheltered Shallow Water Habitat	Avoid Down Drift Shore Starvation
0	0.085	4.55	0.4598	4.855	1.3466
1	0.126805099	4.688568129	0.590394887	4.859857428	1.415641658
2	0.189170979	4.831356287	0.75808204	4.864719716	1.488223158
3	0.282209938	4.978492991	0.973396608	4.869586869	1.564525991
4	0.421007756	5.130110675	1.249865985	4.874458892	1.644740954
5	0.628069768	5.286345804	1.604859692	4.879335789	1.729068626
6	0.936969992	5.375900515	2.060680635	4.884217565	1.749872987
7	1.397794976	5.392052433	2.64596631	4.889104226	1.753376236
8	2.085265067	5.408252878	3.397487994	4.893995775	1.756886497
9	3.110849928	5.424501999	4.362460938	4.898892219	1.760403786
10	4.640842753	5.440799939	5.601510723	4.903793561	1.763928117
11	4.891783046	5.457146847	5.6	4.908699807	1.767459503
12	4.916303211	5.473542869	5.6	4.913610962	1.77099796
13	4.940946283	5.489988154	5.6	4.918527031	1.7745435
14	4.965712879	5.506482848	5.6	4.923448018	1.778096138
15	4.990603619	5.5230271	5.6	4.928373929	1.781655889
16	5.015619123	5.53962106	5.6	4.933304768	1.785222767
17	5.040760019	5.556264877	5.6	4.93824054	1.788796785
18	5.066026934	5.572958699	5.6	4.94318125	1.792377959
19	5.091420499	5.589702679	5.6	4.948126904	1.795966302
20	5.116941351	5.606496966	5.6	4.953077506	1.799561829
21	5.142590126	5.623341711	5.6	4.958033061	1.803164554
22	5.168367466	5.640237067	5.6	4.962993574	1.806774492
23	5.194274016	5.657183184	5.6	4.96795905	1.810391657
24	5.220310423	5.674180217	5.6	4.972929493	1.814016063
25	5.246477338	5.691228317	5.6	4.97790491	1.817647726
SUM	89.91212259	140.1077842	107.7045058	127.8213728	44.85994113
SUM / 26	3.458158561	5.388760933	4.142480993	4.916206648	1.725382351
TOTAL AVERAGE ANNUAL BENEFITS FOR 16 BW SALIENT = 19.63098949					

Table 4. AVERAGE ANNUAL ENVIRONMENTAL BENEFITS
EIGHT BREAKWATER WITH SALIENT FILL

Year	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/ Improve Water Quality	Increase Sheltered Shallow Water Habitat	Avoid Down Drift Shore Starvation
0	0.323	3.99	0.663	4.855	1.6028
1	0.436004395	4.11151359	0.809790029	4.859857428	1.684977313
2	0.588544373	4.236727821	0.989079775	4.864719716	1.771367947
3	0.794451805	4.365755392	1.208064765	4.869586869	1.862187924
4	1.072397766	4.498712438	1.475533636	4.874458892	1.957664341
5	1.44758557	4.635718628	1.802220852	4.879335789	2.058035938
6	1.954036131	4.703912951	2.20123752	4.884217565	2.070385118
7	2.637672882	4.718045879	2.688597578	4.889104226	2.072456539
8	3.560485971	4.732221269	3.283860497	4.893995775	2.074530032
9	4.806153347	4.746439249	4.010916269	4.898892219	2.0766056
10	6.487628426	4.760699947	4.898944194	4.903793561	2.078683244
11	6.856948589	4.775003491	4.9	4.908699807	2.080762967
12	6.891319187	4.789350011	4.9	4.913610962	2.08284477
13	6.925862068	4.803739634	4.9	4.918527031	2.084928657
14	6.960578096	4.818172492	4.9	4.923448018	2.087014628
15	6.995468139	4.832648713	4.9	4.928373929	2.089102687
16	7.030533069	4.847168428	4.9	4.933304768	2.091192835
17	7.065773763	4.861731767	4.9	4.93824054	2.093285073
18	7.101191101	4.876338862	4.9	4.94318125	2.095379405
19	7.13678597	4.890989844	4.9	4.948126904	2.097475833
20	7.172559258	4.905684845	4.9	4.953077506	2.099574358
21	7.208511861	4.920423997	4.9	4.958033061	2.101674982
22	7.244644677	4.935207433	4.9	4.962993574	2.103777708
23	7.28095861	4.950035286	4.9	4.96795905	2.105882538
24	7.317454567	4.96490769	4.9	4.972929493	2.107989474
25	7.35413346	4.979824777	4.9	4.97790491	2.110098518
SUM	130.6506831	122.6509744	97.53124511	127.8213728	52.74067843
SUM / 26	5.025026272	4.717345171	3.751201735	4.916206648	2.028487632
	TOTAL AVERAGE ANNUAL BENEFITS FOR 8 BW SALIENT =				**20.43826746**

Table 5. AVERAGE ANNUAL ENVIRONMENTAL BENEFITS
SIXTEEN BREAKWATER WITH NO FILL

Year	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/ Improve Water Quality	Increase Sheltered Shallow Water Habitat	Avoid Down Drift Shore Starvation
0	3.57	3.268	0.568	0.2913	0.157
1	3.545097261	3.300843946	0.693756767	0.291591446	0.165049562
2	3.520368233	3.334017979	0.847356428	0.291883183	0.173511834
3	3.495811704	3.367525417	1.034963479	0.292175212	0.182407976
4	3.471426469	3.40136961	1.264107247	0.292467534	0.191760233
5	3.447211336	3.435553943	1.543984079	0.292760147	0.20159199
6	3.423165117	3.450641864	1.885826412	0.293053054	0.226739617
7	3.399286633	5.740039976	2.303353581	0.293346254	0.231320061
8	3.375574715	5.745782887	2.813322417	0.293639747	0.235993036
9	3.352028201	5.751531544	3.43619976	0.293933533	0.240760412
10	3.328645937	5.757285952	4.196983864	0.294227614	0.245624095
11	3.305426777	5.763046118	4.2	0.294521988	0.250586031
12	3.282369584	5.768812047	4.2	0.294816658	0.255648204
13	3.259473228	5.774583744	4.2	0.295111622	0.26081264
14	3.236736586	5.780361216	4.2	0.295406881	0.266081405
15	3.214158546	5.786144468	4.2	0.295702436	0.271456606
16	3.191737999	5.791933507	4.2	0.295998286	0.276940393
17	3.169473849	5.797728337	4.2	0.296294432	0.28253496
18	3.147365003	5.803528965	4.2	0.296590875	0.288242545
19	3.125410379	5.809335397	4.2	0.296887614	0.294065431
20	3.1036089	5.815147638	4.2	0.29718465	0.300005947
21	3.081959499	5.820965694	4.2	0.297481984	0.306066469
22	3.060461115	5.826789571	4.2	0.297779614	0.312249422
23	3.039112694	5.832619275	4.2	0.298077543	0.318557278
24	3.01791319	5.838454812	4.2	0.29837577	0.324992562
25	2.996861564	5.844296187	4.2	0.298674295	0.331557848
SUM	85.16068452	133.6063401	83.58785403	7.669282371	6.591556558
SUM / 26	3.275410943	5.138705388	3.214917463	0.294972399	0.253521406
	TOTAL AVERAGE ANNUAL BENEFITS FOR 16 BW NO FILL =				12.1775276

Table 6. AVERAGE ANNUAL ENVIRONMENTAL BENEFITS
EIGHT BREAKWATER WITH NO FILL

Year	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/ Improve Water Quality	Increase Sheltered Shallow Water Habitat	Avoid Down Drift Shore Starvation
0	4.77	4.45	0.781	0.5825	0.383
1	4.736726593	4.494723244	0.907392544	0.583082791	0.40263683
2	4.703685286	4.539895963	1.054239729	0.583666166	0.423280462
3	4.670874461	4.585522676	1.224851817	0.584250124	0.444982515
4	4.63829251	4.735689023	1.423074783	0.584834666	0.467797256
5	4.605937836	4.678156379	1.653377013	0.585419793	0.491781735
6	4.573808853	5.734302806	1.92095003	0.586005506	0.522211214
7	4.541903989	5.740039976	2.231825523	0.586591805	0.527459524
8	4.510221678	5.932621413	2.593011317	0.58717869	0.53276058
9	4.478760369	5.962358801	3.012649339	0.587766162	0.538114913
10	4.447518521	5.992245249	3.500199164	0.588354222	0.543523058
11	4.416494602	6.022281504	3.5	0.588942871	0.548985555
12	4.385687092	6.052468315	3.5	0.589532108	0.554502952
13	4.355094481	6.082806439	3.5	0.590121935	0.560075799
14	4.324715271	6.113296633	3.5	0.590712352	0.565704654
15	4.294547973	6.14393966	3.5	0.59130336	0.571390081
16	4.264591108	6.174736286	3.5	0.591894959	0.577132646
17	4.23484321	6.20568728	3.5	0.59248715	0.582932926
18	4.205302819	6.236793417	3.5	0.593079934	0.588791499
19	4.175968489	6.268055474	3.5	0.59367331	0.594708952
20	4.146838783	6.299474233	3.5	0.594267281	0.600685876
21	4.117912272	6.331050479	3.5	0.594861845	0.60672287
22	4.08918754	6.362785002	3.5	0.595457004	0.612820536
23	4.060663179	6.394678594	3.5	0.596052759	0.618979485
24	4.032337791	6.426732054	3.5	0.59664911	0.625200332
25	4.004209989	6.458946182	3.5	0.597246058	0.6314837
SUM	113.7861247	150.4192871	72.80257126	15.33593196	14.11766595
SUM / 26	4.376389411	5.785357195	2.800098895	0.589843537	0.542987152
	TOTAL AVERAGE ANNUAL BENEFITS FOR 8 BW NO FILL =				**14.09467619**

Table 7. AVERAGE ANNUAL ENVIRONMENTAL BENEFITS
NO ACTION PLAN

Year	Increase Beach	Increase Habitat Diversity	Reduce Shore Erosion/ Improve Water Quality	Increase Sheltered Shallow Water Habitat	Avoid Down Drift Shore Starvation
0	1	0.7	0.7	0.7	3
1	1	0.7	0.7	0.7	3
2	1	0.7	0.7	0.7	3
3	1	0.7	0.7	0.7	3
4	1	0.7	0.7	0.7	3
5	1	0.7	0.7	0.7	3
6	1	0.7	0.7	0.7	3
7	1	0.7	0.7	0.7	3
8	1	0.7	0.7	0.7	3
9	1	0.7	0.7	0.7	3
10	1	0.7	0.7	0.7	3
11	1	0.7	0.7	0.7	3
12	1	0.7	0.7	0.7	3
13	1	0.7	0.7	0.7	3
14	1	0.7	0.7	0.7	3
15	1	0.7	0.7	0.7	3
16	1	0.7	0.7	0.7	3
17	1	0.7	0.7	0.7	3
18	1	0.7	0.7	0.7	3
19	1	0.7	0.7	0.7	3
20	1	0.7	0.7	0.7	3
21	1	0.7	0.7	0.7	3
22	1	0.7	0.7	0.7	3
23	1	0.7	0.7	0.7	3
24	1	0.7	0.7	0.7	3
25	1	0.7	0.7	0.7	3
SUM	26	18.2	18.2	18.2	78
SUM / 26	1	0.7	0.7	0.7	3
TOTAL AVERAGE ANNUAL BENEFITS FOR NO ACTION PLAN = 6.1					

AVERAGE ANNUAL COSTS ANALYSIS

Table 8 shows the breakdown of total construction and planting costs that were used to evaluate the NER plan. Totals are not in average annual values.

Table 9 shows the total and average annual project costs that were used in the NER analysis, for each of the six breakwater alternatives. Total construction costs (construction and planting costs), Plans and Specifications (P&S), and total interest costs were determined and put into average annual values. Monitoring and real estate costs were not included as they were added to the total project cost after the Best Buy plan was selected.

Table 10 illustrates how the average annual equivalent costs for Plans and Specifications (P&S), and Interest During Construction (IDC) were derived, for the selected NER plan. Values were derived based on a 25-year project life, using a 5-7/8 percent discount rate, and are shown in October 2002 (Fiscal Year 2003) price levels.

Table 8. TOTAL CONSTRUCTION AND PLANTING COSTS FOR THE SIX BREAKWATER ALTERNATIVES

		Alternative						
		16 BW Tombolo	8 BW Tombolo	16 BW Salient	8 BW Salient	16 BW No Fill	8 BW No Fill	No Action
Construction Costs	MOB/ DeMOB	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$0
	Amount of Geotextile Fabric	12,450	9,350	12,450	9,350	12,450	9,350	0
	Cost Geotextile Fabric/ YD2	$7	$7	$7	$7	$7	$7	$7
	Geotextile Fabric Costs	$87,150	$65,450	$87,150	$65,450	$87,150	$65,450	$0
	Access Roads	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$0
	Staging Areas	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$0
	Surveys	$15,000	$12,000	$15,000	$12,000	$15,000	$12,000	$0
	Breakwater - Class III Rip Rap Amounts (Tons)	27000	20000	27000	20000	27000	20000	0
	Cost of In-Place Rocks/ Ton	$62	$62	$62	$62	$62	$62	$62
	Breakwater Costs	$1,674,000	$1,240,000	$1,674,000	$1,240,000	$1,674,000	$1,240,000	$0
	Amount of Fill Sand (YD3)	42,300	42,300	28,200	28,200	0	0	0
	Cost Of Fill Sand/ YD3	$12	$12	$12	$12	$12	$12	$12
	Fill Sand Costs	$507,600	$507,600	$338,400	$338,400	$0	$0	$0
Planting Costs	Acres SAV	6.7	4.2	12.6	10.9	15.9	18.5	0
	Price/ Acre SAV	$5,300	$5,300	$5,300	$5,300	$5,300	$5,300	$5,300
	Cost of SAV	$35,510	$22,260	$66,780	$57,770	$84,270	$98,050	$0
	Acres Alt. Flor.	2.4	1.9	2.4	1.9	0	0	0
	Price/ Acre Alt. Flor.	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500
	Cost of Alt. Flor.	$22,800	$18,050	$22,800	$18,050	$0	$0	$0
	Acres Patens	2	1.7	0.1	0.1	0	0	0
	Price/ Acre Patens	$8,400	$8,400	$8,400	$8,400	$8,400	$8,400	$8,400
	Cost of Patens	$16,800	$14,280	$840	$840	$0	$0	$0
	Acres Srub Shrub	3.4	3.4	3.4	3.4	0	0	0
	Price/ Acre Scrub Shrub	$5,300	$5,300	$5,300	$5,300	$5,300	$5,300	$5,300
	Cost of Scrub Shrub	$18,020	$18,020	$18,020	$18,020	$0	$0	$0
Total Costs	Total Costs	$2,402,880	$1,923,660	$2,248,990	$1,776,530	$1,886,420	$1,441,500	$0
	15% Contingency	$360,432	$288,549	$337,349	$266,480	$282,963	$216,225	$0
	Total Costs Plus 15% Contingency Costs	**$2,763,312**	**$2,212,209**	**$2,586,339**	**$2,043,010**	**$2,169,383**	**$1,657,725**	**$0**

Table 9. TOTAL AND AVERAGE ANNUAL COSTS FOR THE SIX BREAKWATER ALTERNATIVES

16 Breakwater No Fill	
Cost(FY 2003 $$$)	2,169,383.00
Base Year	2004
Present Value Factor	0.892099
Capital Recovery Factor	0.0773
Present Value of Cost	1,935,304.85
Average Annual Cost	149,599.06
PED Costs	199,000.00
Present Value of PED	177,527.74
Average Annual PED Cost	13,722.89
Total Interest	86,520.20
Present Value of Interest	77,185
Average Annual Interest	5,966.37
Total Average Annual Costs	169,288.33

16 Breakwater Salient	
Cost(FY 2003 $$$)	2,586,339.00
Base Year	2004
Present Value Factor	0.892099
Capital Recovery Factor	0.0773
Present Value of Cost	2,307,270.97
Average Annual Cost	178,352.05
PED Costs	199,000.00
Present Value of PED	177,527.74
Average Annual PED Cost	13,722.89
Total Interest	99,844.15
Present Value of Interest	89,071
Average Annual Interest	6,885.18
Total Average Annual Costs	198,960.12

16 Breakwater Tombolo	
Cost(FY 2003 $$$)	2,763,312.00
Base Year	2004
Present Value Factor	0.892099
Capital Recovery Factor	0.0773
Present Value of Cost	2,465,148.44
Average Annual Cost	190,555.97
PED Costs	199,000.00
Present Value of PED	177,527.74
Average Annual PED Cost	13,722.89
Total Interest	105,499.37
Present Value of Interest	94,116
Average Annual Interest	7,275.16
Total Average Annual Costs	211,554.03

8 Breakwater No Fill	
Cost(FY 2003 $$$)	1,657,725.00
Base Year	2004
Present Value Factor	0.892099
Capital Recovery Factor	0.0773
Present Value of Cost	1,478,855.16
Average Annual Cost	114,315.50
PED Costs	199,000.00
Present Value of PED	177,527.74
Average Annual PED Cost	13,722.89
Total Interest	70,170.02
Present Value of Interest	62,599
Average Annual Interest	4,838.87
Total Average Annual Costs	132,877.27

8 Breakwater Salient	
Cost(FY 2003 $$$)	2,043,010.00
Base Year	2004
Present Value Factor	0.892099
Capital Recovery Factor	0.0773
Present Value of Cost	1,822,567.60
Average Annual Cost	140,884.48
PED Costs	199,000.00
Present Value of PED	177,527.74
Average Annual PED Cost	13,722.89
Total Interest	82,481.92
Present Value of Interest	73,582
Average Annual Interest	5,687.89
Total Average Annual Costs	160,295.26

8 Breakwater Tombolo	
Cost(FY 2003 $$$)	2,212,209.00
Base Year	2004
Present Value Factor	0.892099
Capital Recovery Factor	0.0773
Present Value of Cost	1,973,509.89
Average Annual Cost	152,552.31
PED Costs	199,000.00
Present Value of PED	177,527.74
Average Annual PED Cost	13,722.89
Total Interest	87,888.72
Present Value of Interest	78,405
Average Annual Interest	6,060.74
Total Average Annual Costs	172,335.95

Table 10. AVERAGE ANNUAL COSTS FOR THE NER PLAN - EIGHT BREAKWATERS WITH TOMBOLO FILL

PED Amount =	199,000.00	IDC for PED =	17,196.94
Interest Rate =	5.875	IDC For Construction =	70,691.77
PED Period Length =	9.00	Total Interest =	87,888.72
Construction Amount =	2,212,209		
Construction Length =	12.00		

MONTH	PED CALCULATIONS	CONSTRUCTION CALCULATIONS
1	108.25	902.55
2	217.03	1809.52
3	325.82	2716.51
4	434.60	3623.50
5	543.39	4530.49
6	652.17	5437.48
7	760.96	6344.47
8	869.74	7251.47
9	978.53	8158.46
10	998.21	9065.45
11	1003.10	9972.44
12	1008.01	10879.43
13	1012.95	
14	1017.91	
15	1022.89	
16	1027.90	
17	1032.93	
18	1037.99	
19	1043.07	
20	1048.18	
21	1053.31	

APPENDIX 3

REAL ESTATE PLAN

APPENDIX 3

REAL ESTATE PLAN

TABLE OF CONTENTS

LIST OF EXHIBITS

APPENDIX 3

REAL ESTATE PLAN

STATEMENT OF PURPOSE

This Real Estate section is tentative in nature, and it is for planning purposes only. The figures in this report are subject to changes once: (a) the project scope is defined; (b) concrete parameters are set; (c) maps are drawn showing the exact locations; (d) the exact number of acres needed for mitigation, environmental restoration, and utility relocation are identified; (e) realistic values are established as to the cost of the property to be acquired; and (f) a determination is made as to the exact number of rights of entry needed.

PROJECT DESIGNATION

This study was authorized by Section 206 of the Water Resources Development Act of 1996 (Public Law 104-305). In that authorization, the Secretary of the Army is authorized to study Federal interest in and feasibility of providing improvements for aquatic ecosystem restoration and protection. This authority is used primarily for manipulation of the hydrology in and along bodies of water, including lands and riparian areas. No relationship to an existing Corps Project is required. Projects can be undertaken if a finding is made that environmental, economic and social benefits both monetary and non-monetary, justify the cost and the project will not result in environmental degradation. The Local Sponsor will pay 100 percent of the cost lands, easements and rights of ways.

SITE LOCATIONS AND DESCRIPTIONS

The proposed project is located in the Town of Saxis, a community on DELMARVA peninsula known as the Eastern Shore of the Coast of Virginia. Saxis is just south of the Virginia-Maryland state line and is situated on the Pocomoke Sound portion of the Chesapeake Bay. The small town is densely populated and is surrounded by marshland. The project area is rarely used as a beach due to the low water level, tall grasses, etc. The Corps project is the construction of segmented offshore breakwater structures along 6,000 feet of shoreline in order to restore historically vegetated aquatic and wetland habitat.

REAL ESTATE REQUIREMENTS

The real property interest needed for this project are 6 access points 15 feet wide to the shoreline from the main public road, a staging area along the entire 25-foot wide, 6,000 foot long shoreline. Four access points are public and owned by the town. The other two points are along private properties and have a width of 15 feet. The town is very much in favor of the project, and the mayor has pleaded his support and use of his property and that of a town council member as possible access points. He has stated he

would like for the District to come over for a town meeting at which time he believes he will be able to get most of the agreements needed for the project signed that night. He will personally go door-to-door to obtain the other property owners' signatures. There are no known utilities that will be affected or require relocation.

OWNERSHIP OF REAL PROPERTIES NEEDED FOR THIS PROJECT

Access Points

ID #	Map parcel No(s).	Owner	Present use
6 parcels			
160	022B2A000018300	Town of Saxis	Public Wharf
140	022B2A000014000	Town of Saxis	Public Road
4	022B00000000000	Town of Saxis	Public Road
6	022B1A000000100	Barbara Drawdy	Private Residential
27	022B1A000005500	Charles Tull	Private Residential
1	0220000000000000	Town of Saxis	Public Road

Staging & Work Areas

ID #	Map parcel No(s).	Owner	Present use
31 parcels			
7	022B1A0000001A0	Barbara Drawdy	Private Residential
8	022B1A000000200	Joseph Drawdy	Private Residential
6	022B1A000000100	Barbara Drawdy	Private Residential
9	022B1A000000300	Henry Nesbitt Jr.	Private Residential
10	022B1A000000400	Martin Kessler	Private Residential
11	022B1A000000500	Marian Fletcher	Private Residential
12	022B1A000000600	Weston Paul Watkinson, Jr.	Private Residential
15	022B1A0000008A0	Albert Froelich	Private Residential
16	022B1A000000900	Bobby Wessells	Private Residential
50	022B1A000C00001	Town of Saxis	Public Dredge
51	022B1A000C00002	Town of Saxis	Public Dredge Disposal Site
52	022B1A000C00003	Town of Saxis	Public Dredge Disposal Site
53	022B1A000C00004	Town of Saxis	Public Dredge Disposal Site
29	022B1A000005600	Howard Underwood	Private Residential
44	022B1A000009200	Eddie Lewis	Private Residential
49	022B1A000009700	Eddie Lewis	Private Residential
48	022B1A000009600	Lee Tessier	Private Residential
55	022B2A000000100	Town of Saxis	Public Property
70	022B2A000001600	R E Realty Inc.	Private Residential
120	022B2A000012000	Town of Saxis	Public

ID#	Map parcel No(s).	Owner	Present use
31 parcels (Cont'd)			
107	022B2A0000090A0	Town of Saxis	Public
106	022B2A000009000	Town of Saxis	Public
108	022B2A000009100	Town of Saxis	Public
140	022B2A000013600	Albert L. Maslar	Private Residential
141	022B2A000013700	Jacob M. Foerster, Jr.	Private Residential
151	022B2A0000177A0	James H. Dennis	Private Residential
153	022B2A0000178A0	Saxis Associates Partnership	Private Residential
155	022B2A0000179A0	Ralph James Miles	Private Residential
157	022B2A0000180A0	Town of Saxis	Public
158	022B2A000018100	Martin C. Linton	Private Residential
159	022B2A000018200	L. Kefford Linton	Private Residential

ESTATE REQUIRED

A standard Right-of-Entry for Construction agreement will be acquired from each of the properties along the shoreline, as well as the properties that will be used for ingress/egress. These agreements will be acquired for a period of two years. The District will use the standard estate as shown in the Right-of-Entry for Construction. In the Commonwealth of Virginia, the right to do work on state owned river bottom is included in the joint regulatory permit review process, and no additional real property interest will be required.

PROPERTY VALUES

The local sponsor, who is the town of Saxis, will acquire all of the real property interest needed for this project. A brief gross appraisal has been prepared for the interest to be acquired for access, staging and construction and indicate a value of:

NINE THOUSAND AND NO/100 DOLLARS ($9,000.00)

RECOMMENDATION

This report has been prepared in accordance with Corps of Engineers Regulation 405-1-12, Chapter 12 (Draft). It is recommended that this report be approved.

Dated: 1/29/02

Prepared by: David B. Parson
Realty Specialist

Dated: 1/29/02

Reviewed by: Wayne T. Barnes
Appraiser

Dated: 1/29/02

Recommended by: Dillard H. Horton
Chief, Real Estate Branch

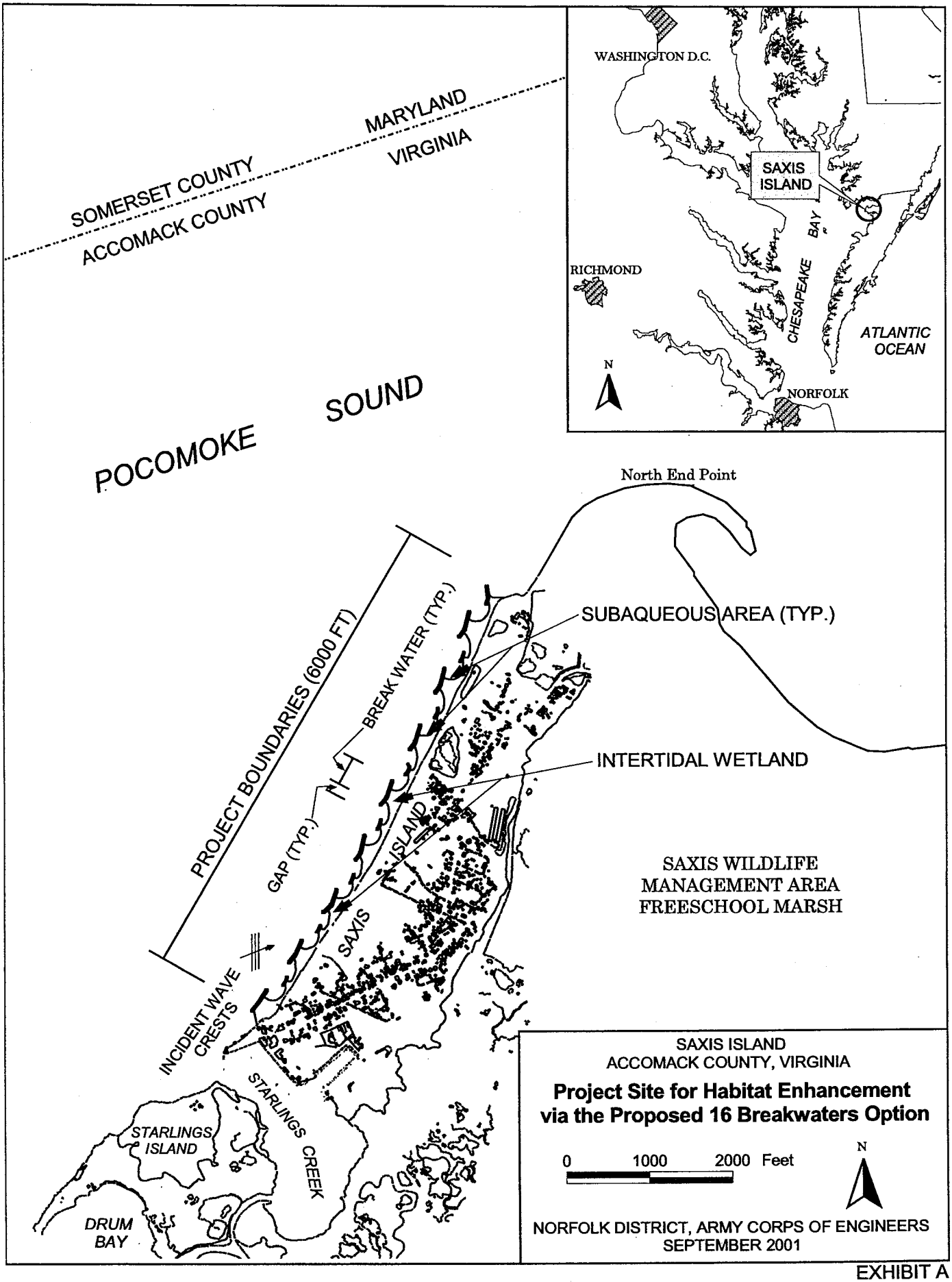
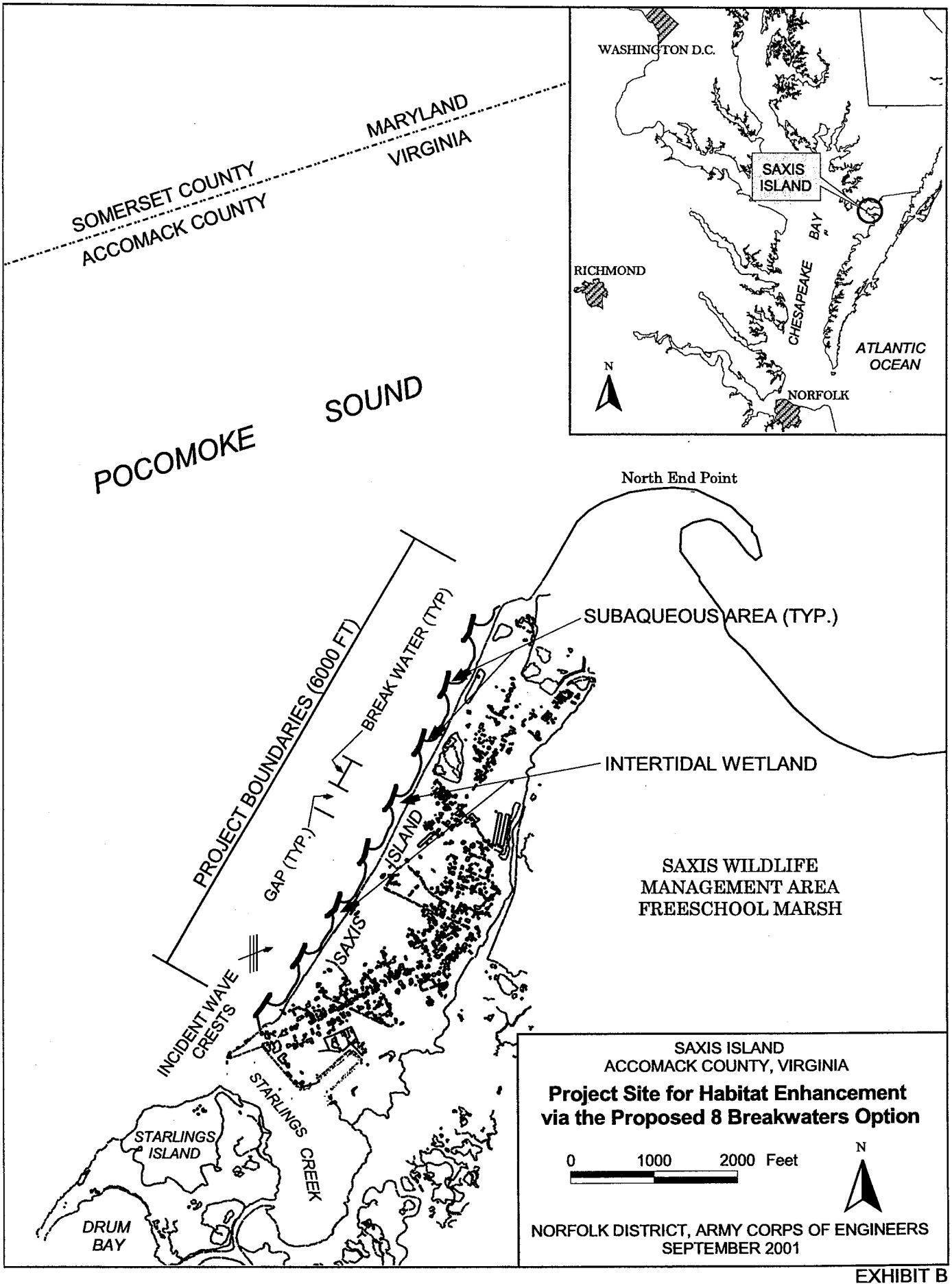

WASHINGTON D.C.
SAXIS ISLAND
BAY
RICHMOND
CHESAPEAKE
ATLANTIC OCEAN
N
NORFOLK
MARYLAND
VIRGINIA
SOMERSET COUNTY
ACCOMACK COUNTY
POCOMOKE SOUND
North End Point
SUBAQUEOUS AREA (TYP.)
INTERTIDAL WETLAND
PROJECT BOUNDARIES (6000 FT)
BREAK WATER (TYP.)
GAP (TYP.)
ISLAND
SAXIS
INCIDENT WAVE CRESTS
SAXIS WILDLIFE MANAGEMENT AREA
FREESCHOOL MARSH
STARLINGS ISLAND
STARLINGS CREEK
DRUM BAY
SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Project Site for Habitat Enhancement via the Proposed 16 Breakwaters Option
0 1000 2000 Feet
N
NORFOLK DISTRICT, ARMY CORPS OF ENGINEERS
SEPTEMBER 2001

EXHIBIT A


WASHINGTON D.C.
SAXIS ISLAND
BAY
CHESAPEAKE
RICHMOND
ATLANTIC OCEAN
N
NORFOLK
MARYLAND
VIRGINIA
SOMERSET COUNTY
ACCOMACK COUNTY
POCOMOKE SOUND
North End Point
SUBAQUEOUS AREA (TYP.)
INTERTIDAL WETLAND
PROJECT BOUNDARIES (6000 FT)
BREAK WATER (TYP)
GAP (TYP.)
ISLAND
SAXIS
INCIDENT WAVE CRESTS
SAXIS WILDLIFE MANAGEMENT AREA
FREESCHOOL MARSH
STARLINGS ISLAND
STARLINGS CREEK
DRUM BAY
SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Project Site for Habitat Enhancement via the Proposed 8 Breakwaters Option
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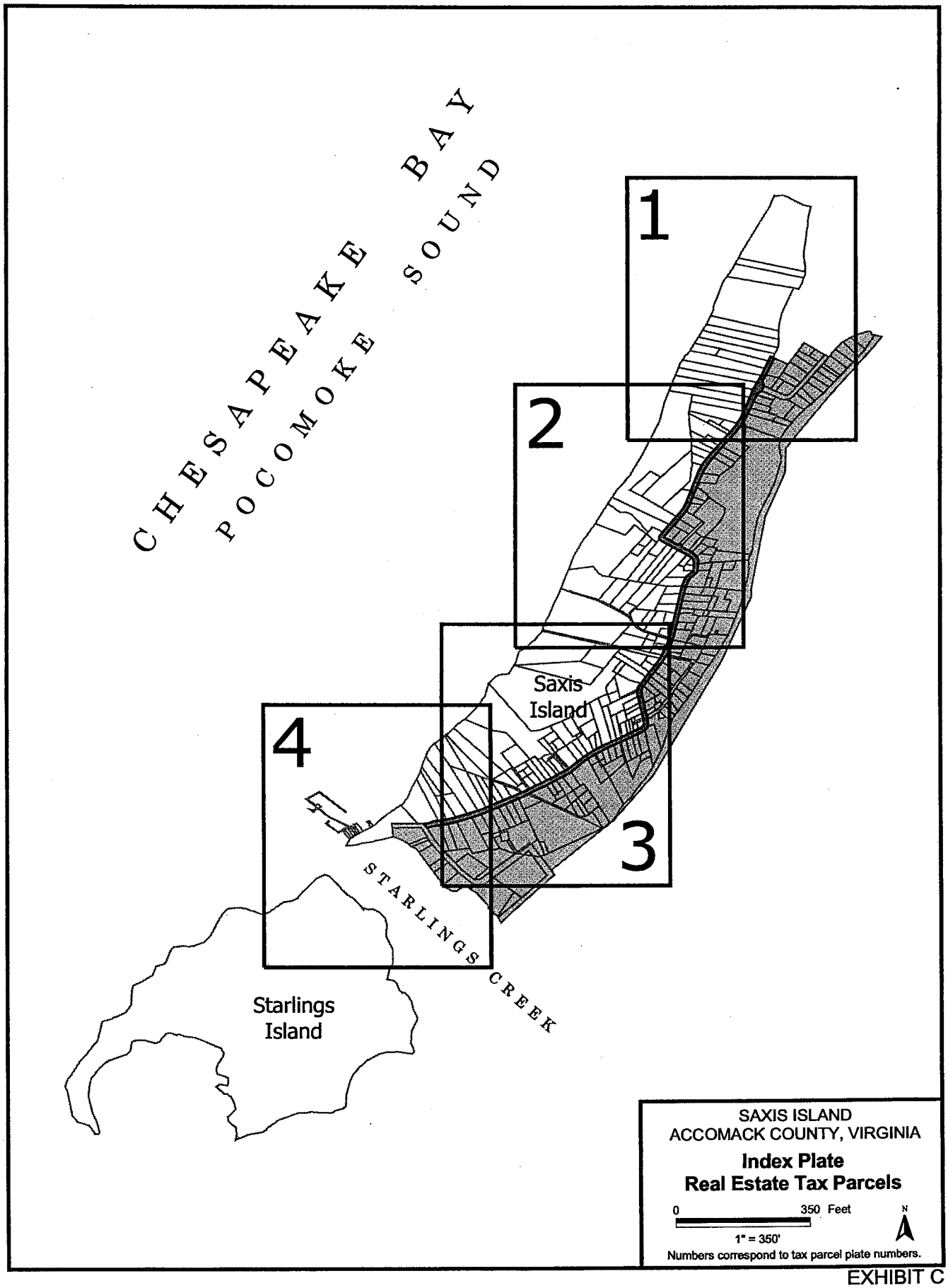
NORFOLK DISTRICT, ARMY CORPS OF ENGINEERS
SEPTEMBER 2001

EXHIBIT B



SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA

Index Plate
Real Estate Tax Parcels

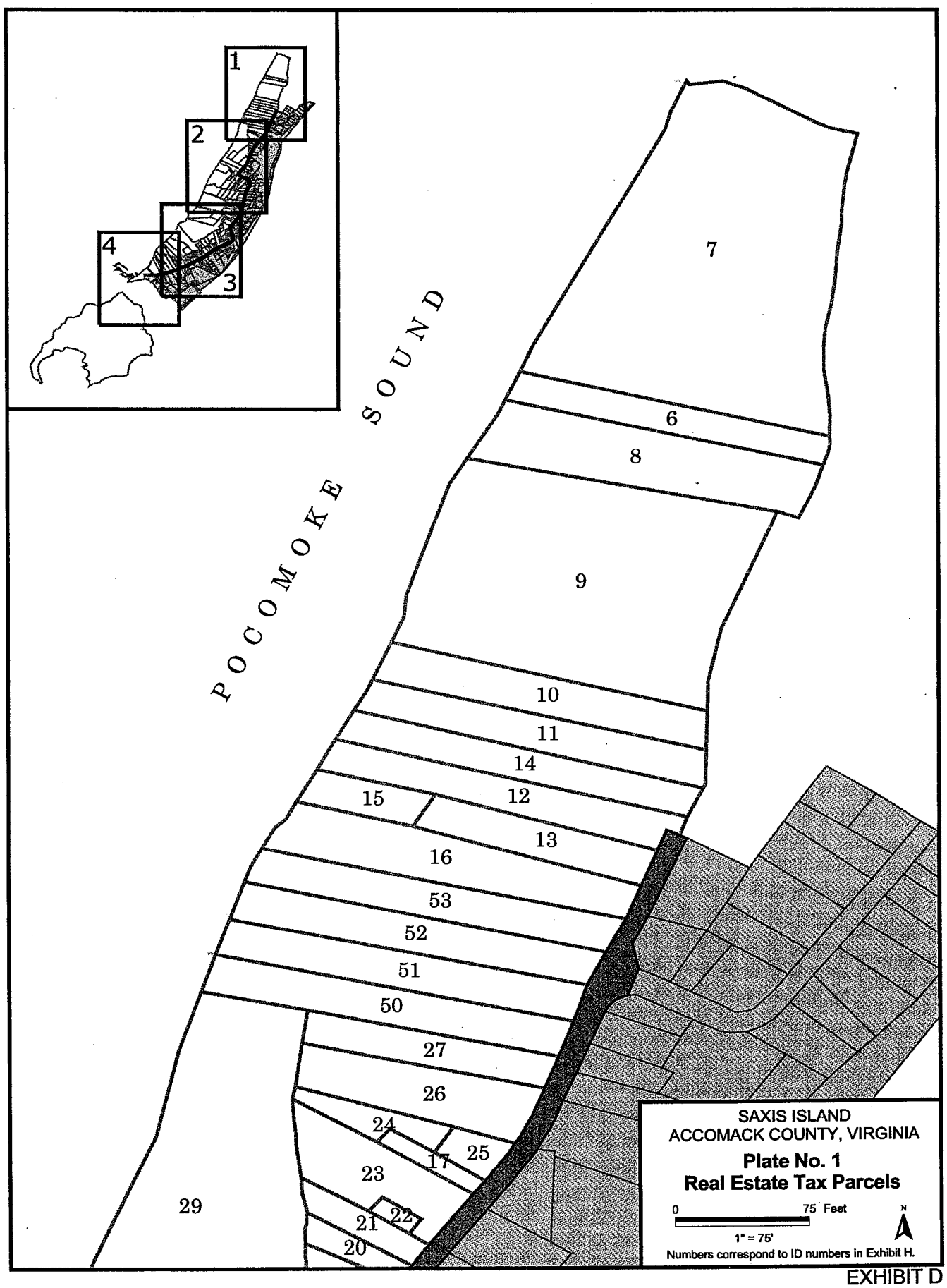
0 350 Feet

1" = 350'

N

Numbers correspond to tax parcel plate numbers.

EXHIBIT C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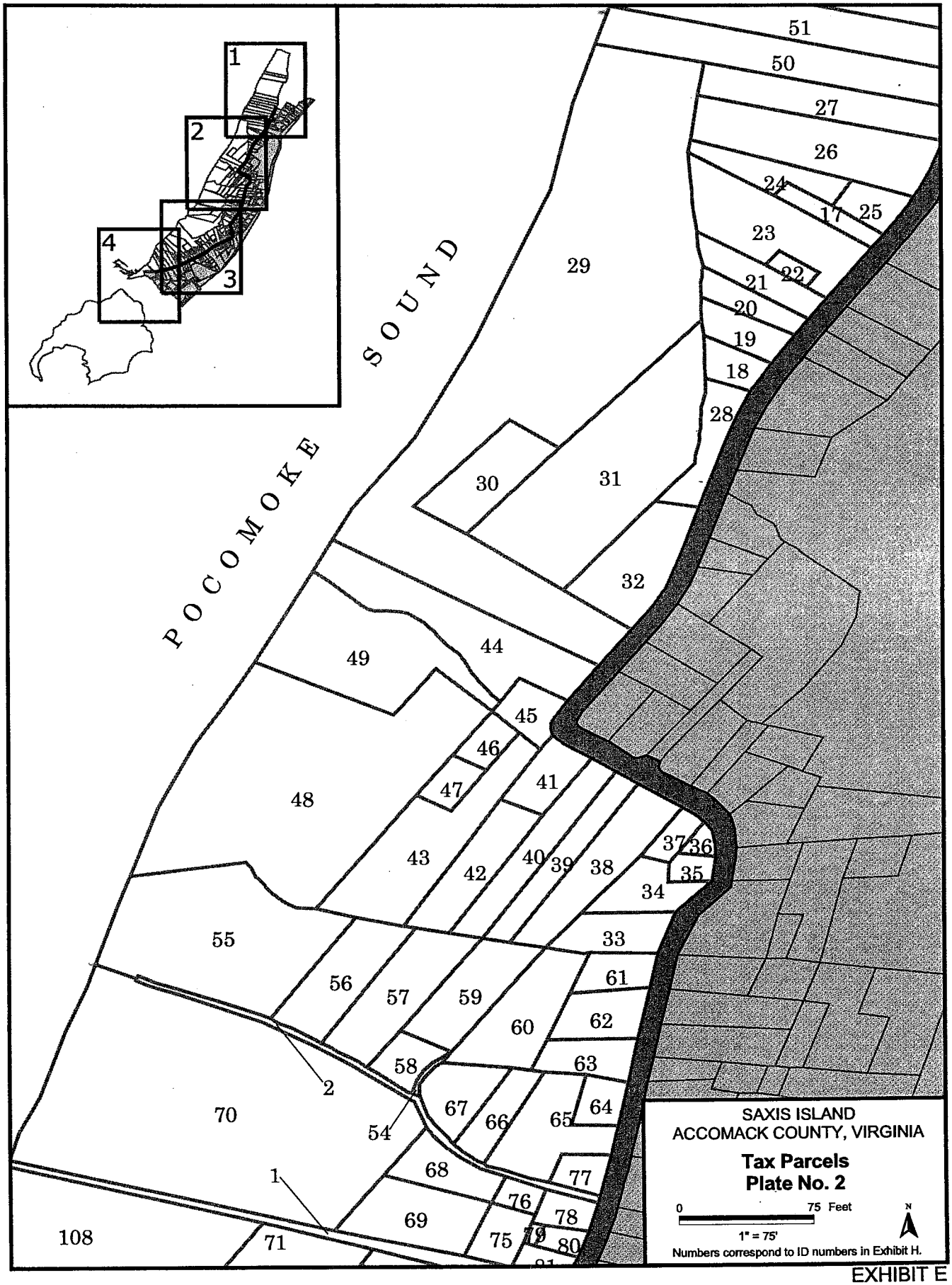
2
3
4
POCOMOKE SOUND
7
6
8
9
10
11
14
15
12
13
16
53
52
51
50
27
26
24
17
25
23
29
21
22
20
SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Plate No. 1
Real Estate Tax Parcels
0
75 Feet
N
1" = 75'
Numbers correspond to ID numbers in Exhibit H.

EXHIBIT D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49
44
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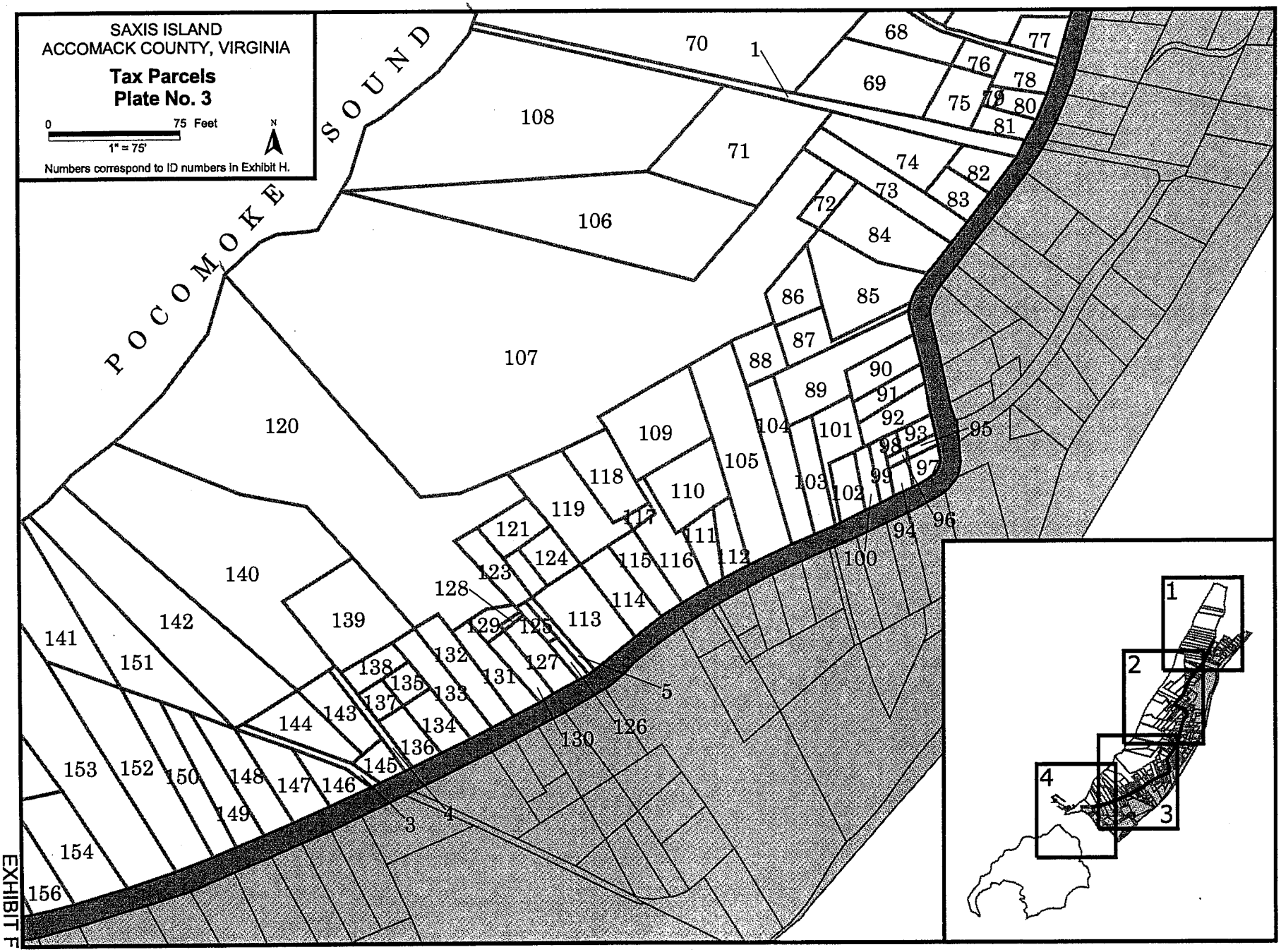
63
64
65
66
67
54
70
2
1
68
77
76
78
69
75
79
80
108
71
SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Tax Parcels
Plate No. 2
0
75 Feet
1" = 75'
N
Numbers correspond to ID numbers in Exhibit H.

EXHIBIT E


SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Tax Parcels
Plate No. 3
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75 Feet
1" = 75'
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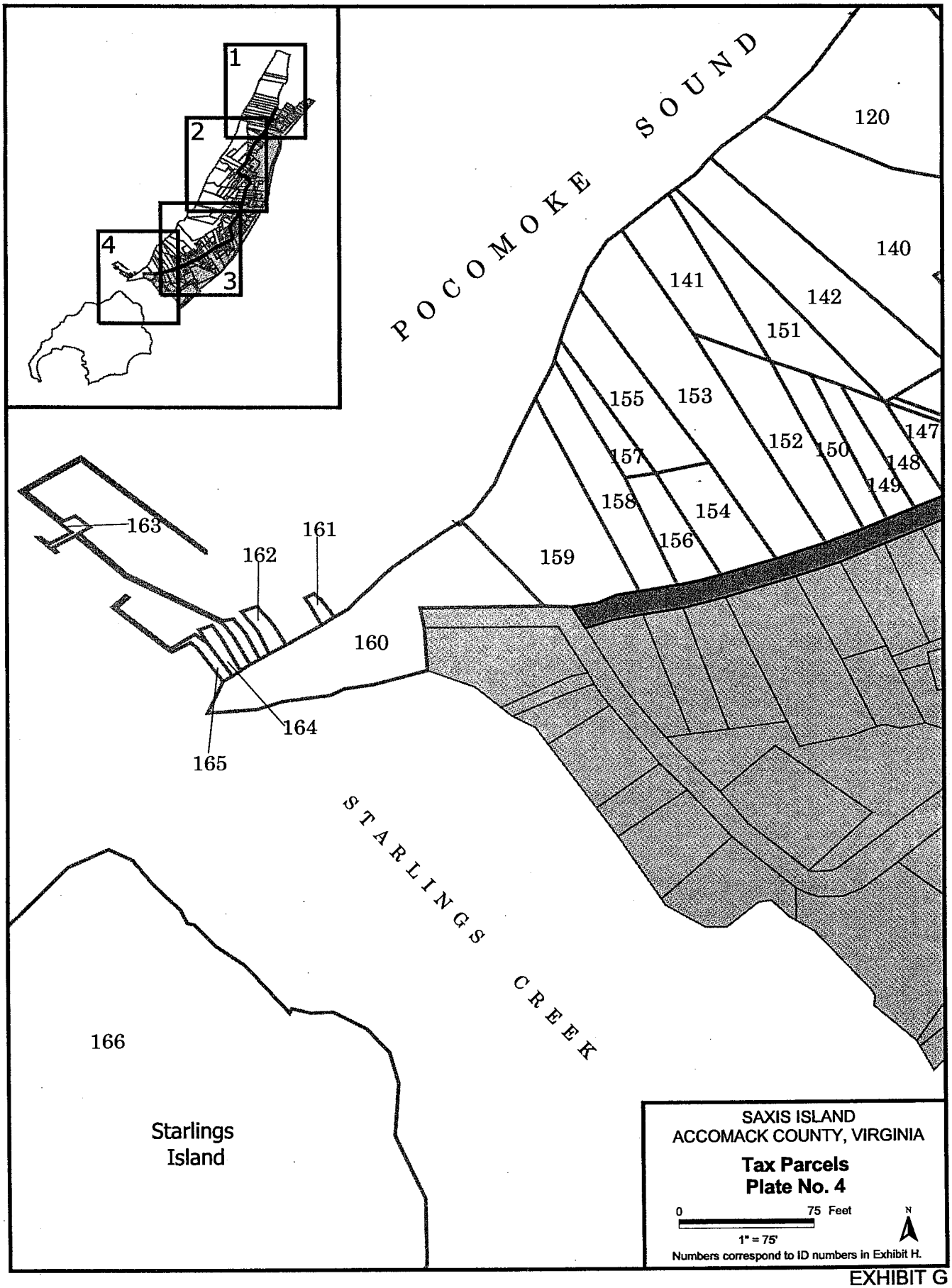
Numbers correspond to ID numbers in Exhibit H.
POCOMOKE SOUND
EXHIBIT F
1
2
3
4
5


1
2
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4
POCOMOKE SOUND
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142
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155
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152
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147
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149
157
158
154
156
159
163
161
162
160
164
165
STARLINGS CREEK
166
Starlings Island
SAXIS ISLAND
ACCOMACK COUNTY, VIRGINIA
Tax Parcels
Plate No. 4
0
75 Feet
1" = 75'
N
Numbers correspond to ID numbers in Exhibit H.

EXHIBIT G

APPENDIX 4

PERTINENT CORRESPONDENCE

Town of Saxis
P.O. BOX 156
Free School Road
Saxis Virginia 23427

Colonel David L. Hansen
District Engineer
U.S. Army Engineer District, Norfolk
803 Front Street
Norfolk, Virginia 23510-1096

RE: Saxis Island, Accomack County, Virginia-Section 206 Aquatic Ecosystem Restoration Project

Dear Colonel Hansen:

The purpose of this letter is to covey our continued interest and support of the subject project. The Town of Saxis understands its responsibilities under existing cost-sharing policies and will financially participate in the feasibility, design, and construction phases of the project on a 65 percent Federal and 35 percent non-Federal basis. The Town of Saxis also recognizes its responsibility to financially participate in the construction and maintenance of the project in accordance with provisions of the Water Resources Development Acts of 1986 and 1996, as amended.

Sincerely,

Charles Tull
Mayor

7-10-03

TOWN OF SAXIS
P.O, BOX 156
SAXIS VIRGINIA, 23427

Colonel David L. Hansen
District Engineer
U.S. Army Engineer District, Norfolk
803 Front Street
Norfolk, Virginia 23510

December 19,2001

RE; Use of Section 206 Program at SAXIS ISLAND

Dear Colonel Hanson

Thank you for the preparation of the subject draft feasibility report. The Town of Saxis understands its responsibilities under the existing study cost-sharing policies and will financially participate in the feasibility, design and construction phases of the study on a 65 percent Federal 35 present non- Federal bases. The County also recognizes its responsibility to financially participate in the construction and maintenance of a potential project in accordance with provisions of the Water Resources Development Act of 1986 and 1996, as amended.

Thank you:

Charles Tull
Mayor