PRETLOW

FINAL DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT

YORK RIVER, VIRGINIA

NAVIGATION STUDY OF YORK RIVER ENTRANCE CHANNEL

US Army Corps
Of Engineers

Norfolk District

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SYLLABUS

This report presents the findings and recommendations of the Norfolk District's study of the navigation problems associated with the entrance channel into the mouth of the York River. The study examined the Federal interest in implementing improvements on the waterway to better serve the commercial and military users located on the lower York River. The waterway feeds into the lower Chesapeake Bay immediately north of the urban complex of Norfolk, Virginia Beach, Newport News, and Hampton, Virginia.

In 1951-52, the Corps of Engineers deepened and widened the natural entrance channel portion of the Federal Civil Works project on the York River to serve the national defense needs of the U. S. Navy. The resultant channel, sometimes referred to as the "Navy Channel" was requested and funded by the Department of the Navy to serve naval vessels taking on munitions and supplies at the Naval Weapons Station at Yorktown, Virginia. Two commercial facilities later developed on the lower York River to take advantage of the deepened channel. Original military project dimensions provided for a 39-foot-deep, 750-foot wide, and approximately 11-mile long channel extending from the 39-foot contour in the Chesapeake Bay to a point about 4 miles east of the mouth of the York River. The channel has a present depth of less than 36 feet.

The results of this study show that there is a need and opportunity to increase the navigational efficiency and safety of the existing channel to better serve the commercial and military users of the waterway. Several potential measures were examined which included pipeline construction, provision of a lightering facility, channel improvements, the "no action" alternative, and plans by other interests. It was determined after several levels of formulation that channel improvements were the only feasible means to achieve the study objectives.

The recommended plan for the lower York River would provide for the modification of the existing Federal Civil Works project on the York River to further improve the entrance channel under Section 107 of the 1960 River and Harbor Act, as amended, with an authorized project depth of 37 feet and bottom width of 750 feet. This channel, to be referred to as the York River Entrance Channel, would extend from the 38-foot contour (37-foot project depth plus 1-foot of required overdredging) in the Chesapeake Bay to a point

adjacent to the piers at the Yorktown Naval Weapons Station, approximately 8 miles above the river mouth. This plan is the National Economic Development plan and addresses the essential needs of general commerce and meets the specific national defense channel requirements of the U. S. Navy. Dredged material resulting from project construction and maintenance would be placed in the Wolf Trap (Alternate) Disposal Site which is located north of the project in the Chesapeake Bay.

Dredging of the proposed channel and dredged material placement, as proposed, will not cause any significant or controversial adverse effects to either man's environment or the estuarine/marine habitat. An Environmental Assessment was considered appropriate for this study. A draft EA was coordinated with Federal, state, and regional agencies in spring 1992. A FINDING OF NO SIGNIFICANT IMPACT was signed on July 28, 1992.

The total first cost of the recommended plan is $4,900,000 which would be cost shared with the local sponsor, the Virginia Port Authority, in accordance with the requirements of the Water Resources Development Act of 1986. Average annual benefits, resulting from transportation savings and the elimination of risks to the commercial and military users, are estimated at $1,312,000. Average annual project costs are estimated at $758,000, including $329,000 for annual operation and maintenance. The benefit-cost ratio is 1.73 with net remaining benefits estimated at $554,000.

YORK RIVER, VIRGINIA (ENTRANCE CHANNEL)

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INTRODUCTION

This feasibility report presents the results of the Norfolk District's navigation study of the York River Entrance Channel (Navy Channel), Virginia. The study addresses the navigational needs and opportunities of the military and commercial users located on the lower York River.

The Virginia Port Authority is the study sponsor as indicated in correspondence dated March 22, 1990 (see appendix D).

STUDY AUTHORITY

The following paragraphs present the authorities under which this study was conducted.

CONGRESSIONAL RESOLUTIONS

This study was initiated in compliance with the two following resolutions adopted by the Committee on Public Works of the Senate and of the House of Representatives, respectively:

Resolution of 25 February 1961:

> "Resolved by the Committee on Public Works of the United States Senate, THAT the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, Approved June 12, 1902, be, and is hereby requested to review the reports of the Chief of Engineers on the York and Pamunkey Rivers, Virginia, published as House Committee Document numbered 54, Seventy-first Congress, second session, and other reports, with a view to determining whether the existing project should be modified in any way at the present time, with particular reference to provision of increased navigable depths between Yorktown and West Point, Virginia."

Resolution of 24 June 1965:

"Resolved by the Committee on Public Works of the House of Representatives, United States, THAT the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on York River, Virginia, published in Senate Executive Document No. 104, 46th Congress, second session, and other pertinent reports, with a view to determining if modification of the existing project is advisable at this time."

In response to the above resolutions, the Norfolk District completed a 1985 interim report on the Upper York River and a 1986 feasibility report on the York and Pamunkey Rivers. Specific information on these reports is presented later in this report.

SECTION 107 AUTHORITY

During the later stages of this study, it was determined that it was appropriate to continue this study under the authority of Section 107 of the 1960 River and Harbor Act, as amended. This report was, therefore, completed and submitted pursuant to the Section 107 authority.

STUDY AREA

The York River is one of several large estuarine systems flowing into the Chesapeake Bay. Together with its tributaries, the Pamunkey and Mattaponi Rivers, it drains an area centrally located in Virginia, extending from the foothills of the Blue Ridge Mountains to Chesapeake Bay. The York River has a total length of approximately 34 miles and lies between the towns of West Point and Yorktown.

The lower York River study area includes the York River and surrounding land extending from the river mouth upstream to approximately the Naval Supply Center at Cheatham Annex, as shown in figure 1. The area is generally centered around Yorktown and is located immediately north of the urban complex of Norfolk, Portsmouth, Newport News, Hampton and vicinity. Also included in the study area is the lower Chesapeake Bay in the vicinity of the York River mouth and surrounding the entrance channel. Surrounding counties include Gloucester and York.

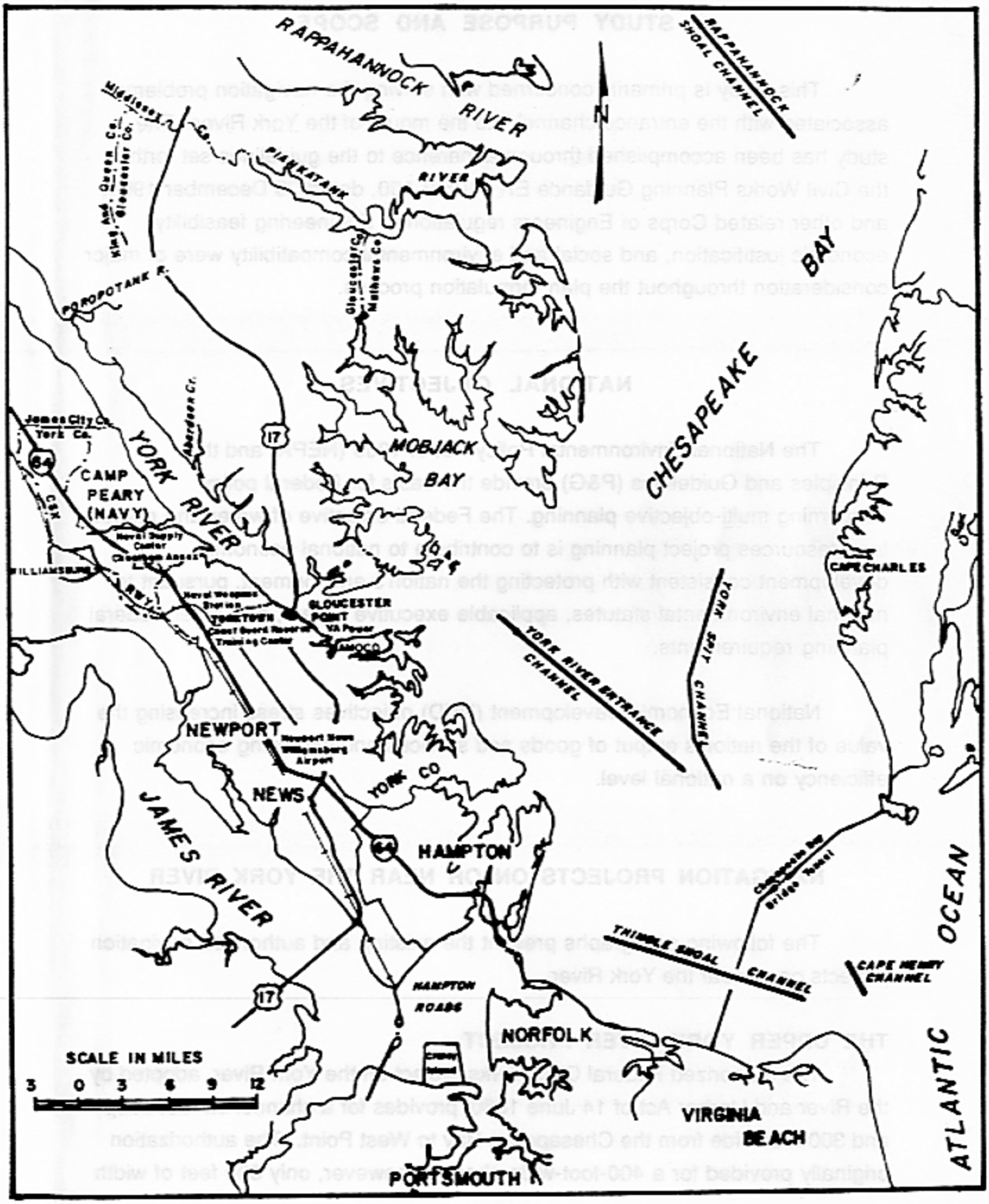

Figure I. Lower York River Study Area

STUDY PURPOSE AND SCOPE

This study is primarily concerned with solving the navigation problems associated with the entrance channel into the mouth of the York River. The study has been accomplished through adherence to the guidelines set forth in the Civil Works Planning Guidance ER 1105-2-100, dated 28 December 1990, and other related Corps of Engineers regulations. Engineering feasibility, economic justification, and social and environmental compatibility were of major consideration throughout the plan formulation process.

NATIONAL OBJECTIVES

The National Environmental Policy Act of 1969 (NEPA) and the Principles and Guidelines (P&G) provide the basis for Federal policy concerning multi-objective planning. The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

National Economic Development (NED) objectives stress increasing the value of the nation's output of goods and services and improving economic efficiency on a national level.

NAVIGATION PROJECTS ON OR NEAR THE YORK RIVER

The following paragraphs present the existing and authorized navigation projects on or near the York River.

THE UPPER YORK RIVER PROJECT

The authorized Federal Civil Works project on the York River, adopted by the River and Harbor Act of 14 June 1880, provides for a channel 22 feet deep and 300 feet wide from the Chesapeake Bay to West Point. The authorization originally provided for a 400-foot-wide channel; however, only 300 feet of width

was ever completed, and on 5 August 1977, the uncompleted width was deauthorized. A 22-foot-deep turning basin and an 8,800-foot dike on the south bank at West Point are also provided. The project is shown in figure 2. Maintenance of the project is basically limited to dredging the Poropotank Bar and West Point Bar and the turning basin. The remainder of the project is naturally deeper than 22 feet and wider than 300 feet and requires no maintenance.

THE YORK RIVER ENTRANCE CHANNEL

In 1951-52, the Corps of Engineers deepened and widened the natural entrance channel portion of the Federal Civil Works project on the York River to serve the national defense needs of the U. S. Navy. The resultant channel, sometimes referred to as the "Navy Channel" was requested and funded by the Department of the Navy to serve naval vessels taking on munitions and supplies at the Naval Weapons Station at Yorktown, Virginia. Original military project dimensions provided for a 39-foot-deep, 750-foot wide, and approximately 11-mile long channel extending from the 39-foot contour in the Chesapeake Bay to a point about 4 miles east of the mouth of the York River. The incremental depth and width of the entrance channel below 22 feet and beyond 300 feet, respectively, are not authorized components of the Federal Civil Works project on the York River.

THE BALTIMORE HARBOR AND CHANNELS

The Baltimore Harbor and Channels 50-foot project was adopted by the River and Harbor Act of 1970. The project provides for the improvement of the prior 42-foot project to 50 feet through shoals in the lower Chesapeake Bay in the vicinity of Cape Henry, York Spit, and Rappahannock Shoal, as shown in figure 1.

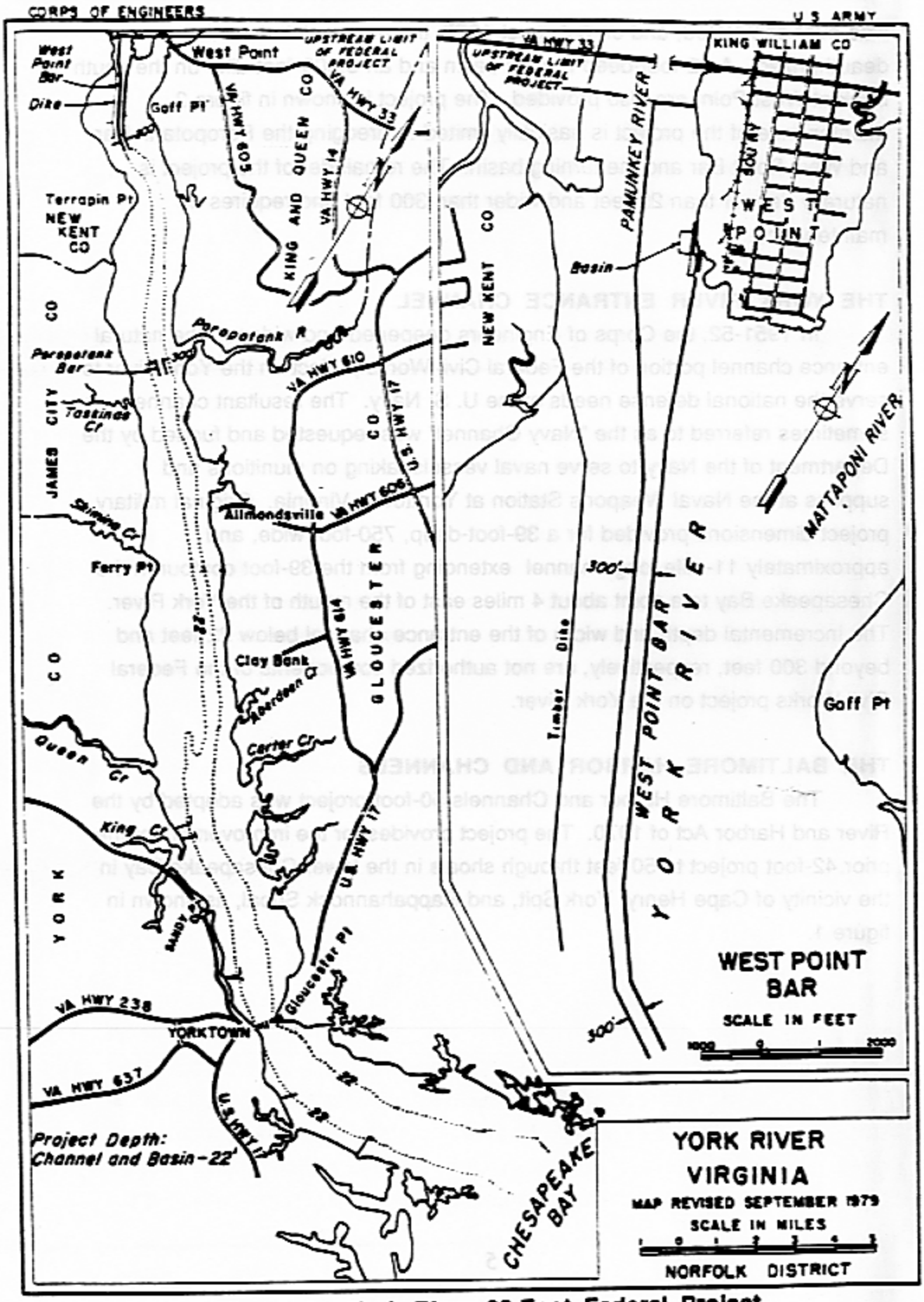

Figure 2. York River 22-Foot Federal Project

The Cape Henry Channel

The Cape Henry Channel lies at the mouth of the Chesapeake Bay near Cape Henry. The improvement consists of a channel 50 feet deep, 1,000 feet wide, and approximately 3 miles long between the 50-foot contours at the entrance to the Chesapeake Bay. The improvement was completed in 1989. Ships destined for the York River from the Atlantic Ocean follow a course in the Chesapeake Bay through the Cape Henry Channel and then through the entrance channel to the York River.

The York Spit Channel

The York Spit Channel is located in the lower Chesapeake Bay near the mouth of the York River and immediately east of the York River Entrance Channel. The improvement consists of a channel 50 feet deep, 1,000 feet wide, and approximately 18.2 miles long. Deepening to 50 feet for a width of 800 feet was completed in 1989.

The Rappahannock Shoal Channel

The Rappahannock Shoal Channel is located in the Chesapeake Bay opposite the mouth of the Rappahannock River approximately 45 miles north of Cape Henry. The improvement provides for a channel 50 feet deep, 1,000 feet wide, and approximately 9.9 miles long. Initial construction to a depth of 50 feet and a width of 800 feet was completed in 1987.

REPORTS AND STUDIES BY THE CORPS OF ENGINEERS ON THE YORK RIVER

The following paragraphs present a brief description of the studies and reports that have been accomplished by the Norfolk District to address the navigational needs on the York River.

1968 and 1972 Review Reports on the York and Pamunkey Rivers, Virginia. In response to the 1961 and 1965 resolutions cited above, a study of the upper and lower York River was initiated in 1966 and a report submitted in 1968 to higher authority with a recommendation for a 37-foot-deep entrance channel to Yorktown. No improvements were recommended for the

22-foot Federal project in the upper York River. The report was returned to the district for consideration of alternatives and review of cost apportionment. A revised report was resubmitted in 1972. This report recommended the provision of an improved entrance channel consisting of a two-lane, two-level channel with a 50-foot-deep, 500-foot-wide inbound lane and a 37-foot-deep, 250-foot-wide outbound lane. The first cost of this modification, based on March 1971 price levels, was estimated at $23,857,000 or $36,305,000 depending on whether an open water or combined upland disposal site was selected, respectively. Annual charges (50-year life, 5-1/2 percent interest) were estimated at $1,630,000 and $2,480,000, respectively. With average annual benefits estimated at $9,890,000, the benefit-to-cost ratio was 6.1 to 1 with open water disposal and 4.0 to 1 with confined upland disposal. The report was reviewed by the Board of Engineers for Rivers and Harbors (BERH), Office of the Chief of Engineers (OCE), Office of the Secretary of the Army (OSA), and Office of Management and Budget (OMB). In September 1973, OMB returned the report to OSA for further study. OMB requested that the recommended improvements for York River await the recommendations of the Norfolk Harbor and Channels, Baltimore Harbor and Channels, and Deepwater Port studies, which were completed in the late 1970's and early 1980's.

The OMB decision to hold the study in abeyance was based on economic analyses contained in the 1972 report that suggested that improvements to the Norfolk Harbor Channels and the Cape Henry Channel (part of the Baltimore Harbor and Channel system) to 50 or 55 feet might enhance the economic feasibility of a lightering facility in the lower Chesapeake Bay to the point where it was a better solution to the navigational problems on the York River than was channel deepening. The navigation studies concerning and the present situation surrounding lightering as an alternative are discussed later in this report.

1985 Interim Report on the Upper York River, Virginia. In partial fulfillment of the Congressional Resolutions of 25 February 1961 and 24 June 1965, the Norfolk District conducted an interim Upper York River study of the existing 22-foot Federal project on the York River. The study, conducted between January 1982 and February 1985, had evaluated the project to determine if certain modifications were feasible to better serve the project users.

These modifications included the deepening of the channel below its authorized depth and the relocation of the existing turning basin to an area above the Eltham Bridge at West Point, Virginia.

The findings of the interim report indicated that although modification to the existing Federal project (i.e., a deeper channel and a deeper, relocated turning basin) was economically feasible, a single-use situation would exist because the benefits resulting from the implementation of such a modification would accrue to only one river user. The report cited policy that prohibits the Federal Government from constructing or modifying a project where only one user would receive benefits and where there exists only a remote potential for the development of other users which may also receive benefits. Based on the determination of single use, Federal participation in the modification of the existing Federal project was not recommended at that time. All interested parties were notified of this determination.

The interim study also considered navigation improvements on the Pamunkey River; however, boat activity on the Pamunkey River at that time did not indicate a need for further navigational improvements.

1986 Feasibility Report on the York and Pamunkey Rivers, Virginia. In final fulfillment of the Congressional resolutions of 1961 and 1965, a feasibility report was completed in September 1986 for transmittal through higher authority to the Congress. This report summarized the findings of the 1986 interim report and recommended that the investigation of the navigational needs of the lower York River be completed under the authority of Section 107 of the 1960 River and Harbor Act, as amended. The report was approved by the Board of Engineers for Rivers and Harbors in November 1986 and by the Chief of Engineers in August 1987.

EXISTING CONDITIONS

The following paragraphs present a brief discourse on the base conditions of the study area.

CLIMATE AND PHYSICAL CHARACTERISTICS

The climate of the lower York River is classified as temperate or humid subtropical. The area tends to be warmer and more moist than areas to the immediate west due to prevailing winds and the moderating influence of the Chesapeake Bay and the Atlantic Ocean. The average annual temperature of the area is approximately 58 degrees Fahrenheit, with average winter temperatures of about 43 degrees and average summer temperatures of approximately 76 degrees. The average annual precipitation is about 46 inches and the average annual snowfall is about 9 inches. Snow usually does not stay on the ground more than a few days. The lower York River is not generally subject to ice cover.

The lower York River is occasionally affected by damaging thunderstorms, northeasters, and hurricanes. The prevailing winds are from the south to southwest at an average annual velocity of about 10 miles per hour. Wind velocities may exceed 50 miles per hour during hurricanes, passage of cold fronts, and severe thunderstorms. Fog and haze occur mainly from October through March, accounting for significant periods of poor visibility.

The Chesapeake Bay, in general, is a very complicated area for estimating wave data because of characteristics such as refraction, shoaling, currents, and non-uniform topography. Although there have been no field observations to determine height, direction of approach, and period and length of waves in the area of the lower Chesapeake Bay at the mouth of the York River, it has been estimated that wave heights of 4.5 feet with wavelengths of about 60 feet are possible. These estimates are based on constant winds of 45 miles per hour acting over a fetch of approximately 20 miles, extending from the mouth of Chesapeake Bay to the mouth of York River. Water depths over the fetch length average 30 feet.

Tides in the lower York River are uniformly semidiurnal with the principal variations following the changes in the moon's distance and phase. The mean range of tide at the mouth of the river is 2.3 feet and the spring range is 2.8 feet. Maximum tidal currents in the vicinity of the river mouth are relatively weak, usually less than 2 knots at their peak.

At the mouth of the York River, surface salinity ranges between 14 parts per thousand (ppt) and 21 ppt. The average salinity at the bottom is about 16 ppt. Freshwater flow at the mouth of the York River from an estimated 2,661 square miles averages about 2,500 cubic feet per second.

ENVIRONMENTAL RESOURCES

The following paragraphs present a brief desription of the environmental setting and resources of the study area. An extensive description of the environmental setting and resources of the lower York River is contained in appendix C, the Fish and Wildlife Service Coordination Act Reports.

General

The lower York River and the surrounding Chesapeake Bay in the vicinity of the river mouth are areas of vast importance to the functioning of the bay ecosystem. The extensive tidal wetlands, including vegetated flats and marshes, serve as a major source of primary productivity for the estuarine ecosystem and provide food and essential habitat to an abundance of fish and wildlife. This area's submerged aquatic vegetation (SAV) beds, including eelgrass and wideon grass, are another important component of the bay ecosystem and are the most extensive found on the western shore of Virginia.

Finfish and Shellfish

The study area also supports abundant and diverse populations of finfish and shellfish. Recreationally and commercially important finfish include croaker, spot, flounder, bluefish, rock, sea trout, bay anchovy, menhaden, and alewife. Shellfish include mollusks, oysters, clams, and crabs, of which blue crabs and oysters are commercially important. The commercial harvesting of the blue crab at times exceeds the total catch of all other finfish and shellfish combined. Oyster production and harvesting has been limited by the microparasite MSX and the condemnation of several beds by the state.

Much of the lower Chesapeake Bay serves as primary habitat for the overwintering of the blue crab which supports an extensive winter dredge fishery. This dredge fishery extends from as far north as Wolf Trap off Mattews County out to the mouth of the Bay with the deep waters along and in the channels of the lower Bay representing areas of most extensive and consistent use. The yearly crab dredging season extends from mid-November throught the end of March. Dredging is limited to the open waters of the Bay. A detailed discussion of the blue crab and the winter dredge fishery is presented in appendix C.

Wildlife

An abundance of wildlife exists in the lower York River area. Several species of colonial nesting birds, including the great blue heron, the snowy egret, the tricolored heron, the black skimmer, and the least tern, have established breeding colonies within or near the area. The area also serves as an important wintering area for migratory waterfowl, including the canvasback and the ruddy duck. Threatened or endangered species which may be found in the area include the bald eagle, several species of sea turtle, and the small whorled pogonia.

Threatened and Endangered Species

Four species of sea turtles which are on the Federal Endangered Species list are annual migrants to the Chesapeake Bay. The species include the Atlantic Loggerhead (Caretta caretta), Kemp's ridley (Lepidochelys kempi), the Atlantic leatherback (Dermochelys coriacea), and the green turtle (Chelonia mydas). The turtles migrate to the Bay annually in May and June as sea surface temperatures increase to approximately 18 degrees Celcius, forage throughout the estuary during the summer, and then emigrate in the fall as temperatures decrease.

Research conducted at the Virginia institute of Marine Science by Keinath (1987) and others indicates that the loggerhead is the most abundant sea turtle observed along the Virginia coast and along the coastal United States. Kemp's ridley is the second most abundant turtle observed in Virginia

and is the most endangered species of sea turtle in the world (Carr, 1977). The green turtle and the leatherback turtle are observed infrequently in the area.

Virginia waters provide important habitat for loggerhead sea turtles during the summer months and the Chesapeake Bay in particular is an important developmental habitat and major feeding ground for juvenile loggerhead and Kemp's ridley turtles. Byles (1977) estimates that between 2,000 and 10,000 juvenile loggerheads inhabit the Bay south of the Potomac River each summer. Carr (1977) reports that some of the largest concentrations of immature Kemp's ridleys along the Atlantic seaboard are found in the Chesapeake Bay. Loggerheads inhabit river mouths and channel areas, where their primary diet of horseshoe crabs is abundant. The ridleys prefer shallower waters, such as seagrass beds, which are nursery grounds for the blue crab, their primary diet (Orth and Heck, 1980).

A more detailed discussion of sea turtles is presented in the Final Environmental Assessment.

HISTORICAL AND CULTURAL RESOURCES

The lower York River study area is rich in historical and cultural resources with numerous sites listed on the National Register of Historic Places. Many of the historical sites date back to the colonial period when this section of the state had a major role in the history of the United States. One of the most notable sites in the study area is the Yorktown battlefield area, where the last major battle of the Revolutionary War was fought. Other locally well-known sites or areas of historical interest include Colonial Williamsburg, Jamestown Island, Fort Monroe, Fort Wool, Hampton Institute, Gloucester County Courthouse Square Historical District, and the Colonial National Historical Park.

As would be expected in an area of rich historical traditions, archaeological resources are plentiful. Many of the known sites contain resources from the colonial era and sites of Indian remains can also be found.

There are several archaeological sites in the study area on the National Register. The most important one for this study is the site of the Yorktown Wrecks, which is located in 4 miles of the York River between the Gloucester

and York County shores in the vicinity of Yorktown. The ships that lie here played a crucial role in the Battle of Yorktown.

SOCIO-ECONOMIC RESOURCES

The following paragraphs present the existing economic and demographic resources of the study area.

Population

The three cities and two counties which comprise the lower York River study area are a major part of the old Newport News-Hampton Standard Metropolitan Statistical Area (SMSA), which is now a part of the Hampton Roads Metropolitan Statistical Area (MSA). The study area showed a population increase of about 27 percent between 1970 and 1990, compared to 32 percent for the MSA. Within the study area, Gloucester County had the highest rate of growth for this time period, while the city of Hampton had the smallest growth rate, as can be seen in the following table. In the larger cities of Hampton and Newport News, growth appears to have slowed somewhat, while in the counties it is continuing at a steady pace.

Table 1. POPULATION

City or county	1970	1980	1990	Total % change
Gloucester County	14,059	20,107	30,131	114.3
Hampton	120,779	122,617	133,793	10.8
Newport News	138,177	144,903	170,045	23.1
Poquoson	(a)	(a)	11,005	-
York County	33,203	35,463 (b)	42,422	27.8
TOTAL	306,218	331,816	387,396	26.5

Source: U.S. Department of Commerce, Bureau of the Census, Census of Population for 1970, 1980, 1990.
(a) Included with York County.
(b) Excludes Poquoson.

Existing Development and Land Use

Over half of the land in the lower York River study area is either undeveloped, agricultural, or open space. Even in the more populous and developed cities of Hampton and Newport News, there are large amounts of undeveloped land. In 1979, for example, 56 percent of Hampton's total acreage and 59 percent of the land in Newport News was open space. The largest concentrations of development in the study area are located in the southern part of the area, in Hampton and Newport News. Residential development is concentrated here with additional housing scattered throughout York and Gloucester Counties. Commercial and institutional uses are fairly uniformly dispersed in each municipality although in the counties such development tends to be concentrated along the major highways and in the towns. Industrial land use, a proportionately smaller but important category, is located primarily in Newport News and York County. Two of the most important industries located on the river are the American Oil Company (Amoco) refinery and the Yorktown generating plant of the Virginia Power Company, both of which are on the southern side of the river. Much of the southwestern bank is occupied by governmental installations, namely the Coast Guard Reserve Training Center, the Yorktown Naval Weapons Station, the Naval Supply Center at Cheatham Annex, the Yortown Fuel Terminal, and Camp Peary.

Housing

Although the majority of the housing in the study area is owner-occupied, there is a substantial amount of rental housing in Hampton and Newport News. In Newport News, housing is almost evenly divided between owner and renter occupied, while in the counties and Poquoson owner-occupied units predominate heavily. The median value of the owner-occupied housing varies from $39,000 for Hampton to $61,000 for Poquoson (U.S. Census, 1980). As with housing values, median contract rents for York County and Poquoson were above the state median while those for the other three political jurisdictions were below it.

Employment and Income

The economy of the lower York River is dominated by the government and manufacturing sectors which provide over half the employment in the area. Manufacturing is particularly important in Newport News, where the state's largest private employer, Newport News Shipbuilding and Drydock Corporation, is located. Governmental employment is significant in Hampton with Langley Air Force Base, in Newport News with Ft. Eustis, and in York County with Navy and Coast Guard facilities. Other important sectors of the economy are retail trade and services. Gloucester County and Poquoson have small but significant numbers of people employed in agriculture and fisheries, although this sector has been declining in past years. Because of the large number of jobs in Newport News and Hampton, these cities have more in-commuters than out-commuters, attracting residents from the adjacent counties.

Income levels within the study area vary more for median family income than for per capita income. According to 1980 census data, the median family income for Poquoson was 128 percent of the state average while the figure for Gloucester County was only 88 percent. Hampton and Newport News were slightly below the state median and York County slightly above. All the per capita income figures for 1983 (BEA) for the study area, except Poquoson, were below the U.S. figure. Poquoson was the highest with $5,560 (1972 dollars), while Gloucester County was lowest at $4,710. These figures represent 104 percent and 86 percent of the national average, respectively.

Transportation Facilities

The two major highways which go through the study area are I-64, which runs east to west, and U.S. 17, a north-south route. U.S. 17 crosses the York River near its mouth with a double-swing bridge that has a 450-foot horizontal and a 60-foot vertical clearance above mean high water. Another highway, U.S. 60, parallels I-64 on the western side and generally is used by local traffic. There are numerous state highways that traverse the area, providing access to the smaller communities in the counties.

Other transportation facilities include rail service along the east bank of the river, commercial air service, and freight delivery. The CSX System provides rail service to the refinery, the power station, and naval installations at

various points along the east bank. There are no rail facilities along the west bank. Commercial air service is provided at the Newport News-Williamsburg International Airport. Freight service is provided by a number of interstate carriers authorized to operate in the area.

Commercial Facilities

The two major commercial facilities located on the lower York River are the Amoco Oil Company Refinery and the Virginia Power Yorktown Electric Generating Plant, as shown in figure 3.

Amoco Refinery. The Amoco Oil Company established a refinery on the lower York River at Yorktown in 1956 to take advantage of the deepened navy channel. The facility, located about 3.3 miles above the river mouth, has a refining capacity of about 53,000 barrels per day depending on the grade or crude being refined. Terminal facilities include an offshore pier connected to shore by a 2,600-foot-long, 25-foot-wide catwalk. Water depths of 40 feet are reported along the 1,240-foot outer face of the pier. The pier is capable of handling vessels as large as 150,000 deadweight ton (DWT) tankers. The refinery has a tank storage field with a capacity of 1,360,000 barrels or about 200,000 tons.

Virginia Power Yorktown Electric Generating Plant. In 1963, the Virginia Power Company constructed an electric generating plant at Yorktown about 4.2 miles above the river mouth and immediately adjacent to and upstream of the Amoco refinery. The plant has 3 generating units--2 coal-fired, 150-megawatt units and a fuel-oil-burning, 870-megawatt unit. Approximately 400,000 tons of fuel oil are delivered annually to the plant on deep-draft tankers. The plant does not have docking facilities of its own and has a long-term agreement to utilize pier facilities at Amoco.

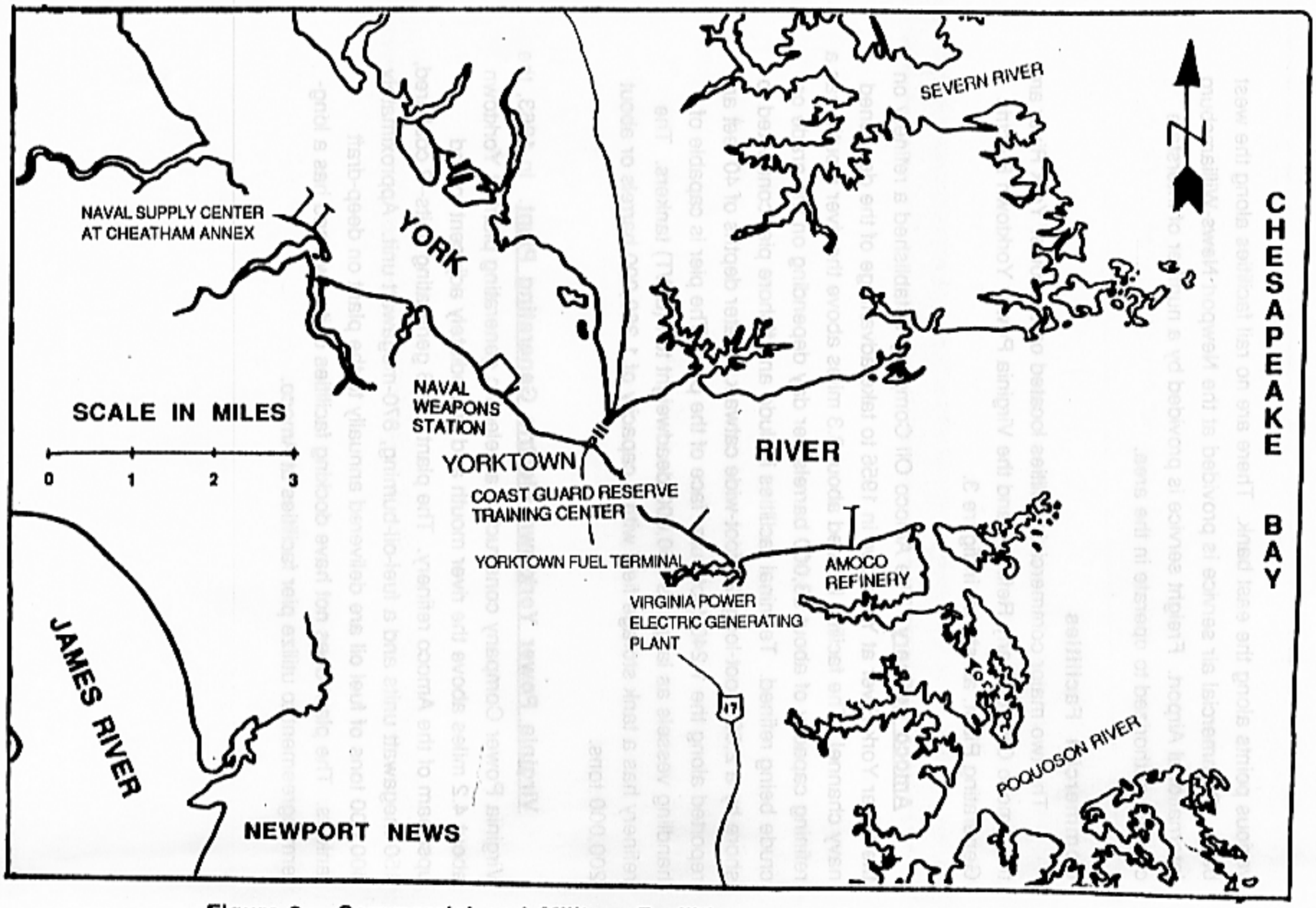

Figure 3. Commercial and Military Facilities on the Lower York River

Military Facilities

Four major military facilities are located on the lower York River. These are the Coast Guard Reserve Training Center, the Yorktown Fuel Terminal, the Yorktown Naval Weapons Station, and the Naval Supply Center at Cheatham Annex, as shown in figure 3.

The Coast Guard Reserve Training Center. The Coast Guard Reserve Training Center is located on the south side of the York River about 4.5 miles above the mouth near the point where Wormley Creek and West Branch enter the river. Two piers are located at the facility, each 20 feet wide and 2,070 feet long, and connecting to a common "T" shaped head. Reported water depths are about 30 feet.

The Yorktown Fuel Terminal. The Yorktown Fuel Terminal is a naval facility located immediately downstream and adjacent to the Coast Guard Reserve Training Center. The facility utilizes the adjacent Coast Guard pier for the receiving and distribution of petroleum products required to support fleet and shore activities.

The Yorktown Naval Weapons Station. The Yorktown Naval Weapons Station is located on the southwest side of the river approximately 8 miles above the mouth. Facilities include two piers, each of which connects to a common head. One pier is 40 feet wide and 1,900 feet long and the other is 40 feet wide and 2,500 feet long. The pier head is 100 feet wide and 2,300 feet long. Water depths of about 39 feet are reported at the outer ends of the piers.

The Naval Supply Center at Cheatham Annex. The Naval Supply Center at Cheatham Annex is located on the southwest side of the river approximately 11.5 miles above the mouth. Two piers are located at the center, each is 45 feet wide and 2,800 feet long. The southeasterly "T" shaped pier has reported water depths of 22 feet, while the northwesterly "L" shaped pier has reported depths of 14 feet. Greater depths are reported close to the pier faces.

Existing Commerce

Commerce moved on the lower York River consists principally of crude oil and refined petroleum products, and naval stores and munitions destined for the companies and military facilities on the lower York River. The following table is a summary of waterborne commerce on the lower York River from 1970 to 1990. Details on the movement of crude oil and petroleum products and naval stores and munitions on the York River are presented in Appendix B, Navigation Benefits.

Table 2. WATERBORNE COMMERCE, LOWER YORK RIVER
(Short Tons)

Year	Principal Commodities			Distribution			
				Foreign		Domestic (a)	
	Crude oil	Fuel oil	Other fuels	Imports	Exports	Receipts	Shipments
1970	1,688,522	753,720	753,338	1,380,895	0	646,860	1,167,825
1971	1,743,355	809,005	831,629	1,766,062	0	402,606	1,201,467
1972	2,536,610	841,573	1,236,414	2,570,704	0	357,637	1,669,412
1973	2,487,880	721,638	1,072,614	2,619,993	0	325,497	1,327,613
1974	2,359,665	849,820	943,608	2,317,834	0	530,267	1,283,461
1975	2,025,526	1,886,750	868,018	2,738,684	0	565,492	1,431,548
1976	2,386,146	2,809,231	1,048,345	4,442,418	0	277,766	1,514,313
1977	2,286,860	3,491,885	1,101,470	5,130,898	0	459,757	1,276,409
1978	2,465,641	3,348,649	1,124,911	4,776,246	0	863,118	1,299,837
1979	1,768,120	2,615,026	601,146	3,437,884	0	844,275	692,463
1980	2,326,481	3,603,694	918,560	3,279,815	0	922,498	618,830
1981	1,789,222	1,108,156	867,919	2,156,037	0	174,053	1,435,207
1982	2,137,135	1,145,738	1,050,147	2,330,706	0	403,967	1,598,347
1983	2,127,773	618,287	1,013,871	2,072,977	0	468,332	1,218,622
1984	2,375,409	1,065,499	1,030,936	2,422,324	0	358,643	1,690,877
1985	2,825,847	524,297	1,098,688	2,721,389	0	316,730	1,410,713
1986	2,475,364	1,070,998	811,023	3,520,895	0	642,435	1,194,055
1987	2,198,006	1,976,704	459,897	2,297,311	0	653,810	1,683,486
1988	2,857,194	1,962,860	1,451,916	3,025,380	0	567,793	2,688,797
1989	2,899,215	2,272,220	1,441,356	3,069,915	0	650,592	2,892,284
1990 (b)	2,550,035	1,399,012	1,206,830	2,850,107	0	78,770	2,227,000

Source: "Waterborne Commerce Statistics," Corps of Engineers
(a) Includes all coastwise, inbound, outbound, upbound, downbound, and through traffic.
(b) Preliminary data reported by Amoco Oil Company and Virginia Power Company. Tonnages do not include domestic and/or foreign movements to and from military facilities on the lower York River.

Vessel Traffic

Existing traffic on the lower York River includes tankers, and naval and Coast Guard vessels of all classes. Smaller vessels, including dry cargo freighters, tugboats, and barges, seafood harvesting boats, and recreational craft, also pass through the lower river in route to destinations upstream of Yorktown. The following table presents a breakdown of trips and drafts of commercial vessels arriving and departing from the lower York River for the period 1970 to 1990. Data do not include naval vessel traffic, but do include commercial vessel trips to naval facilities. Detailed information on the tankers and naval vessels may be found in the Plan Formulation section of this report and in Appendix B, Navigation Benefits.

Table 3. TRIPS AND DRAFTS OF VESSELS ON YORK RIVER, 1970-1990, INBOUND AND OUTBOUND.

	Draft in feet				
Year	35-39	30-34	25-29	20-24	19 & under
1970	-	119	28	88	22,183
1971	-	115	50	68	23,911
1972	-	193	58	84	23,794
1973	-	171	56	72	23,792
1974	52	99	29	46	20,946
1975	53	112	52	89	31,512
1976	109	100	62	114	19,415
1977	93	118	81	83	15,702
1978	105	49	92	98	17,496
1979	79	45	68	119	19,965
1980	75	43	56	131	13,710
1981	46	21	64	149	9,615
1982	35	34	63	90	11,567
1983	36	24	37	105	20,989
1984	36	30	75	159	3,110
1985	39	29	86	127	2,787
1986	51	25	39	54	3,383
1987	45	26	35	147	4,937
1988	39	26	34	102	8,504
1989 (a)	26	12	43	NA	NA (b)
1990 (a)	28	20	35	NA	NA (b)

Source: "Waterborne Commerce Statistics," Corps of Engineers.

(a) Virginia Pilots Association, tanker class vessel trips only, inbound and outbound, lower York River. Does not include commerce to military facilities on the York River.

(b) Not available.

IDENTIFICATION OF PROBLEMS, NEEDS, AND OPPORTUNITIES

The York River, as is the case with many large waterways, serves many water and related land resource needs of its surrounding area. As such, it is not surprising that concerns about various aspects of these needs and uses are expressed by various interests. These include water quality, wastewater treatment, recreation, commercial activity, military operations, navigation, environmental resources, cultural and historical aspects, and related land use, to name a few. Of these categories only three issues fall directly under the scope of this study--commercial activity, military operations, and navigation. The remaining issues are indirectly related to the scope of this study as they may be impacted by Corps activities to address the primary issues. The following paragraphs discuss these primary issues.

Channel Shoaling Situation

Six surveys, which have been accomplished over the past 40 years at the entrance channel, provide the basis for examining the shoaling situation in the channel. The 1951 survey was accomplished before the channel was dredged in 1951-52 for the Navy, while the 1952 survey was made after the dredging was completed. The 1966, 1988, and 1989 surveys are condition surveys and the 1984 survey was accomplished in conjunction with the 1986 feasibility study. The following table presents the controlling depths at low water over each quarter of the 750-foot channel width for each survey. It was not possible to relate the vertical datum planes of the 1951, 1952, and 1966 surveys with the mean low water datum used for the later surveys. The 1989 survey was reported to navigation interests on the river and represents the existing condition of the channel.

Table 4. CONTROLLING DEPTHS AT THE ENTRANCE CHANNEL

Date of survey	Controlling depth in feet below mean low water: Left outside quarter	Left inside quarter	Right inside quarter	Right outside quarter
Sept '51	33.0	33.0	32.7	32.7
Mar '52	37.2	39.0	39.0	39.8
Oct '66	37.0	38.0	38.5	37.7
Feb '84	35.6	37.1	39.0	37.6
Oct '88	35.3	37.4	38.7	36.7
Jun '89	35.0	37.5	38.3	35.5

For future conditions in the absence of dredging and with the continued use of the channel by shipping interests, it is expected that controlling depths in the center half of the channel will stabilize at about 37 feet. In the outside quarters of the channel, it is expected that the controlling depths would stabilize at depths approaching the 1951 survey, about 33 feet. Over a 50-year period, it is considered reasonable to assume a linear reduction of the controlling depths in the outside quarters of about 2 feet (0.04 foot per year). The resulting channel depths 50 years in the future would, thus, be approximately 33.0 feet in the left, outside quarter and about 33.5 feet in the right, outside quarter. Vessels navigating the channel generally follow the channel centerline and veer away from the centerline during passing situations. The shoaling of the outer quarters poses the greatest hindrance to navigation during passing situations, when the total width of the channel is required to provide for safe, two-way navigation.

Local interests have expressed a need for a means of monitoring the conditions of the channel periodically and a means of responding in a reasonably rapid manner to a developing shoaling problem. The Navy, in particular, has indicated that its operations on the York River would be very

sensitive to any reductions in the available water depths in the channel. Local interests have suggested that modifications to the entrance channel would address such a need.

Commercial Navigation Needs

Based on presently available information, approximately 4,400,000 tons of crude oil, fuel oil, and petroleum products are moved on the lower York River each year. This total includes the import of about 2 million tons of crude oil to the Amoco refinery and the shipment of about 2 million tons of refined petroleum products from the refinery to locations along the Atlantic Coast. The Virginia Power Company power station requires the import of about 400,000 tons of fuel oil annually.

Crude and fuel oil are moved into the York River in tankers ranging in size from 35,000 DWT to 150,000 DWT with maximum loaded drafts between 37 feet and 51 feet. The current 35.5-foot controlling depth in the right, outside quarter of the inbound half of the channel forces vessels to light load significantly in order to safely navigate the channel. Since the vessels are unable to enter the channel fully loaded, much of the transportation benefits associated with their usage is lost.

Representatives of Amoco, the Virginia Power Company, and the study sponsor, the Virginia Port Authority, have expressed the need to provide a means of delivering crude and fuel oil to Yorktown by the utilization of more fully-loaded vessels. They report that this more efficient movement of oil should result in significant savings in the form of reduced transportation costs.

Opportunities to alleviate the problems and address the needs of commercial navigation on the York River include several structural and nonstructural alternatives which are discussed in later portions of this report.

Additional discussions of navigational problems can be found in Appendix B, Navigation Benefits.

Naval Navigation Needs

The naval navigation needs on the York River are centered around the capability for naval vessels to traverse the river to take on and to offload supplies at the Naval Supply Center and the Naval Weapons Station. Personnel of the Naval Facilities Engineering Command, Atlantic Division, have reported that, while most naval vessels are able to navigate the channel without limitation, the current controlling depth of 35 feet in the left quarter of the outbound portion of the channel requires that large Navy vessels of the WICHITA class be light loaded in order to exit the waterway or take on munitions at anchorage. Vessels of this class support the Atlantic Fleet with the rapid replenishment at sea of fuel, munitions, and refrigerated and dry stores. Depth requirements are presently determined by the WICHITA class vessels as the larger SACRAMENTO class vessels have been reassigned.

Navy personnel have expressed the need for a 37-foot-deep, 750-foot-wide, Federally maintained, channel into the York River. A channel with these dimensions, they report, would provide the opportunity for the complete loading of the WICHITA class vessels at the Weapons Station and eliminate additional operational costs. A deeper channel, they state, is of vital importance to national defense.

Other Concerns and Needs

The additional concerns expressed by the public are of a social and environmental nature and are indirectly related to the needs expressed in the previous paragraphs. Concerns have been expressed about the impacts on cultural and historical sites and public health and safety resulting from potential increased industrial development associated with the provision of navigational improvements on the York River. Concerns have also been expressed about the impacts of navigational improvements on the environmental quality of the York and Pamunkey Rivers and adjacent areas. Specific concerns include water quality and saltwater intrusion of the freshwater aquifers, and impacts on commercial and recreational fishing and wildlife. In addition, concerns were presented surrounding dredging and the subsequent placement of dredged material.

Summary of Study Opportunities and Needs

Based on the discussions of the water and related land resource problems of the study area as presented in the preceding paragraphs, the following study objectives were developed:

a. Provide the opportunity for the safe and efficient movement of crude oil and petroleum products to the companies located on the lower York River.

b. Provide the opportunity for the safe and efficient movement of naval stores and munitions to and from the naval facilities located on the lower York River.

c. Provide for the means of monitoring channel conditions and responding in a timely manner to any shoaling problems which may develop.

d. Where possible, formulate measures that minimize impacts on the social, cultural, and environmental features of the area and that, in general, are compatible with the integrity of the area.

PLAN FORMULATION

The purpose of this section is to provide the background on the criteria used in the formulation process and a logical presentation of the procedures followed from the identification of the study objectives to the designation of the selected plan. The formulation process involves the evaluation of alternative measures for resolving the problems and fulfilling the needs that have been identified in the study area. These alternatives were screened to arrive at a plan that best responded to the problems and needs of the area. Plans were formulated with regard to all pertinent benefits and costs, both tangible and intangible.

PLANNING CONSTRAINTS

Planning constraints are any policy, technicality, or other consideration that has the capacity to restrict or otherwise impact the planning process. Typical constraints include state of the art, time, money, uncertainty of the future,

and the inaccuracies inherent in design procedures on which alternative plans are based.

FORMULATION AND EVALUATION CRITERIA

Environmental, technical, and economic criteria, in addition to intangible considerations, permit the development and selection of a plan which best responds to problems and needs of an area. These criteria are discussed in the following paragraphs.

Technical Criteria

The following technical criteria, within a planning framework, were adopted for use in plan formulation:

a. The plan selected should be consistent with local, regional, and state goals for navigational development.

b. Dimensions of channels and other alternative improvements should be adequate to accommodate expected future use.

c. Channel improvements considered should be designed to provide maximum safety and ease of navigation.

d. Physical obstructions such as bridges, piers, and other facilities should be considered in the formulation of alternatives and the final plan selection.

Economic Criteria

The economic criteria which were applied in the formulation of the alternative plans are essentially as follows:

a. Tangible benefits exceed project economic costs.

b. Each separable unit of improvement provides benefits at least equal to its cost, unless justifiable on a non-economic basis.

c. The scope of the development provides the maximum net benefits.

d. There is no economical means, evaluated on a comparable basis, of accomplishing the same purpose or purposes which would be precluded from development if the plan were undertaken. The limitation refers only to those alternative possibilities that would be physically displaced or economically precluded from development if the project is undertaken.

e. The benefits and costs are expressed in comparable quantitative economic terms to the maximum practicable extent. The costs for alternative plans of development are based on preliminary designs and investigations, estimates of quantities, and 1992 unit prices. Annual charges are based on a 50-year amortization period and an interest rate of 8-1/2 percent. The annual charges also include the cost of maintenance.

Environmental and Social Criteria

The following environmental and social criteria were considered in the formulation of plans:

a. Consideration should be given to public health, safety, and social well-being, including possible loss of life.

b. Detrimental environmental effects on the ecosystem related to the project should be minimized or avoided.

c. Destruction or disruption of aesthetic and cultural values, community cohesion, and the availability of public facilities and services should be avoided or minimized.

d. Adverse effects on employment, tax base, and property values and the disruption of normal and anticipated community growth should be minimized.

IDENTIFICATION AND SCREENING OF POTENTIAL MEASURES

Several management measures are available for addressing the navigational needs of the lower York River users. Some measures address the needs of both the commercial and military users, while others either address the needs of the commercial users or the needs of the military users.

Measures which Address the Commercial and Military Needs on the Lower York River Waterway

The following measures address the needs of both the commercial and military users of the lower York River waterway.

Modification of the Entrance Channel Portion of the 22-foot Federal Project. The modification of the existing 22-foot project on the York River to further improve the entrance channel would clearly address the concerns expressed by the commercial and military users of the waterway. Under such a measure, the channel width and depth would be modified as necessary to more efficiently handle the present and potential commercial and military vessel traffic and, in general, provide for greater safety on the river. The channel would also be monitored periodically through the accomplishment of condition surveys and the appropriate maintenance would be scheduled as necessary.

No Action Alternative. The "no action" alternative is the basic alternative to any plan of improvement and implies acceptance of the existing navigational conditions. With regard to the York River Entrance Channel, this would mean that the channel would continue to shoal in the absence of maintenance dredging. The relatively inefficient movement of commercial and naval cargo would continue as small deep-draft vessels and light loaded vessels continue to operate on the waterway. The "no action" plan is automatically adopted in cases where all other alternatives are found not to be implementable on the basis of economic, engineering, or environmental feasibility.

Measures which Address the Commercial Needs on the Lower York River Waterway

The following measures are potential means of transporting petroleum and residual fuel oil to the Amoco refinery and the Virginia Power Company generating plant.

Pipeline Construction. The construction of a pipeline from deep water in the lower Chesapeake Bay or Hampton Roads areas to the Amoco refinery and the Virginia Power Company generating plant at Yorktown is an alternative means of transporting petroleum products to their destination. Investigations of this alternative for the 1972 report considered a pipeline passing through the cities of Newport News or Hampton and originating adjacent to a deepwater channel. The pipeline was not found to be a satisfactory solution to the problems of the commercial users due to opposition from these cities and estimated high acquisition and construction costs. Recent investigations of several pipeline routes indicate that, while municipal opposition might be reduced by utilizing existing railroad and power transmission line rights-of-way, the estimated cost of any pipeline construction would be much greater than the cost of any channel improvements that might be considered.

Offshore Terminal Construction. The construction of an offshore, deepwater terminal facility may have the potential to solve the problems of getting petroleum and residual fuel oil to Amoco and Virginia Power Company, respectively. Under this arrangement, large tankers would offload petroleum at a manmade island for shipment to East Coast ports (including the York River) via smaller tankers. In a 1969 feasibility report prepared by the Philadelphia District, preliminary investigations indicated that an offshore terminal constructed in Delaware Bay was a feasible alternative to further deepening of the Delaware Bay. The 1972 report examined the feasibility of utilizing the proposed Delaware facility as a means for importing petroleum to the York River. For the purposes of estimating costs and benefits, the York River analysis was derived from a direct proportion of tonnage moving to the York River and tonnage moving elsewhere. The analysis found that use of the then proposed Delaware Bay terminal was more costly than the direct movement of petroleum to the York River via a deepened channel.

The reexamination of the offshore deepwater terminal alternative, together with the review of available reports addressing the potential of these facilities along the East Coast, indicates that the Delaware Bay is still the most logical location for such a facility. However, the use of such a facility for the movement of petroleum to the lower York River remains much more costly than

the direct movement on a deepened channel. Moreover, the State of Delaware has passed legislation that prohibits construction of such a facility in Delaware Bay.

Lightering without a Fixed Facility. Lightering without a fixed facility was accomplished for many years by Amoco in Hampton Roads. Under this system, tankers with loaded drafts in excess of 36 feet would enter the harbor and proceed to an anchorage area assigned by the Captain of the Port. After the tankers were anchored, lighter barges were secured to the tanker and petroleum was pumped until the tanker was sufficiently light to proceed through the York River Entrance Channel. The lightering operation would take place with both vessels in a "free floating" condition around the anchorage lines of the tanker.

Lightering operations have not taken place in the lower York River since 1978. Shipping officials cite the substantially higher cost of the double handling of petroleum as compared to conventional docking as the reason for the discontinuation. In-port costs are also much greater with lightering because discharging at sea takes 4 to 8 times longer than discharging at a shore terminal. On the lower York River, the additional costs associated with lightering are not outweighed by the economies of scale because the present restrictions on the waterway place a significant restriction on the size of tanker that could call at the refinery even in a lightened condition. Shipping officials have, thus, found it significantly less costly to light load larger vessels and use the entrance channel.

Lightering with a Fixed Facility. Another alternative to channel deepening is the construction of a lightering facility in the Norfolk Harbor. Under this alternative, large tankers would proceed to the fixed lightering facility where they would partially offload their cargo to barges. The tanker would be lightered to a depth where it could navigate the York River Channel and then both the tanker and barges would proceed to the terminal on the York River to discharge their cargo. Comparison of transportation costs on an improved York River Channel with those costs incurred with the utilization of a lightering facility, as presented in the 1972 report, indicated that the unit costs for delivering petroleum from its source to a York River Channel user via a lightering facility

was more expensive than direct shipment on an improved channel in the York River. Recent reevaluation indicates that, for the same rationale as presented above for lightering without a fixed facility, the utilization of a lightering facility would be significantly more costly than the light loading of larger vessels in conjunction with the use of the entrance channel.

Transshipment. Transshipment is a measure that presently represents a major practice for oil shipment to the York River. Under this arrangement, oil is carried from producing areas to the Caribbean on Ultra Large Crude Carriers (ULCC) or Very Large Crude Carriers (VLCC) and then transferred to smaller vessels for shipment to the York River. Using the Caribbean as a central port allows shippers to take advantage of the economies of scale associated with large tankers over a major portion of the trade route. Transshipment is, therefore, more attractive on routes from North Africa, West Africa, northern Europe, the Arabian Gulf, and Alaska and becomes less attractive as the length of the route decreases. It is likely that transshipment will continue as a practice under the with and without project conditions.

Pilotage Regulations. At this time, there are no restrictions imposed on the use of the York River Channel with regard to time of day or adverse weather conditions. Appropriate "common sense" measures are taken, however, during severe storm activity and during periods of low visibility. Vessel passing is also allowed without restriction. While the pilots do not restrict maximum vessel size through the channel, they do recommend appropriate light loading to compensate for the existing depth of the entrance channel. Pilot recommendations are certain under the with or without project scenario.

Measures which Address the Military Needs on the Lower York River Waterway

The following measures address the needs that have been identified by the Navy.

Alteration of Naval Vessel Loading Sequence. An alternative to the deepening and/or maintenance of the entrance channel is the alteration by the Navy of the vessel loading sequence. A WICHITA class vessel requiring

munitions would typically proceed from the Naval Station, Norfolk, through the entrance channel (assuming that the channel were sufficiently deep), up to the Weapons Station. The vessel would already be carrying a full load of fuel which it would have taken on at the Craney Island Fuel Depot prior to initial docking at the Naval Station, Norfolk. After taking on munitions, the fully loaded vessel would then deploy to support the Atlantic Fleet.

With the present situation of insufficient water depths in the channel, an alternative to the above sequence, which the Navy uses on occasion, would require that the vessel, upon leaving the Naval Station, would first partially offload its fuel (either at Craney Island Depot or the Naval Station) so that it could take a full load of munitions from the Weapons Station through the entrance channel. The vessel could then deploy; however, it could not meet the fuel needs of the fleet. Alternatively, the vessel could retrace its route and proceed to the Craney Island Depot to take on additional fuel supplies before leaving to supply the fleet. However, the Navy had opposed this alternative because the retracing of the vessel's route would add about 80 miles to its trip. This is undesirable from a contingency standpoint because the ship's response time is reduced considerably. In addition, loading fuel at Craney Island after loading munitions places a potentially explosive ship in a highly active and very congested harbor which poses a safety threat to the fuel depot, Coast Guard facilities, and some civilian developments.

Offshore Loading of Naval Vessels. Another method of providing for the movement of naval stores and munitions from the Weapons Station would be to load naval vessels of the WICHITA class in deeper water. This is the current practice of the Navy, in response to insufficient water depths in the existing channel, and involves the loading of munitions on WICHITA class vessels at Whiskey Anchorage in Hampton Roads. The ships would have previously taken on full loads of fuel, and munitions would be brought out to the vessels by barge. The Navy has determined that the double handling of munitions has increased vessel transportation costs and more importantly increases ship response time since only one ship at a time can be loaded at anchorage. Although the Navy has found this alternative to be unacceptable from a contingency perspective, it has stated that this method of loading the

WICHITA class vessels will continue to represent the most feasible and likely Naval response to shoaling problems in the entrance channel.

Screening of Potential Measures

The preceding discussion of potential measures indicates that the modification of the existing 22-foot project on the York River to further improve the entrance channel would clearly address the concerns expressed by the commercial and military users of the waterway and would offer the greatest potential for solving the navigational problems being experienced on the lower York River.

Pipeline construction and lightering (with or without a fixed facility) were found to be significantly more costly than the light loading of larger vessels in conjunction with the use of the entrance channel. Additionally, pipeline construction would not be readily supported by those localities through which the pipeline would have to be routed and lightering is not presently supported or practiced by the appropriate shipping officials.

The construction of an offshore terminal facility serving several East Coast ports is considered inappropriate to address the York River situation. The most logical location for such a facility remains the Delaware Bay; however, such a plan is not implementable because the State of Delaware has passed legislation which prohibits such construction.

Transshipment and pilotage regulations are current practices on the lower York River and are expected to continue under a with or without project condition. In this regard, it is not deemed necessary to address these measures further as specific implementable measures under this study. Furthermore, these measures are encompassed in the "no action" measure which will be examined further for comparison purposes.

Measures identified by the Navy were found to be unacceptable because they did not fully address national defense concerns. Increased response time for the deployment of the WICHITA class vessels, increased transportation costs, and increased safety hazards would result from the implementation of these measures.

DEVELOPMENT OF CHANNEL PLANS

Further evaluation of the channel alternatives for the lower York River requires a more detailed examination of channel design and dredged material placement.

Implementation Authority

During the course of this study, Section 107 of the 1960 River and Harbor Act, as amended, was not the only authority considered for the modification and maintenance of the entrance channel portion of the 22-foot Federal project on the York River. Early in the study, consideration was also given to the appropriateness of the authority contained in Section 117 of the 1968 River and Harbor Act. Section 117 states the following:

> "The Chief of Engineers, under the direction of the Secretary of the Army, is hereby authorized to maintain authorized river and harbor projects in excess of authorized project depths where such excess depths have been provided by the United States for defense purposes and whenever the Chief of Engineers determines that such waterways also serve essential needs of general commerce."

Based on guidance provided by higher authority, it was determined that Section 117 was not the appropriate authority for the modification and maintenance of the entrance channel portion of the 22-foot Federal project on the York River.

Channel Design

Channel design for this study involved determining the optimum channel depth, width, and alignment that would safely accommodate present and projected vessel traffic. Design is based on Engineering Manual 1110-2-1613, dated 8 April 1983, entitled "Engineering and Design, Hydraulic Design of Deep-Draft Navigation Projects," including appropriate references.

Project Limits. In order to address the navigational needs of all commercial and military users on the lower York River, the limits of any proposed modification to the entrance channel portion of the 22-foot Federal project

should extend from the contour in the lower Chesapeake Bay corresponding to the authorized project depth plus 1 foot of required overdredging to a point adjacent to the piers at the Yorktown Naval Weapons Station (approximately 8 miles above the river mouth).

Channel Alignment. Any proposed modification should follow the alignment of the existing entrance channel to take advantage of the existing deep water.

Vessel Characteristics. Several classes of commercial and military deep- and shallow-draft vessels enter the York River via the entrance channel. The largest of the commercial vessels include crude oil tankers destined for the Amoco refinery and Virginia Power Company generating plant at Yorktown. The largest military vessels are of the Navy WICHITA class rapid replenishment supply ships. Table 5 presents the characteristics of these vessels as obtained from representatives of Amoco, the Virginia Power Company, and the Department of the Navy.

Amoco officials have indicated that docking facilities are adequate for handling vessels as long and as wide as the 150,000 DWT tankers and, as such, project that these are the largest vessels to be used in the future on the lower York River. The dock facilities at the Yorktown Weapons Station are presently adequate to handle the largest naval vessels afloat. However, for the foreseeable future, the WICHITA class vessels will most likely remain the largest vessels to visit the Weapons Station.

Table 5. CHARACTERISTICS OF LARGE VESSELS USING THE YORK RIVER ENTRANCE CHANNEL

Vessel type	Average maximum loaded draft (ft.)	Average beam (ft.)	Average length (ft.)	Deadweight tonnage average (long tons)
Tanker	51 (a)	120 (b)	865 (b)	100-150,000 (a)
Tanker	43 (a)	105 (b)	798 (b)	70-100,000 (a)
Tanker	37 (a)	86 (b)	615 (b)	35-40,000 (a)
WICHITA Class Naval Vessel	33.3 (c)	96 (c)	659 (c)	N. A.

(a) Average values of actual vessel trips (1989-1991).
(b) From WRSC-IWR "Annual U. S. and Foreign Flag Vessel Data."
(c) From Janes Fighting Ships. Navy operations personnel have indicated that several vessels in the WICHITA class have been modified on an individual vessel basis and have loaded drafts up to 1 foot greater than the 33.3 feet shown in the table.

Channel Depth. Channel depth design is based on the draft of the design vessel or vessels plus an additional depth allowance to account for minimum safe clearance, sinkage due to salinity changes, trim, squat, and tidal and wave effects, as shown in figure 4. The additional depth allowances required for commercial tankers and naval vessels operating on the lower York River are shown in table 6. As indicated in the table, the additional depth allowance for commercial vessels is 4.5 feet, while the allowance for naval vessels is 3.5 feet.

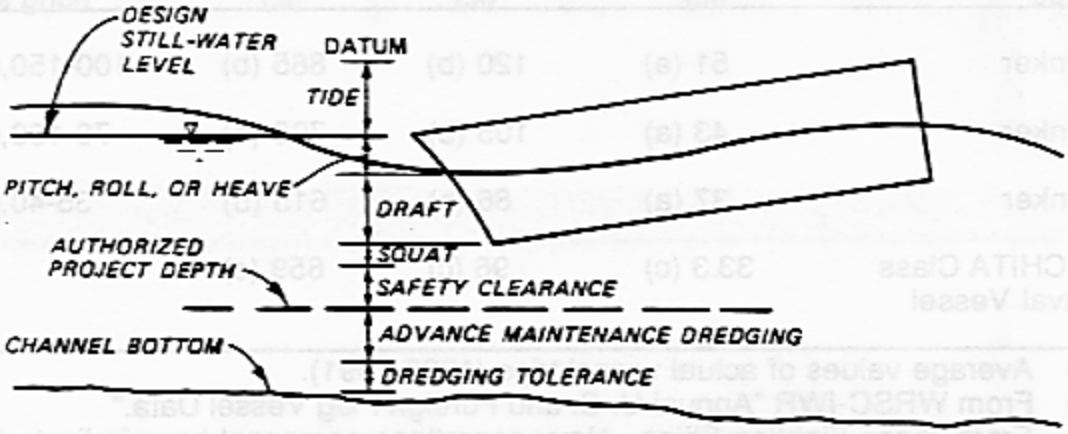

Figure 4. Channel Depth Factors

Table 6. ADDITIONAL DEPTH ALLOWANCE REQUIREMENTS

Factors	Definition	Tanker (feet)	Naval vessel (feet)	Comment
Minimum Safe Clearance	Minimum clearance provided between the bottom of a vessel in motion and channel bottom to avoid damage to ship propellers from sunken debris, reduce displacement of bottom material, and avoid fouling pumps and condensers.	2.0	2.0	Clearance of 2.0 feet recommended by EM 1110-2-1613 for soft bottom material.
Sinkage Due to Salinity Decrease	Increase in draft of vessel due to a decrease in the density of the water.	0.5	0.5	Calculated increase in draft of vessels destined for Yorktown (Atlantic Ocean salinity = 35 ppt, the York River mouth salinity = 20 ppt).
Squat	Sinkage of vessel in motion due to lowering of water surface caused by increased velocity of water past the moving vessel.	0.0	0.0	Calculations, using procedures outlined in EM 1110-2-1613, show that squat is insignificant for the entrance channel.
Trim	Difference between vessel draft at midship and the bow or stern as controlled by loading practice.	1.0	0.0	This allowance is based on reports that tankers destined for Yorktown are generally lower at the stern to increase vessel maneuverability. Navy vessels are "even" trimmed.

Table 6. ADDITIONAL DEPTH ALLOWANCE REQUIREMENTS

(Continued)

Factors	Definition	Tanker (feet)	Naval vessel (feet)	Comment
Vessel Seawater Intake Clearance	Clearance provided, when necessary, between vessel seawater intake and channel bottom to avoid clogging of vessel systems using seawater.	0.0	0.0	Actual vessel operations on the waterway have not indicated any problems or concerns about potential clogging of vessel systems through the seawater intake.
Tidal Effects	The periodic vertical change in water level due to the gravitational attraction of the moon and sun.	0.0	0.0	The reference datum, 0.0 foot, for the study area is mean low water (National Ocean Survey). The possibility of tides falling 1 foot or more below mean low water during the arrival of a tanker to the York River is very rare.
Wave Effects	Allowance for wind-generated waves which could result in ship motions known as pitch, roll, and heave.	1.0	1.0	Significant pitching or heaving of vessels is not anticipated. Roll, however, could be significant, especially from swells from the northeast and east. A 1-degree vessel roll, which is common, could result in an increase in vessel draft of about 1 foot.
Total Depth Allowance		4.5	3.5 (a)	

(a) The 3.5-foot depth allowance computed for the naval WICHITA Class vessels using the guidance provided in EM 1110-2-1613 corresponds with the 3.5-foot clearance required by the Department of the Navy for its largest draft vessels.

Applying the additional depth allowances to the drafts of the fully loaded design vessels presented in the previous table, results in the following project depths, rounded to the nearest foot:

a. 100,000-150,000 DWT tanker (51-foot draft) 56 feet

b. 70,000-100,000 DWT tanker (43-foot draft) 48 feet

c. 35,000-40,000 DWT tanker (37-foot draft) 42 feet

d. WICHITA class naval vessel (33.3-foot draft) 37 feet

The above project depths indicate that a 37-foot channel would serve the needs of the Navy, while channels as deep as 56 feet should be evaluated for the commercial vessels. In reality, it has been determined that, based on consideration of the capacity of the refinery storage tank farm, the existing depths at the refinery terminal facilities, and current transshipment practices, 45 feet is the appropriate upper limit of channel depths to be evaluated. It is very unlikely that shipping officials would allow storage reserves to become depleted to the point where fully loaded 100-150,000 DWT or 70-100,000 DWT tankers, requiring 48- to 56-foot water depths, would be needed to replenish the refinery supply. Also, the reported water depth at the terminal facilities is approximately 40 feet and, while it is reasonable to project that refinery officials would consider improvements to 45 feet, it is considered very unlikely that officials would undertake very costly improvements up to 56 feet. In addition, current transshipment practices implemented by shipping officials would tend to negate the need for fully loaded tankers utilizing up to a 56-foot channel.

Based on the above discussion, it is considered appropriate to evaluate channel depths at 1-foot increments between the existing channel depth of approximately 36 feet and the maximum channel depth determined to be 45 feet.

Channel Width. The existing York River Entrance Channel was constructed to a width of 750 feet based on then existing Department of the Navy criteria contained in Naval Facilities Engineering Command Design

Manual 26. Over the years, the 750-foot width has proven adequate for handling two-way vessel movement of all types and sizes. Navy officials have reported that naval vessels have traversed the channel without problem and have reaffirmed their position that the 750-foot width be maintained. Discussions with the Virginia Pilots Association indicates that the 750-foot width has also proven adequate over the years for utilization by tankers as large as the 150,000 DWT class. The 750-foot width was also recommended in the 1972 Corps York River report based on criteria in effect at that time and received the concurrence of shipping interests and Governmental agencies. Based on the above, selection of a 750-foot, two-way channel width for the York River Entrance Channel would appear appropriate.

The existing 750-foot channel width is supported by channel design criteria contained in EM 1110-2-1613. While this manual provides guidance specifically for interior channels, it is possible to apply the criteria to the York River Entrance Channel using appropriate judgment and conservatism. Channel design criteria are developed to provide adequate width for the safe and efficient movement of vessels. Allowances are provided for a maneuvering lane, clearances between lanes, and bank clearances, as shown in figure 5. The general criteria governing the selection of appropriate widths for each element are presented in table 7.

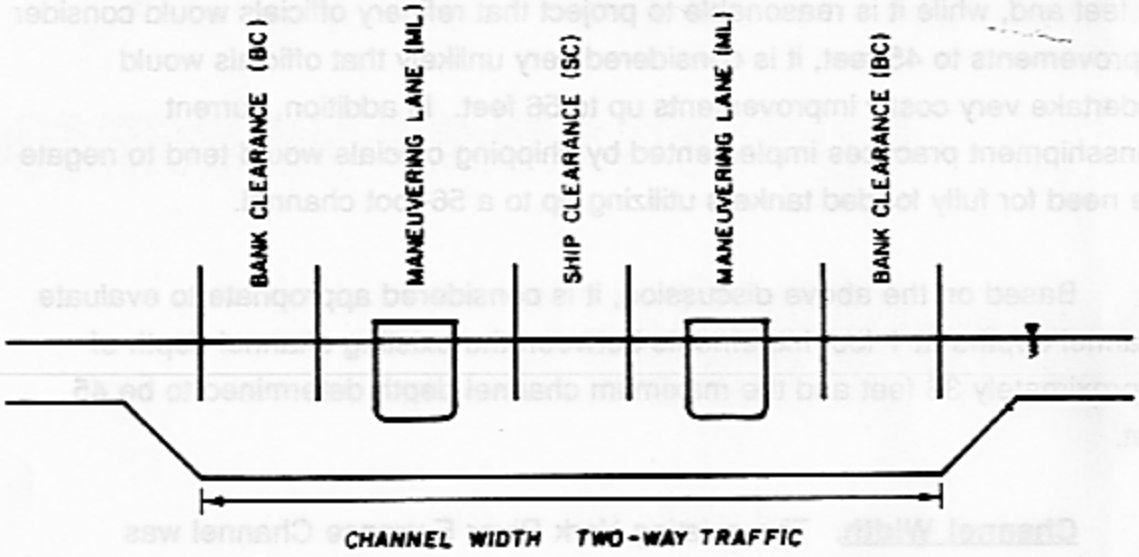

Figure 5. Channel Width Elements

Table 7. GENERAL CRITERIA FOR CHANNEL WIDTHS

Location	Minimum channel width in percent of beam (ft.)			
	Vessel controllability			Channels with yawing forces
	Very good	Good	Poor	
Maneuvering lane, straight channel	160	180	200	Judgment(a)
Bend, 26-degree turn	325	370	415	Judgment(a)
Bend, 40-degree turn	385	440	490	Judgment(a)
Ship clearance	80	80	80	100 but not less than 100 feet
Bank clearance	60	60+	60+	150

SOURCE: EM 1110-2-1613 dated 8 April 83.
(a) Judgment will have to be based on local conditions at each project.

As indicated in table 7, the width of each element, in feet, is calculated as a selected percent of the beam of the design vessel depending on vessel controllability. The following table presents the channel width calculations for a 100,000-150,000-DWT tanker with a beam of 120 feet passing another 100,000-150,000 DWT tanker. The percent of beam values shown in the table are considered reasonable for vessels exhibiting "good" to "poor" maneuverability in an entrance channel. As indicated in the table, the application of Corps channel design criteria results in a channel width of 744 feet, which supports the selection of the channel width of 750 feet.

Table 8. CHANNEL WIDTH CALCULATIONS

Width elements	Percent beam	Channel width in feet: Commercial tanker #1	Channel width in feet: Commercial tanker #2
Bank Clearance	80	96	---
Maneuvering Lane	190	228	---
Ship Clearance	80	48	48
Maneuvering Lane	190	---	228
Bank Clearance	80	---	96
Subtotal		372	372
Computed channel width		744	

One-way channels were also considered, but not recommended, for the lower York River. Because they would require less channel width, one-way channels would be less costly to construct and maintain. However, one-way channels would restrict traffic flow and require a traffic monitoring and regulatory program to reduce the potential for collisions. Safety is a significant

concern on the York River because of the relatively long channel and the relatively frequent movement of fully loaded munitions vessels leaving the river and loaded tankers entering the river. Two-way channels, though more costly to construct and maintain, would provide for unrestricted traffic flow in both directions and would, thus, eliminate this safety concern.

Based on the above discussion concerning the selection of a 750-foot channel width for a lower York River Channel, vessel simulation investigations were not considered warranted during this feasibility effort. Present vessel operations on the existing channel clearly indicate that a 750-foot width provides for the safe and efficient movement of commerce and naval stores. The 750-foot channel width is also supported by the commercial and naval users, the Pilots Association, and the Coast Guard. The expenditure for costly simulation was not deemed necessary.

Channel Plans

Based on the above discussion on channel design, the following channel plans were developed for further evaluation. Initial and annual maintenance dredging quantities are shown graphically in figures 6 and 7, respectively.

Plan C-1. Plan C-1 would provide for the modification and maintenance of the entrance channel to a project depth of 36 feet over a bottom width of 750 feet. The channel would extend from the 37-foot contour (36-foot project depth plus 1-foot required overdreding) in the mouth of the river to that depth in the Chesapeake Bay. The channel would accommodate light loaded tankers of the 35,000-40,000 DWT, 70,000-100,000 DWT, and 150,000 DWT class. Maintenance dredging would be required about 10 years after initial dredging and then on 15-year intervals thereafter.

Plan C-2. Plan C-2 would provide for a channel 37 feet deep and 750 feet wide. The channel would accommodate light loaded tankers of the 35,000-40,000 DWT, 70,000-100,000 DWT, and 150,000 DWT class as well as fully loaded WICHITA class Navy vessels. Maintenance dredging would be required about once every 10 years.

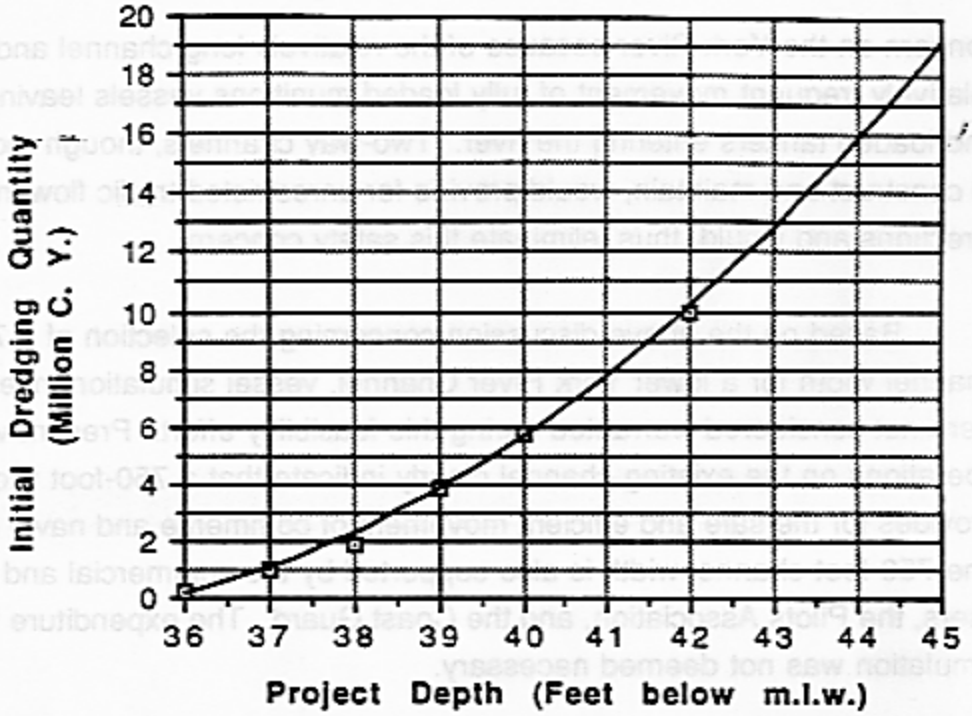

Figure 6. Initial Dredging Quantities

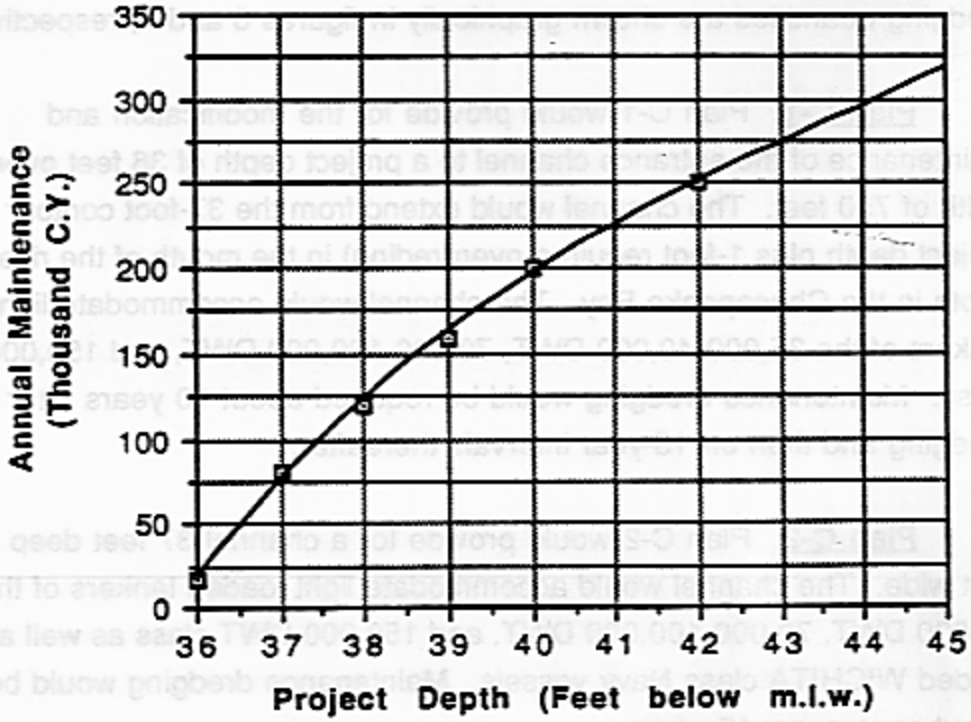

Figure 7. Annual Maintenance Dredging Quantities

Plan C-3. Plan C-3 would provide for a channel 38 feet deep and 750 feet wide. Maintenance dredging would be required about once every 10 years.

Plan C-4. Plan C-4 would provide for a channel 39 feet deep and 750 feet wide. Maintenance dredging would be required about once every 10 years.

Plan C-5. Plan C-5 would provide for a channel 40 feet deep and 750 feet wide. Maintenance dredging would be required about once every 10 years.

Plan C-6. Plan C-6 would provide for a channel 41 feet deep and 750 feet wide. Maintenance dredging would be required about once every 10 years.

Plan C-7. Plan C-7 would provide for a channel 42 feet deep and 750 feet wide. Maintenance dredging would be required about once every 8 years.

Plan C-8. Plan C-8 would provide for a channel 43 feet deep and 750 feet wide. Maintenance dredging would be required about once every 8 years.

Plan C-9. Plan C-9 would provide for a channel 44 feet deep and 750 feet wide. Maintenance dredging would be required about once every 8 years.

Plan C-10. Plan C-10 would provide for a channel 45 feet deep and 750 feet wide. Maintenance dredging would be required about once every 8 years.

Geotechnical Investigations

Subsurface investigations of the York River Entrance Channel were accomplished in October 1984. The detailed results of the laboratory analysis of the samples taken are presented in Appendix A, Engineering and Design.

In general, the geotechnical investigations indicate that the entrance channel is divided into two areas based on different sedimentary deposits. Area I begins at the mouth of the York River and extends along the channel in a southeast direction for a distance of about 8 miles. Area 2 begins at this point within the channel and continues in a southeast direction for a distance of about 7 miles to the boundaries of the York Spit Channel.

Area 1 is composed primarily of soft saturated high-plastic clays. This is a low-energy stable paleo-depositional environment characterized by the consistency of sediment and the lack of sand-size particles. Sediments at the surface are underconsolidated, characterized by high moisture content, low density and low shear strength. The sediments become more normally consolidated with depth as moisture decreases and density and strength increase.

Sediments in Area 2 range from soft high-plastic clays with traces of sand to clean beach samples. This area reflects an energetic and varied paleo-depositional environment. Generally, the samples are soft at the surface with rapidly increasing stiffness with depth. No particular sediment classifications were dominant or continuous throughout Area 2. Each sediment is characterized by different soil parameters and is discussed individually in appendix A.

Dredged Material Placement Evaluation

During the course of this study, several alternatives for dredged material placement were evaluated with consideration given to economic, environmental, social, and technical feasibility and within the known engineering and administrative constraints. These alternatives fall within the categories of (I) open water placement, (2) placement in Craney Island, (3) beach nourishment, and (4) upland containment. Figure 8 shows those placement sites which were considered during the course of this study.

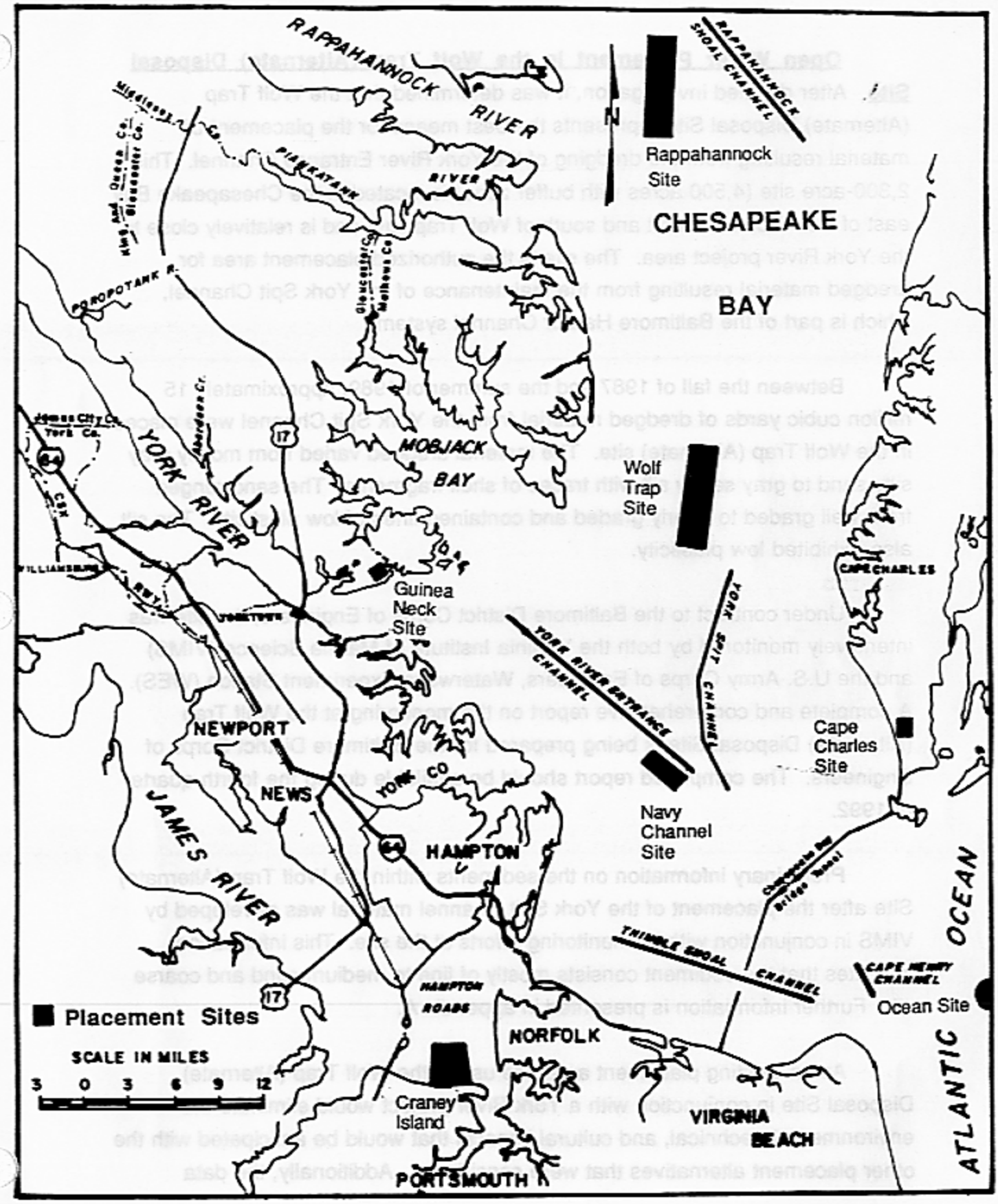

Figure 8. Dredged Material Placement Sites Considered

Open Water Placement in the Wolf Trap (Alternate) L[illegible] Site. After detailed investigation, it was determined that the Wolf Trap (Alternate) Disposal Site represents the best means for the placement o[illegible] material resulting from the dredging of the York River Entrance Channel. [illegible] 2,300-acre site (4,500 acres with buffer zone) is located in the Chesapeak[illegible] east of New Point Comfort and south of Wolf Trap light and is relatively clos[illegible] the York River project area. The site is the authorized placement area for dredged material resulting from the maintenance of the York Spit Channel, which is part of the Baltimore Harbor Channel system.

Between the fall of 1987 and the summer of 1989, approximately 15 million cubic yards of dredged material from the York Spit Channel were placed in the Wolf Trap (Alternate) site. The material dredged varied from mostly gray silty sand to gray sandy silt with traces of shell fragments. The sand ranged from well graded to poorly graded and contained fines of low plasticity. The silt also exhibited low plasticity.

Under contract to the Baltimore District Corps of Engineers, the site was intensively monitored by both the Virginia Institute of Marine Science (VIMS) and the U.S. Army Corps of Engineers, Waterways Experiment Station (WES). A complete and comprehensive report on the monitoring at the Wolf Trap (Alternate) Disposal Site is being prepared for the Baltimore District Corps of Engineers. The completed report should be available during the fourth quarter of 1992.

Preliminary information on the sediments within the Wolf Trap (Alternate) Site after the placement of the York Spit Channel material was developed by VIMS in conjunction with its monitoring efforts at the site. This information indicates that the sediment consists mostly of fine to medium sand and coarse silt. Further information is presented in appendix A.

As an existing placement area, the use of the Wolf Trap (Alternate) Disposal Site in conjunction with a York River project would eliminate the environmental, technical, and cultural impacts that would be anticipated with the other placement alternatives that were considered. Additionally, the data

collected and analyzed as a result of extensive monitoring by VIMS and WES will be very valuable in developing a placement program for a York River project.

Detailed coordination on the use of the Wolf Trap (Alternate) Site has taken place between the Norfolk District staff and the appropriate staffs of the Baltimore District and the Virginia Institute of Marine Science. Specific information regarding this coordination is presented in the Final Environmental Assessment (EA). The assessment also contains a summary of the conclusions of the VIMS investigations and recommendations for the future use of the site by the Norfolk District in conjunction with a York River project. State Water Quality Certification pursuant to Section 401 of the Clean Water Act has been applied for and received from the Commonwealth of Virginia. A permit was applied for and received from the Virginia Marine Resources Commission (VMRC) in compliance with Section 62.1-3 of the Code of Virginia.

Alternative Placement Sites Considered. The following alternatives to the use of the Wolf Trap (Alternate) Site were evaluated during dredged material placement investigations.

a. Confined Containment in an Upland Site. Investigations of upland containment indicate that an area of several hundred acres would be needed to contain dredged material resulting from the construction and maintenance of an entrance channel at the mouth of the York River. An evaluation of land areas in the vicinity of the lower Chesapeake Bay suggested that the areas of greatest potential for use would be those on the Virginia Eastern Shore or the upper peninsula between the York River mouth and the Rappahannock River mouth. Two sites examined in these general areas during the 1972 York River study were Cape Charles and Guinea Neck.

The use of an upland site would present the potential for environmental and social impacts. While there would be minimal impacts on the aquatic environment if the area were properly constructed, there would be a loss of existing habitat. From a social standpoint, the use of a large upland site could displace people, businesses, or farms; reduce long-term productivity of renewable resources; and change the quality of nearby community life. Field

studies would be needed to determine if there are any archaeological resources in the area which would be adversely affected by the containment. In general, it is likely that county officials and residents would oppose the placement of a large upland site in their communities.

Upland containment of dredged material would be costly from the standpoint of land acquisition and preparation because of the large area which would be needed. In addition, because of the location of the entrance channel in the Chesapeake Bay, there would be a greater construction cost. The use of an upland site would require that the channel work be accomplished by hopper dredge, with the vessel making several round trips to a rehandling basin located in deep water offshore of the upland site. From this basin, the dredged sediment would then be pumped to the upland site.

b. Placement in Craney Island. The placement of dredged material in Craney Island would eliminate the environmental, social, and cultural concerns that would be associated with upland disposal. The major problem with this alternative is the 80-mile round trip hauling distance that would be required and the significant increase in construction time and cost that would result. There is also concern about the impact that this alternative would have on the long-term capacity of Craney Island.

c. Beneficial Uses. Consideration during this study was given to the productive uses of dredged material for habitat development and creation and for the placement of suitable material on erosional shorelines. Habitat development and creation were determined to be environmentally infeasible because of concerns about sensitive resources, including submerged aquatic vegetation (SAV's), within proximity to the channel area. With regard to placement on erosional shorelines, existing information suggests that, although sand does exist in portions of the channel bottom, it may not be suitable in quality or available in sufficient quantities for beach nourishment uses.

d. Open Water Placement in the Atlantic Ocean. Atlantic Ocean sites were evaluated on a preliminary basis and were found to be infeasible because of the extensive hauling distance between the sites and the York River channel area.

e. Open Water Placement in the Rappahannock Site. Consideration was given to the placement of dredged material in the Rappahannock Site, which was utilized for the placement of material resulting from the dredging of the Rappahannock Shoal Channel. This site is located near the northern end of that channel and is conveniently located for use in conjunction with the maintenance of Baltimore District projects. Although the Rappahannock Site could possibly be utilized in conjunction with a project on the York River, it was determined that placement at the Wolf Trap Site was more appropriate. This determination is based on consideration of the overall dredged material management requirements of the Norfolk and Baltimore Districts in the lower Chesapeake Bay and on the considerably shorter and more economical hauling distance from the York River Entrance Channel to the Wolf Trap Site.

f. Open Water Placement in the Navy Placement Site. The placement site used during the initial construction of the York River Entrance Channel in 1951-52, referred to as the Navy Placement Site, was considered for containment of dredged material from the York River project during the 1986 study. The 1,000-acre site is immediately adjacent to the southeastern terminus of the channel and would have resulted in lower placement costs compared with the other alternatives. The use of this site would also have eliminated those environmental, social, and cultural concerns projected for upland placement. However, the site was located within the productive winter crab dredging area of the lower Chesapeake Bay, and there was the potential for some loss to that resource. It was estimated that the use of the Navy Placement Site could result in the estimated loss of up to $1,000 (1985 dollars) annually to the winter crab dredging industry over the life of the project. A permit was applied for from the Virginia Marine Resources Commission, but was eventually denied because of the potential impact that dredged material placement would have on the crab dredge fishery.

EVALUATION OF DETAILED PLANS

The following paragraphs present the assessment and evaluation of the detailed plans formulated in the previous sections.

Environmental Impacts Evaluation

The following discussion of the potential environmental impacts of the detailed plans is general in nature and is not intended to address specifically any particular plan that might ultimately be selected. A more detailed discussion of impacts is presented in the Final Environmental Assessment. Specific impacts that could be result from the selection of specific plan will be presented later in this document.

Dredging Activities, General. Projected environmental impacts would result from dredging activities, the most obvious impact of which would be the direct destruction or displacement of benthic macroinvertebrates in the path of the dredge. Past studies have shown that recolonization of a deepened channel by benthic organisms may occur within 2 weeks to 2 years. Even though the original biomass may be attained in that period, recolonization is usually by opportunistic species which are less valuable to the food chain. Original species diversity is seldom achieved and the number of bottom feeding fish consequently seldom attains pre-dredging proportion and species diversity. Species diversity in the deepened channel may be influenced by the substrate type in the original channel. Decreased oxygen supply in and above the substrate may also influence species diversity.

During the dredging operation, bottom sediments would be disturbed and suspended. Turbidity created during dredging can reduce the penetration of light necessary for photosynthesis by phytoplankton and macrophytes, thus reducing the oxygen supply in the water column. Suspended sediment could cause adverse impacts on filter-feeding organisms. In filter feeders, heavy suspended sediment loads could cause abrasion of gill filaments, clogging of gills, impaired respiration, impaired feeding, reduced pumping rates, retarded egg development, and reduced growth and survival of larvae. Similar impacts could occur to zooplankton, larval fish, and larval blue crabs. These impacts would not readily affect adult fish because of their mobility. However, filter-feeding fish could be affected more than non-filter-feeding fish. If the dredging

operation would not extend for a long period, and was scheduled to avoid critical spawning and nursery periods, these impacts from suspended sediments should not be significant.

Dredging could result in chemical changes in the water column such as decreased dissolved oxygen levels due to increased oxygen demand resulting from resuspension of nutrients and pollutants. Low oxygen levels in the water column could have a synergistic effect because the York River has experienced periods of low oxygen levels during summer due to the "red tide" effect caused by high concentrations of dinoflagellates. Oxygen demand may also be associated with suspension of the deeper sediment layers, which in estuarine systems typically exhibits increasingly reduced (deoxidized) sediment deposits. Heavy metals and potential increased oxygen demand due to oxidation of deep sediments when suspended, along with the potential suspension of other pollutants, can have significant adverse impacts on aquatic organisms.

Dredging Operations and Endangered Species. Hopper dredging operations have the potential to adversely impact sea turtles which are on the Federal Endangered Species list. In the Chesapeake Bay, the most critical period is mid-May to mid-November when the turtles are present in the Bay. The two most abundant speices are the Atlantic Loggerhead and the Kemp's ridley. There are documented takings of sea turtles by hopper dredges, most notably in Port Canaveral, Florida. There have been no previously recorded takings of sea turtles in the Chesapeake Bay by hopper dredges, however, the dredges have not been specifically monitored for such an occurrence. Dredging by clamshell method has no reported impact on sea turtles.

Dredged Material Placement. The impacts associated with overboard dredged material placement would be similar to those resulting from dredging, except the impact area would be larger. The most obvious and most significant impact from overboard dredged material placement would be direct burial and loss of benthic organisms. In particular, there is the potential for impacts to the commercially important blue crab which overwinters yearly in much of the lower Chesapeake Bay between mid-November and the end of March.

There is also the potential for temporary habitat degradation if dredging or dredged material placement results in a significant change in bottom type. Similarity of materials is the single most important factor in determining the potential of an area to regain its predredged material placement biota composition.

Hazardous and Toxic Wastes. Channel dredging and dredged material placement were evaluated for the likely presence or absence of Hazardous and Toxic Wastes (HTW) in the study area in accordance with CECW-PO letter, "Draft Guidance on HTW for Civil Works Studies and Projects" of 30 July 1990." Historical records indicate that York River sediments at the river mouth have not been contaminated by any documented spills. A review of existing and past land uses in the study area do not indicate any HTW risk. Near the existing entrance channel, most land areas are residential, wetlands, or are otherwise undeveloped. The Amoco Refinery is the closest industry to the channel. Located approximately 4 miles upstream of the York River mouth, the refinery is approximately 8 miles west of the western terminus of the channel.

Social and Cultural Evaluation

The social and cultural impacts which could result from the improvement of the entrance channel at the mouth of the York River would vary according to the particular channel plan that would be undertaken. With regard to potential social impacts, a significant increase in the entrance channel depth could stimulate new development or expansion of existing industries which, in turn, could spur population growth and community development. The negative effects of such growth could include displacement of people, businesses, or farms; reduction in the long-term productivity of renewable resources; and a change in the quality of community life. With regard to potential impacts to cultural resources, the channel plans under consideration would not have a significant effect on archaeological resources in the study area since these resource areas have been previously disturbed by the earlier, original channel dredging.

thereafter. All costs are based on the placement of dredged material in the Wolf Trap (Alternate) Disposal Site.

Dredging by hopper method was selected over other dredging methods as the basis for the development of cost estimates for the alternative plans due to its more common use in an openwater environment such as the lower Chesapeake Bay and the availability of production and bid data resulting from several hopper dredging operations accomplished in deep-draft channel projects in the lower Chesapeake Bay.

Table 10. SUMMARY OF COSTS FOR LOWER YORK RIVER CHANNEL PLANS

Plan no./ channel dimensions (feet)	Total investment cost, new work ($) (a)	Average annual cost, new work ($)	Average annual maintenance cost ($) (b)	Total average annual cost ($)
C-1 (36' X 750')	1,869,000	157,000	129,000	286,000
C-2 (37' X 750')	4,967,000	418,000	332,000	750,000
C-3 (38' X 750')	9,209,000	775,000	461,000	1,236,000
C-4 (39' X 750')	17,158,000	1,443,000	617,000	2,060,000
C-5 (40' X 750')	25,486,000	2,143,000	650,000	2,793,000
C-6 (41' X 750')	37,371,000	3,143,000	726,000	3,869,000
C-7 (42' X 750')	44,310,000	3,726,000	900,000	4,626,000
C-8 (43' X 750')	63,470,000	5,338,000	1,182,000	6,520,000
C-9 (44' X 750')	80,425,000	6,764,000	1,234,000	7,998,000
C-10 (45' X 750')	97,721,000	8,218,000	1,275,000	9,493,000

(a) Includes interest during construction.
(b) Includes cost for periodic channel condition surveys to be conducted on the average of three times between each maintenance dredging at a current cost estimated at $150,000. Also includes costs for commercial and Naval waterway users to maintain their berthing areas.

Economic Comparison. The summary of the comparison of costs and benefits for the alternative plans is presented in the following table and shown graphically in figure 9. As indicated by the benefit-to-cost ratios computed, four channel plans, plans C-1, C-2, C-3, and C-4, are economically justified. Of these plans, channel plan C-2, the 37-foot project, results in the greatest excess benefits over costs and is, thus, the National Economic Development plan. The "no action" plan is not conducive to a benefit-cost comparison.

Table 11. ECONOMIC COMPARISON OF CHANNEL PLANS

Plan no./ channel dimensions (feet)	Average annual benefits ($) (a)	Average annual cost ($) (b)	Benefit to cost ratio	Total net benefits ($)
C-1 (36' X 750')	799,000	286,000	2.79	513,000
C-2 (37' X 750')	**1,385,000**	**750,000**	**1.85**	**635,000**
C-3 (38' X 750')	1,782,000	1,236,000	1.44	546,000
C-4 (39' X 750')	2,167,000	2,060,000	1.05	107,000
C-5 (40' X 750')	2,510,000	2,793,000	0.90	-283,000
C-6 (41' X 750')	2,773,000	3,869,000	0.72	-1,096,000
C-7 (42' X 750')	3,013,000	4,626,000	0.65	-1,613,000
C-8 (43' X 750')	3,236,000	6,520,000	0.50	-3,284,000
C-9 (44' X 750')	3,458,000	7,998,000	0.43	-4,540,000
C-10 (45' X 750')	3,626,000	9,493,000	0.38	-5,867,000

(a) Total of commercial and naval benefits is shown in table 9.
(b) Total of average annual first and maintenance costs is shown in table 10.

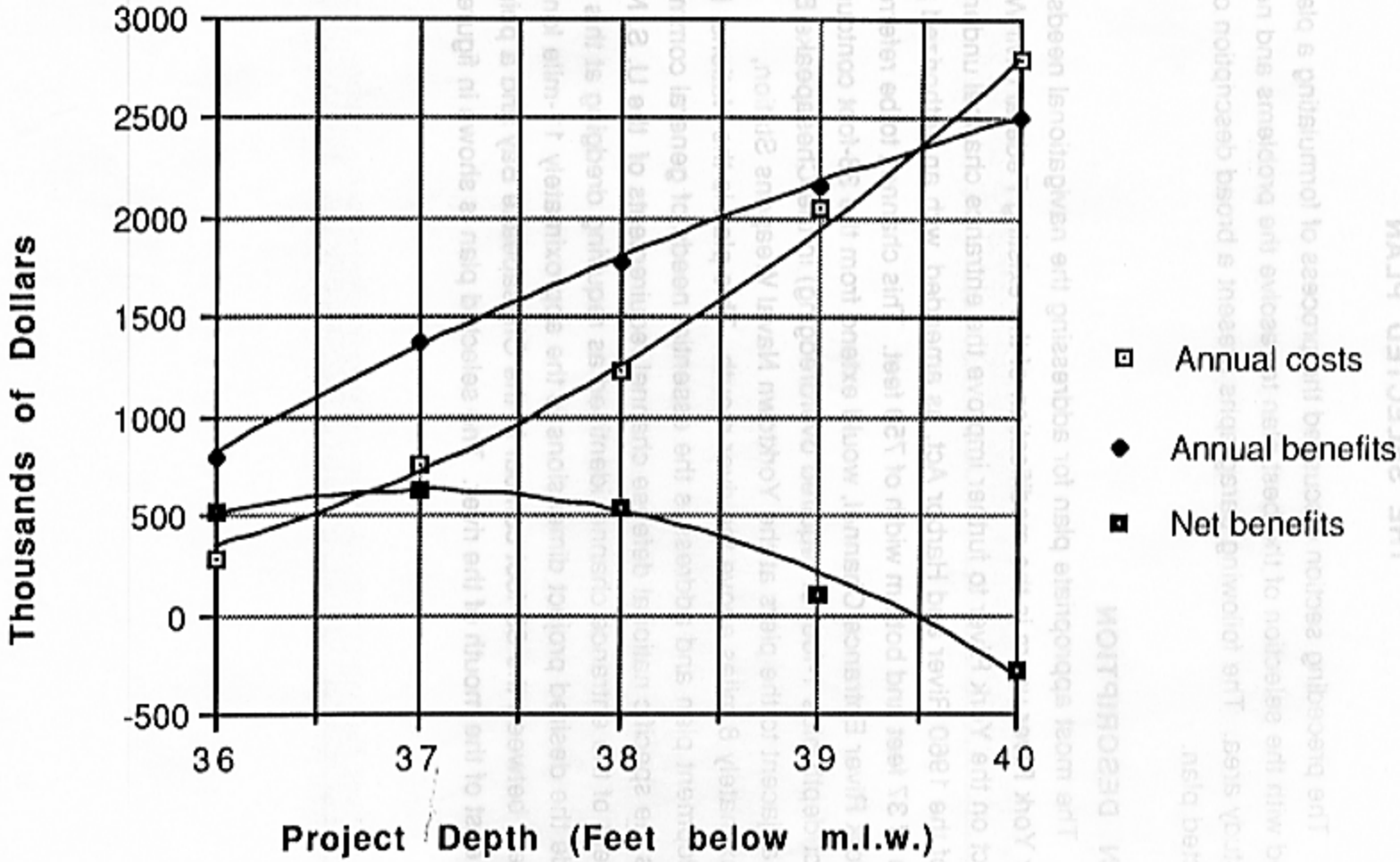

Figure 9. Graphic Presentation of Project Economics

THE SELECTED PLAN

The preceding section discussed the process of formulating a plan. It ended with the selection of the best plan to resolve the problems and needs of the study area. The following paragraphs present a broad description of the selected plan.

PLAN DESCRIPTION

The most appropriate plan for addressing the navigational needs of the lower York River users is the modification of the existing Federal Civil Works project on the York River to further improve the entrance channel under Section 107 of the 1960 River and Harbor Act, as amended, with an authorized project depth of 37 feet and bottom width of 750 feet. This channel, to be referred to as the York River Entrance Channel, would extend from the 38-foot contour (37-foot project depth plus 1-foot of required overdredging) in the Chesapeake Bay to a point adjacent to the piers at the Yorktown Naval Weapons Station, approximately 8 miles above the river mouth. This plan is the National Economic Development plan and addresses the essential needs of general commerce and meets the specific national defense channel requirements of the U. S. Navy. The segment of the entrance channel identified as requiring dredging at this time to provide the desired project dimensions is the approximately 11-mile long segment between the 38-foot contour in the Chesapeake Bay and a point about 4 miles east of the mouth of the river. The selected plan is shown in figure 10.

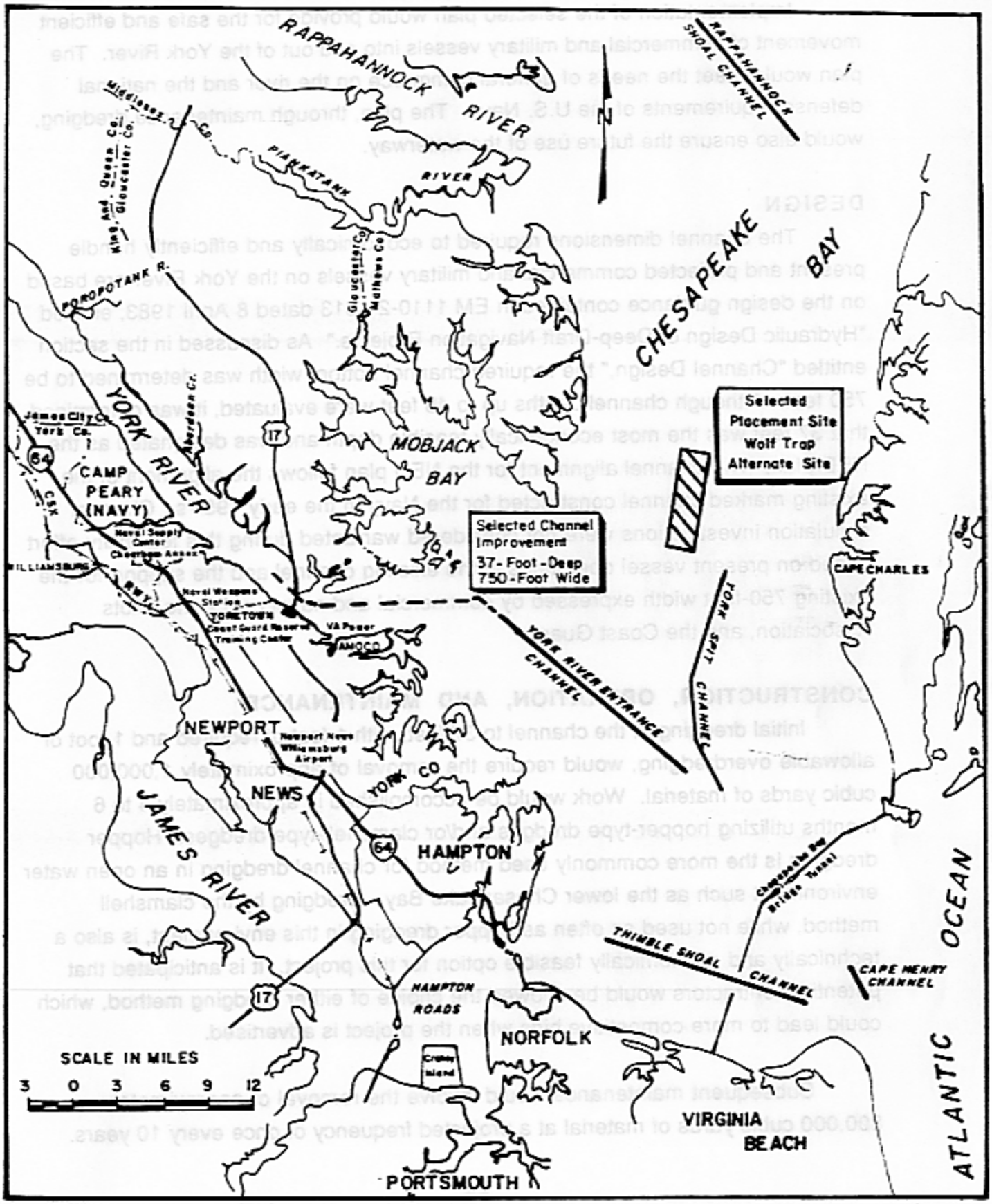

Figure 10. The Selected Plan

PLAN ACCOMPLISHMENTS

Implementation of the selected plan would provide for the safe and efficient movement of commercial and military vessels into and out of the York River. The plan would meet the needs of general commerce on the river and the national defense requirements of the U.S. Navy. The plan, through maintenance dredging, would also ensure the future use of the waterway.

DESIGN

The channel dimensions required to economically and efficiently handle present and projected commercial and military vessels on the York River are based on the design guidance contained in EM 1110-2-1613 dated 8 April 1983, entitled "Hydraulic Design of Deep-Draft Navigation Projects." As discussed in the section entitled "Channel Design," the required channel bottom width was determined to be 750 feet. Although channel depths up to 45 feet were evaluated, it was determined that 37 feet was the most economically feasible depth and was designated as the NED plan. The channel alignment for the NED plan follows the alignment of the existing marked channel constructed for the Navy in the early 1950's. Channel simulation investigations were not considered warranted during this feasibility effort based on present vessel operations in the existing channel and the support for the existing 750-foot width expressed by commercial and naval users, the Pilots Association, and the Coast Guard.

CONSTRUCTION, OPERATION, AND MAINTENANCE

Initial dredging of the channel to 37 feet, with 1 foot of required and 1 foot of allowable overdredging, would require the removal of approximately 1,000,000 cubic yards of material. Work would be accomplished in approximately 4 to 6 months utilizing hopper-type dredges and/or clamshell-type dredges. Hopper dredging is the more commonly used method for channel dredging in an open water environment such as the lower Chesapeake Bay. Dredging by the clamshell method, while not used as often as hopper dredging in this environment, is also a technically and economically feasible option for this project. It is anticipated that potential contractors would be allowed the choice of either dredging method, which could lead to more competitive bids when the project is advertised.

Subsequent maintenance would involve the removal of approximately 800,000 cubic yards of material at a projected frequency of once every 10 years.

Periodic condition surveys would be accomplished at 3-year intervals between maintenance dredging.

DREDGED MATERIAL PLACEMENT

All initial and maintenance dredged material would be deposited in the Wolf Trap (Alternate) Disposal Site, as shown in figure 10. This 2,300-acre (4,500 acres with buffer zone) site is located in the Chesapeake Bay east of New Point Comfort and south of Wolf Trap Light. Water depths in the site range from 32 to 37 feet below mean low water.

Coordination with representatives of the Virginia Institute of Marine Science (VIMS) during the course of this study have led to several recommendations for the future use of the Wolf Trap (Alternate) Site. These are: (1) if possible, dredged material should be placed in a relatively thin layer, this allows for better and more rapid recruitment of benthic organisms; (2) patchy thickness is preferred over a homogeneous thick layer; (3) depth of placement site should be kept at about 9 to 10 meters since resource value is lower for crabs and other, more sedentary organisms at depths shallower than 9 meters (but, probably would not be of lower value than the site was originally--a trough of low resource value). The VIMS recommendations will be adhered to as thoroughly as possible during the use of the Wolf Trap (Alternate) Site with the implementation of the selected project.

There is the potential that a portion of the material to be dredged could be of suitable quality and in sufficient quantity to be used for beach nourishment purposes. During the Plans and Specifications phase of this project, further dredged material investigations will be accomplished to document the location, quantity, and quality of sand that will be dredged to provide the dimensions of the selected project. This information will be made available to officials of the Commonwealth of Virginia and the localities in the vicinity of the project area. Any decision to place suitable sand on beaches within the vicinity of the project could result in revisions to the project cost estimate and implementation schedule.

ENVIRONMENTAL IMPACTS

The environmental impacts which could result from implementation of the selected plan are expected to be relatively minor, of short duration, and, as proposed, will not create any significant or controversial adverse environmental

effects. The two impact areas would be the existing entrance channel bottom and the Wolf Trap (Alternate) Disposal Site. Environmental impacts of the selected plan are detailed in the Final Environmental Assessment.

Significant Resources

No long-term, major adverse effects are anticipated on water or sediment quality within the dredging or dredged material placement areas.

No special measures will be employed to reduce potential impacts to the non-commercial benthic community because no evidence indicates that the entrance channel area or the Wolf Trap (Alternate) Site harbors any unique characteristics or exceptionally diverse or productive communities of such benthos. Fairly rapid recolonization of the non-commercial community in the Wolf Trap (Alternate) Site is expected within 1-2 years after the placement of dredged material.

Shellfish resources will not be significantly impacted by the project. Commercially exploitable concentrations of oyster resources in the lower York River and the lower Chesapeake Bay are not present due to destructive impacts of the MSX virus and predatory oyster drills. Hard clams are present only at low density within the project area. Commercially exploitable quantities are sufficiently distant from the impact area so that no adverse impacts to this resource are anticipated. Finfish resources, whether commercial or sport oriented, are not expected to be adversely affected by project activities. The Virginia Institute of Marine Science has reported that commercially exploitable crabs overwinter in the Wolf Trap (Alternate) Site and has recommended to the Virginia Marine Resources Commission (VMRC) that a time-of-year restriction be imposed in order to avoid impacts to this fishery (see section to follow entitled "RESOURCE PROTECTION MEASURES").

There should be no significant adverse impacts to wetland habitats due to the implementation of the selected plan. The closest submerged aquatic vegetation beds are located more than 1 mile away from the channel. Dredged material placement is not expected to raise bottom elevations to the extent that they would no longer be within their existing aquatic habitats, i.e., intertidal or subtidal.

Threatened and Endangered Species

VIMS has indicated that endangered and threatened sea turtles may be present in the project area from mid-May to mid-November. Consultation with the National Marine Fisheries Service has led to the recommendation of time-of-year restrictions on hopper dredging to protect sea turtles. If hopper dredging is to take place during the time period which is restricted for sea turtles (mid-May through mid-November), precautions would be taken to avoid impacts to the turtles (see section to follow entitled "RESOURCE PROTECTION MEASURES"). Clamshell dredging would have no impact on sea turtles.

SOCIAL AND CULTURAL RESOURCES

Adoption of this alternative is not projected to have any major social or cultural resource impacts. Since the channel dimensions would be less than those that were provided when the channel was dredged in 1951-52, no additional development would occur as a result of this plan. Since both the channel and the Wolf Trap (Alternate) Disposal Site have been previously disturbed, no additional disruption of archaeological resources would be expected from project implementation. The Virginia Department of Historic Resources was contacted with regard to this study and has stated that no field survey will be necessary for the selected plan.

RESOURCE PROTECTION MEASURES

State Water Quality Certification pursuant to Section 401 of the Clean Water Act has been applied for and received from the Commonwealth of Virginia. A permit was applied for and received from the Virginia Marine Resources Commission (VMRC) in compliance with Section 62.1-3 of the Code of Virginia (encroachment in, on, or over State-owned subaqueous bottoms). A condition of the VMRC permit requires that "No overboard disposal of dredged material shall be performed during the period from November 15 through March 30 of any calendar year in order to minimize potential impacts to overwintering blue crabs and the crab dredge fishery." The State Water Quality Certification and the VMRC permit are included in appendix D.

Consultation under Section 7 of the Endangered Species Act of 1973, as amended, has led to the National Marine Fisheries Service (NMFS) recommending time-of-year restrictions (mid-May through mid-November) on hopper dredging to protect sea turtles. If hopper dredging is to take place during this restricted time

period, precautions would be taken to avoid impacts to the turtles. These precautions would include:

(1) Initiation of an observer program with on-board biologists to document the take of sea turtles by the dredge, and the modification of gear to screen discharge ports for the presence of sea turtle parts.

(2) Issuance of (and adherence to by the Corps) an "Incidental Take Statement" by NMFS (See paragraph 5.18 of the Environmental Assessment).

Because of the VMRC time-of-year restrictions at the placement site regarding the overwintering crabs (no overboard disposal of dredged material during the period from November 15 through March 30 of any calendar year), it would not be possible to completely avoid hopper dredging during the time period when sea turtles are expected to occupy the bay. Avoidance, however, will be accomplished to the greatest extent possible. Coupled with the VMRC restrictions, the total prohibited period on the project would extend from 16 May through 30 March, leaving only a 1.5 month unrestricted period from 1 April through 15 May of any calendar year. Because the time required for dredging the channel is approximately 4 months, it is necessary that at least 2.5 months of hopper dredging be performed during the turtle restriction period, thus requiring that the turtle observer program be implemented and that the Corps adhere to an "Incidental Take Statement" by NMFS.

As indicated in the section entitled "CONSTRUCTION, OPERATION, AND MAINTENANCE," clamshell dredging is a technically and economically feasible alternative method available to potential contractors for partial or total dredging of the recommended project. The clamshell dredge, which would have no impact on sea turtles, could be used to continue dredging in the event that hopper dredging must be halted to comply with the "Incidental Take Statement." Potential contractors would also have the option of basing their bid on the use of the clamshell method, and thus preclude the need for protective measures related to sea turtles.

With the implementation the safeguards discussed above, it is not anticipated that there would be any significant adverse impact to sea turtles. Similarly, impacts to the overwintering blue crabs would be minimized by adherence to the VMRC time-of-year restrictions at the dredged material placement site.

ECONOMIC EVALUATION OF THE SELECTED PLAN

The following paragraphs present the benefits, costs, and justification of the selected plan.

Benefits

The selected plan of improvement for the lower York River would allow quantifiable benefits of $1,385,000 to accrue to the major commercial and military users of the river. The benefits are defined as the reduction in vessel transportation cost and the elimination of navigational risks, as summarized in the following table. A detailed evaluation of benefits is presented in appendix B.

Table 12. AVERAGE ANNUAL BENEFITS OF THE SELECTED PLAN

Item	Value ($)
Commercial	
Transportation Savings and Elimination of Risks	1,243,000
Military	
Transportation Savings	142,000
TOTAL	1,385,000

Costs

The estimated first cost, maintenance cost, and annual charges of the selected plan are based on October 1992 price levels and are summarized in the following tables. The estimates are based on the use of a single "Manhattan Island" class, self-propelled hopper dredge with 2 dragheads and a nominal capacity of 3,600 cubic yards. The life of the project is 50 years and the interest rate is 8-1/4 percent. Specifics regarding assumptions used and uncertainties associated with the development of the cost estimates for the selected plan are presented in appendix A. Also included in appendix A are an alternative estimate of the cost to dredge the selected plan by clamshell method (see table A-5) and the rationale for basing the project cost estimate on the use of a hopper dredge.

Table 13. THE SELECTED PLAN - ESTIMATED FIRST COST WITH STANDARD ACCOUNT CODES AND AVERAGE ANNUAL CHARGES

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
12.-.-.-	NAVIGATION PORTS & HARBORS				
12.1.-.-	PORTS				
12.1.A.-	Mobilization and Demobilization	1	LS	314,000.00	314,000
12.1.3.-	Hopper Dredging	1,000,000	CY	3.30	3,300,000
	Subtotal, Ports				3,614,000
12.1.2.-	Contingencies				436,000
12.-.-.-	Navigation Ports and Harbors Total				4,050,000
29.-.-.-	LOCAL COOPERATION AGREEMENTS				
29.-.-.-	Local Cooperation Agreement	1	LS	20,000.00	20,000
	Subtotal, Local Cooperation Agreements				20,000
29.0.Z.-	Contingencies				3,000
29.-.-.-	Local Cooperation Agreements Total				23,000
30.-.-.-	ENGINEERING AND DESIGN				
30.D.-.-	Environmental and Regulatory Activities	1	LS	5,000.00	5,000
30.H.-.-	Plans and Specifications	1	LS	15,000.00	15,000
30.J.-.-	Design Related Engineering				
30.J.1.-	Supplemental Geotech Investigations	1	LS	5,000.00	5,000
30.J.4.-	Obstruction Investigation Surveys	1	LS	138,000.00	138,000
30.J.9.-	Channel Survey, Sta. -16+00 to 740-00	1	LS	92,000.00	92,000
30.J.9.-	Placement Site Survey - Wolf Trap	1	LS	110,000.00	110,000
30.P.-.-	Cost Engineering	1	LS	3,000.00	3,000
30.Q.-.-	Construction Contract Award Activities	1	LS	2,000.00	2,000
30.S.-.-	Engrg & Design Phase Technical Mgmt	1	LS	30,000.00	30,000
30.Z.-.-	Miscellaneous Activities	1	LS	23,500.00	23,500
	Subtotal, Engineering and Design				423,500
30.0.Z.-	Contingencies				63,500
30.-.-.-	Engineering and Design Total				487,000

Table 13. THE SELECTED PLAN - ESTIMATED FIRST COST WITH STANDARD ACCOUNT CODES AND AVERAGE ANNUAL CHARGES (Continued)

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
31.-.-.-	CONSTRUCTION MANAGEMENT				
31.B.-.-	Contract Administration	1	LS	60,000.00	60,000
31.E.-.-	Inspection and Quality Assurance	1	LS	60,000.00	60,000
31.E.3.-	Quantity Surveys and Estimates	1	LS	170,000.00	170,000
31.Z.- -	Miscellaneous Expenses	1	LS	5,000.00	5,000
	Subtotal, Construction Management				295,000
31.0.Z.	Contingencies				45,000
31.-.-.-	Construction Management Total				340,000
	TOTAL PROJECT COSTS				4,900,000
	INTEREST DURING CONSTRUCTION				67,000
	TOTAL INVESTMENT COST				5,017,000
	AVERAGE ANNUAL CHARGES				418,000

Table 14. ESTIMATED MAINTENANCE COST AND ANNUAL CHARGES FOR THE SELECTED PLAN

Item	Cost ($)
NAVIGATION CHANNEL - MAINTENANCE DREDGING	
Mobilization and Demobilization	314,000
Dredging -800,000 c.y. at $3.10/c.y.	2,480,000
SUBTOTAL	2,794,000
Contingencies	696,000
TOTAL - Dredging cost	3,490,000
Engineering and Design	180,000
Supervision and Administration	215,000
Non-Federal and Naval Maintenance of Berthing Areas	450,000
TOTAL PROJECT MAINTENANCE COST	4,335,000
AVERAGE ANNUAL CHARGES (a)	332,000

(a) $37,800 of which is the estimated average annual cost of non-Federal and Naval maintenance of berthing areas.

Justification

A comparison of the estimated benefits and cost of the selected plan of improvement is shown in the following table.

Table 15. ECONOMICS OF SELECTED PLAN

Item	Amount ($)
Average annual benefits	1,385,000
Average annual costs	750,000
Benefit-to-cost ratio	1.85
Net remaining benefits	635,000

DIVISION OF PLAN RESPONSIBILITIES

The following paragraphs discuss the local cooperation requirements and the cost-sharing arrangements as related to the selected plan.

Cost Apportionment

Section 101 of the Water Resources Act of 1986 requires that the local sponsor share in the cost of the construction and modification of the general navigation features of a Federal Civil Works project. The local share is a percentage of the cost that varies according to the range of water depths that is being provided by the project. For channels with depths up to 20 feet, the percentage is 10 percent. For channels with depths greater than 20 feet up to 45 feet, the percentage is 25 percent. For channels with depths greater than 45 feet, the percentage is 50 percent. This variable cost share is to be paid during project construction. In addition, Section 101 requires that the sponsor pay an

additional 10 percent of the construction costs at the completion of the project or over time, up to 30 years, with interest. Credit against this 10 percent contribution is allowed for the value of lands, easements, rights-of-way, relocations, and dredged material placement areas (LERRD) provided by the project local sponsor.

In addition to the cost-sharing requirements imposed by Section 101 of the Water Resources Development Act of 1986, legislative authorities also impose specific Federal funding limits on each specific project implemented under Section 107 of the 1960 River and Harbor Act, as amended. The limit is $4,000,000, which includes project study and implementation costs. While this limit is meant to restrict Federal financial participation in a project not specifically authorized by the Congress, there is no limit on the total cost of a project implemented under the Section 107 authority. Prior to project implementation, the project sponsor must agree to pay all project costs in excess of the Federal funding limit.

Operation and maintenance of the project is 100 percent Federal up to the Section 107 administrative limit of the greater of $4,500,000 or 2.25 times the Federal costs of the project, including the costs for the reconnaissance through construction phases. These expenditures are computed on a present worth basis starting with the date the sponsor accepts the project. The discount rate to be used in determining the value of future operations and maintenance expenditures is the rate applicable to the evaluation of Federal water resources projects in the Federal fiscal year of the first construction contract award. When Federal participation ceases, the operation and maintenance of the project becomes the responsibility of the local sponsor. The cost of maintaining berthing areas needed by the Non-Federal and Naval users to utilize the project is the responsibility of the project users.

Table 16 presents the cost-sharing requirements for the selected 37-foot project on the lower York River in accordance with the guidance contained in the Water Resources Development Act of 1986 and the administrative limitations imposed on Section 107 projects.

Table 16. COST-SHARING FOR THE SELECTED PLAN

Item	Cost ($)
Estimated Project Costs:	
Construction (a)	4,900,000
LERRD (b)	0
SUBTOTAL	4,900,000
Aids to navigation	0
TOTAL	4,900,000
Federal First Costs	
Construction (65%) (c)	3,185,000
LERRD (b)	0
Aids to navigation	0
TOTAL FEDERAL COSTS	3,185,000
Non-Federal First Costs	
Construction - up front 25%	1,225,000
Financed over 30 years - 10%	490,000
LERRD Credit	0
TOTAL NON-FEDERAL COST	1,715,000
TOTAL PROJECT COSTS	4,900,000

(a) Includes $510,000 for Plans and Specifications.
(b) Lands, easements, rights-of-way, relocations, and disposal costs.
(c) The Federal share up front is 75% to account for the 10% non-Federal share that will be financed over 30 years.

Table 17 presents the estimated Federal cost limitation for the selected plan. As indicated in the table, the selected plan complies with ER 1105-2-100, dated 20 December 1990, entitled "Guidance for Conducting Civil Works Planning Studies" in that total Federal expenditures for its construction and operation and maintenance over 50 years do not exceed 2.25 times the Federal costs of the project when discounted at the current discount rate of 8-1/4 percent.

Table 17. ESTIMATED FEDERAL COST LIMITATION FOR THE SELECTED PLAN

Project Data	Cost ($)
Federal Costs:	
Reconnaissance phase	0
Feasibility phase (a)	50,000
Plans and Specifications (65%)	331,500
Construction (65%)	2,853,500
LERRD (b)	0
Aids to navigation	0
TOTAL	3,235,000
Estimated average annual Federal O&M (c)	294,200
Total Project Limit	
Federal costs x 2.25	7,278,800
Minimum total project limit	4,500,000
Total project limit	7,278,800
Construction - 65%	2,853,500
Limit For Future O&M	
Total project limit	7,278,800
(Federal costs)	-3,235,000
Limit for future O&M	4,043,800
Value of future O&M based on a discount rate of 8-1/4% over a 50-year project life	3,587,000

(a) Funds expended after study was moved from the comprehensive York River survey investigation to the Continuing Authorities Program.
(b) Lands, easements, rights-of-way, relocations, and disposal costs.
(c) Total average annual charges minus Non-Federal and Naval costs to maintain berthing areas ($332,000 - $37,800).

Local Cooperation

The non-Federal sponsor of this study is the Virginia Port Authority, a public body that is legally and financially capable of furnishing the required local cooperation for the selected navigation project. The required items of local cooperation are specified in the draft Local Cooperation Agreement which has been developed during the present level of investigations. Prior to project

implementation, a final Local Cooperation Agreement must be coordinated and executed between the non-Federal sponsor and the Federal Government. Port officials have reviewed the draft Local Cooperation Agreement and have indicated, by letter, their intent to sign the final version of this document prior to the implementation of the selected plan. This letter, dated July 23, 1992, is included in appendix D. The following items are excerpted from the draft Local Cooperation Agreement.

> "a. Assume full responsibility for all project costs in excess of the Federal cost limitation of $4,000,000.
>
> "b. Assume responsibility for the operation and maintenance of the general navigation features of the Project when the Government's expenditures for this responsibility have reached the greater of $4,500,000 less the Government's share of the costs of the general navigation features of the Project, including all planning studies costs, or, 2.25 times the Government's share of the construction costs of the general navigation features of the Project, including all planning studies costs, both discounted on a present worth basis starting with the date the sponsor accepts the general navigation features of the Project.
>
> "c. Provide and maintain, at its own expense, all project features other than those for general navigation features of the Project, including dredged depths commensurate with those in related general navigation features in berthing areas and local access channels serving the general navigation features.
>
> "d. Provide to the Government all lands, easements and rights-of-way, including dredged material disposal areas, and perform, or assure performance of, all alterations or relocations of facilities and utilities (except relocations or alterations of highway bridges and railroad bridges and approaches thereto), determined by the Government to be necessary for construction, operation, or maintenance of the Project.

"e. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation facilities assigned to commercial navigation:

"1. 10 percent of the costs attributable to the portion of the Project which has a depth not in excess of 20 feet; and,

"2. 25 percent of the costs attributable to the portion of the Project which has a depth in excess of 20 feet but not in excess of 45 feet.

"f. Repay, with interest, over a period not to exceed 30 years following completion of the period of construction of the Project, an additional 0 to 10 percent of the total cost of construction of general navigation features of the Project assigned to commercial navigation, depending on the value of the credit for lands, easements, rights-of-way, and dredged material placement (LERRD). If the credit allowed for such items is less than 10 percent of the total cost of construction of the general navigation features of the Project assigned to commercial navigation, the Local Sponsor shall repay a percentage of said total cost equal to the difference between 10 percent of the total cost and the percentage of the total cost represented by the value of such items. If the credit allowed is equal to or greater than 10 percent of said total cost, the Local Sponsor shall not be required to repay any additional percentage of the total cost.

"g. Furnish to the Government all lands, easements, and rights-of-way, including suitable borrow and dredged material disposal areas, as may be determined by the Government to be necessary for construction, operation, and maintenance of the general navigation features, and shall furnish to the Government evidence supporting the Local Sponsor's legal authority to grant rights-of-way to such lands. The necessary lands, easements, and rights-of-way may be provided incrementally, but all lands, easements, and rights-of-way determined by the Government to be necessary for work to be performed under a construction contract must be furnished prior to the advertisement of the construction contract.

"h. Provide, or pay to the Government the cost of providing, all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, determined by the Government to be necessary for construction, operation, or maintenance of the general navigation features of the Project.

"i. Shall accomplish or arrange, upon notification from the Government, for accomplishment at no cost to the Government all alterations and relocations of buildings, highways, railroads, storm drains, and other facilities, structures, and improvements, determined by the Government to be necessary for construction, operation, or maintenance of the general navigation features of the Project.

"j. Shall perform or assure performance, upon notification from the Government, of all necessary alterations and relocations of pipelines, cables, and other utilities.

"k. Shall comply with the applicable provisions of the Uniform Relocations 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 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 for construction and subsequent operation and maintenance of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act."

PLAN IMPLEMENTATION

The following paragraphs discuss the steps and funding requirements leading to the implementation of the selected plan.

Non-Federal Sponsor Financial Support

In letter dated July 23, 1992, the non-Federal sponsor indicated its intent to provide the items of local cooperation, including its share of the project costs, as detailed in the Local Cooperation Agreement. Funds will be provided through the normal Commonwealth budgetary and appropriations process upon the authorization by the Virginia General Assembly and the Governor.

Implementation Schedule

Table 19 presents the current schedule of major events leading to the implementation of the selected plan. Portions of this schedule may be modified as needed during the Plans and Specifications effort.

Table 18. IMPLEMENTATION SCHEDULE FOR THE SELECTED PLAN

Task name	Start date	Duration (months)	End date
District submit revised DPR to Division	31 May 93	0	31 May 93
Division review revised DPR	1 Jun 93	1.2	7 Jul 93
Division approve revised DPR	7 Jul 93	0	7 Jul 93
Division submit DPR to OCE	8 Jul 93	0.2	14 Jul 93
Wash. Level review of DPR	15 Jul 93	2.0	15 Sep 93
OCE approve DPR	15 Sep 93	0	15 Sep 93
District receives P&S funding	16 Sep 93	0.5	1 Oct 93
Plans and Specifications	1 Oct 93	13	28 Oct 94
District submit P&S (E-10)	31 Oct 94	0	31 Oct 94
Division review P&S	31 Oct 94	1.1	2 Dec 94
Division approves P&S (E-11)	5 Dec 94	0	5 Dec 94
Prepare final LCA	22 Feb 94	2	22 Apr 94
LCA review process	25 Apr 94	4	24 Aug 94
HQ approve final LCA	25 Aug 94	0	25 Aug 94
Assemble project approval package	22 Feb 94	2	22 Apr 94
Project approval process	25 Apr 94	4	24 Aug 94
HQ Project approval (C-12)	25 Aug 94	0	25 Aug 94
Prepare to execute LCA	25 Aug 94	1	25 Sep 94
LCA execution	26 Sep 94	0	26 Sep 94
Sponsor provide required $$	3 Oct 94	0	3 Oct 94
Ready to advertise	5 Dec 94	0	5 Dec 94
CBD announcement	6 Dec 94	0.7	26 Dec 94
Invitation for bids	26 Dec 94	1.1	27 Jan 95
Government estimate	11 Jan 95	0.6	27 Jan 95
Bid opening	27 Jan 95	0	27 Jan 95
Prepare to award contract	27 Jan 95	1	27 Feb 95
Prepare funds request	7 Feb 95	0.2	13 Feb 95
Constr. funds received (C-13)	21 Feb 95	0	21 Feb 95
Award construction contract	28 Feb 95	0	28 Feb 95
Post-award activities	28 Feb 95	0.7	20 Mar 95
Notice to Proceed	21 Mar 95	0	21 Mar 95
Mobilization	21 Mar 95	1	18 Apr 95
Pre-dredge surveys & estimates	28 Mar 95	2.0	26 May 95
Channel dredging	19 Apr 95	3.9	15 Aug 95
Supervision & inspection	15 Feb 95	7.0	15 Sep 95
Post-dredge surveys & estimates	29 May 95	3	28 Aug 95
Construction complete (C-14)	18 Sep 95	0	18 Sep 95
No dredging permitted - VMRC	15 Nov 94	4.5	30 Mar 95
Unrestricted dredging season	31 Mar 95	1.5	15 May 95
Restricted hopper dredging	16 May 95	6	14 Nov 95

Funding Requirements

Table 19 presents the funding requirements by Fiscal Year necessary to implement the selected plan in accordance with the implementation schedule.

Table 19. FUNDING REQUIREMENTS BY FISCAL YEAR

Item	FY94 Current ($)	FY95 Current ($)	FY94 Fully Funded ($)	FY95 Fully Funded ($)
Plans and Specifications				
Local Cooperation Agreement	23,000	—	24,000	—
Engineering and Design	447,000	40,000	475,500	42,500
Subtotal	470,000	40,000	499,500	42,500
Construction				
Non-Federal Contribution (a)	—	1,715,000	—	1,821,000
Federal Contribution	—	2,675,000	—	2,840,000
Subtotal	—	4,390,000	—	4,661,000
Subtotal	470,000	4,430,000	499,500	4,703,500
Total	4,900,000		5,203,000	

(a) Includes Non-Federal portion that can be financed over 30 years ($490,000 in current dollars, $520,000 in fully funded dollars).

FINDING OF NO SIGNIFICANT IMPACT

York River, Virginia (Entrance Channel)

I have reviewed and evaluated the Environmental Assessment for the project in terms of the overall public interest. The proposal would provide for the modification of the existing Federal Civil Works project on the York River to further improve the entrance channel under Section 107 of the 1960 River and Harbor Act, as amended, with an authorized depth of 37 feet and bottom width of 750 feet. This channel, to be referred to as the York River Entrance Channel, would extend from the 38-foot contour (37-foot project depth plus 1-foot of required overdredging) in the Chesapeake Bay to a point adjacent to the piers at the Yorktown Naval Weapons Station, approximately 8 miles above the river mouth. This plan is the National Economic Development plan and addresses the essential needs of general commerce and meets the specific national defense channel requirements of the U.S. Navy. Through periodic maintenance, the plan would also ensure continued use of the waterway.

The segment of the entrance channel identified as requiring dredging at this time to provide the desired project dimensions is the approximately 11-mile long segment between the 38-foot contour in the Chesapeake Bay and a point about 4 miles east of the mouth of the river. Initial dredging under authority of Section 107 of the 1960 River and Harbor Act would require removal and dredged material placement of approximately 1,000,000 cubic yards of material. Work would be accomplished in approximately 4 to 6 months utilizing hopper-type and/or clamshell-type dredges. Maintenance would be required every 10 years with the removal of 800,000 cubic yards at each interval. The Wolf Trap (Alternate) Disposal Site, located in the Chesapeake Bay east of New Point Comfort and south of Wolf Trap light, near the southeastern end of the channel, will be used for dredged material placement.

Dredging of the proposed channel and dredged material placement, as proposed, will not cause any significant or controversial adverse effects to either man's environment or the estuarine/marine habitat. Threatened or endangered sea turtles may be present in the project area from mid-May to mid-November. Endangered Species Act, Section 7 Consultation with the National Marine Fisheries Service has led to a recommendation that safeguards be employed if hopper dredging takes place during the time period that sea turtles may be present. Alternatives to hopper dredging, such as clamshell dredging, do not have the potential to impact sea turtles. Time-of-year restrictions, as specified by the Virginia Marine Resources Commission, will be employed to avoid impacts to the overwintering crab fishery. With these safeguards in place, there should be no significant impact to sea turtles or the crab fishery . There will be some short-term effects on water quality during dredging and dredged material placement in the open

water site. Benthic (bottom dwelling) organisms will be lost or displaced at the dredging and dredged material placement site. Recovery is expected within 1 to 2 years. Because of the lack of significant impacts, an Environmental Impact Statement will not be required.

28 Jul 92
Date

R. C. JOHNS
Colonel, Corps of Engineers
District Engineer

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FINAL ENVIRONMENTAL ASSESSMENT

York River, Virginia (Entrance Channel)

1. Summary of Proposed Action:

1.01 The York River is one of the major estuarine tributaries of the lower Chesapeake Bay. It flows southeasterly, with no meandering, from the confluence of the Pamunkey and Mattaponi Rivers at West Point and empties into the bay approximately 30 miles north of Norfolk, Virginia. The York River parallels the James and Piankatank Rivers which are south and north of the York River, respectively. Throughout its 34-mile length, the river is tidal, becoming non-tidal near its upstream terminus marked by the confluence of the Pamunkey and Mattaponi Rivers.

1.02 The Federal deep-draft navigation project on the York River consists of a river channel and an entrance channel. Further upstream, on the Pamunkey River, is an additional Federal navigation channel. This latter channel, which is for shallower draft vessels, has a maximum authorized depth of 7 feet.

1.03 The depth of the river channel, adopted by the River and Harbor Act of 14 June 1880, is authorized for 22 feet from the river mouth to West Point, Virginia. Channel width is authorized at 300 feet. Also included in the Federal project are a 22-foot-deep turning basin and an 8,800-foot dike on the south bank at West Point.

1.04 In 1951-52, the Corps of Engineers deepened and widened the natural entrance channel portion of the Federal Civil Works project on the York River to serve the national defense needs of the U. S. Navy. The resultant channel, sometimes referred to as the "Navy Channel" was requested and funded by the Department of the Navy to serve naval vessels taking on munitions and supplies at the Naval Weapons Station at Yorktown, Virginia. Original military project dimensions provided for a 39-foot-deep, 750-foot wide, and approximately 11-mile long channel extending from the 39-foot contour in the Chesapeake Bay to a point about 4 miles east of the mouth of the York River. The incremental depth and width of the entrance channel below 22 feet and beyond 300 feet, respectively, are not authorized components of the Federal Civil Works project on the York River.

1.05 This document addresses a proposal to modify the existing Federal Civil Works project on the York River to further improve the entrance channel under Section 107 of the 1960 River and Harbor Act, as amended, with an authorized depth of 37 feet and bottom width of 750 feet. This channel, to be referred to as the York River Entrance Channel, would extend from the 38-foot contour (37-foot project depth plus 1-foot of required overdredging) in the Chesapeake Bay to a point adjacent to the piers at the Yorktown Naval Weapons Station, approximately 8 miles above the river mouth. This plan is the National Economic Development plan and addresses the essential needs of general

commerce and meets the specific national defense needs of the United States Navy.

1.06 The segment of the entrance channel identified as requiring dredging at this time to provide the desired project dimensions is the approximately 11-mile long segment between the 38-foot contour in the Chesapeake Bay and a point about 4 miles east of the mouth of the river. Initial dredging under the authority of Section 107 of the 1960 River and Harbor Act would require removal and overboard placement, by hopper dredge and/or clamshell dredge, of approximately 1,000,000 cubic yards of material. Projections indicate a relatively low frequency of maintenance dredging. Maintenance is expected to be required once every 10 years with removal of 800,000 cubic yards at each interval. An overboard dredged material placement site, the Wolf Trap (Alternate) Disposal Site will be used as the dredged material placement site. The 2,300-acre (4,500 acres with buffer zone) Wolf Trap (Alternate) Disposal Site is located in the Chesapeake Bay east of New Point Comfort and south of Wolf Trap light (figure 1).

1.07 The hopper dredge is a self-propelled vessel which hydraulically excavates channel sediment and elevates it into the vessel's hoppers for temporary storage. The sediment is drawn up through large suction pipes, usually two, fitted with specially shaped dragheads which are lowered to the required depth and pulled along the area to be dredged. After taking on a full load, the vessel proceeds to the designated placement site where the sediment is dumped by gravity through the vessel's split hull. The vessel is underway while dumping is taking place. The empty dredge then returns to the channel where the entire operation is repeated.

1.08 The clamshell dredge utilizes a bucket operated from a crane or derrick mounted on a barge. The dredge operates in conjunction with two scows, one towing vessel, and one work tug. The dredge would load one scow which, when full, is transported to the designated placement site by the towing vessel. Sediment is dumped at the placement site by the opening of the scow's bottom doors. The towing vessel and scow remain underway while dumping is occurring. On completion of the dump, the doors are closed and the scow is towed back to the dredge where the dredge has been loading the second scow. Upon return, the towing vessel leaves the first scow, now empty, and takes the second loaded scow to the placement site. The work tug is used to maneuver the scows and aid in positioning the dredge. This operation is repeated as the dredge is advanced over the areas of the channel where excavation is required.

2. Need for the Proposed Action:

2.01 Implementation of the selected plan is required for the safe and efficient movement of commercial and military vessel traffic into and out of the York River. The project would meet the needs of the commercial and military users of the waterway. Maintenance dredging would ensure continued use of the waterway by its commercial and military users.

3. Alternatives to the Proposed Action:

3.01 Various alternatives were examined during the plan formulation stages of this study. In addition to the channel plans evaluated, other plans for construction included a petroleum pipeline, offshore terminal, and lightering facility. Four nonstructural measures were also considered. These include lightering (without a constructed facility), transshipment, pilotage regulations, and no action. Each of these alternatives is discussed in detail in the feasibility report.

3.02 An alternative site for overboard dredged material placement was proposed in a previous document on this project dated October 1986. At the time the document was prepared, the Navy Placement Site was proposed for dredged material placement. However, it was determined that the use of the Navy Placement Site could result in the estimated loss of up to $1,000 annually to the winter crab dredging industry over the life of the project. A permit was applied for from the Virginia Marine Resources Commission (March 1986) but was denied because of the potential impact that dredged material placement would have on the crab dredge fishery.

3.03 Consideration was given to the placement of dredged material in the Rappahannock Site, which was utilized for the placement of material resulting from the dredging of the Rappahannock Shoal Channel. This site is located near the northern end of that channel and is conveniently located for use in conjunction with the maintenance of Baltimore District projects. Although the Rappahannock Site could possibly be utilized in conjunction with a project on the York River, it was determined that placement at the Wolf Trap Site was more appropriate. This determination is based on consideration of the overall dredged material management requirements of the Norfolk and Baltimore Districts in the lower Chesapeake Bay and on the considerably shorter and more economical hauling distance from the York River Entrance Channel to the Wolf Trap Site.

3.04 Alternatives to overboard dredged material placement include upland placement and the productive uses of dredged material for habitat development and creation and for the placement of suitable material on erosional shorelines. Placement on an upland site would have minimal to no impacts on the aquatic environment if the dredged material placement area were properly constructed. However, this alternative would adversely impact existing upland habitat at the site. Habitat development and creation were determined to be environmentally infeasible because of concerns about sensitive resources, including submerged aquatic vegetation (SAV's), within proximity to the channel area. With regard to placement on erosional shorelines, existing information suggests that, although sand does exist in portions of the channel bottom, it may not be suitable in quality or available in sufficient quantities or easily and economically separable for beach nourishment uses. The direct impacts of beach placement are based on the abundance and kinds of organisms present, the quantity and quality of the dredged material, and the time of year it is placed on the beach.

3.05 Construction of a pipeline to carry liquified petroleum products from deep water in the lower Chesapeake Bay to the Yorktown refinery (Amoco) and the Virginia Power generating plant could adversely impact wetlands and waterway navigation. These impacts can be minimized by routing the pipeline along an inland route which would avoid areas of substantial wetland or aquatic habitats. A long-term potential impact associated with a petroleum pipeline could be leakages which could have a major adverse impact on these habitats. This potential impact could also be reduced by placing the pipeline route inland.

3.06 The major potential impact of lightering activities would be increased potential for oil spills during lightering and transport of oil to the terminal. Another impact would be the potential for increased vessel accidents due to increased large vessel traffic in the lower Chesapeake Bay, Hampton Roads, and the lower York River.

4. Environmental Setting:

4.01 An extensive description of the setting and environmental resources of the project study area, as developed by the U.S. Fish and Wildlife Service under contract to the U.S. Army Corps of Engineers, is provided in the main text of the feasibility report and in the Fish and Wildlife Service Coordination Act Report, which is included in appendix C. The Fish and Wildlife Service was also contracted by the Corps to prepare a report describing the life history and ecology of the blue crab, Callinectes sapidus, in open waters of the lower Chesapeake Bay. Requested to be included in this report was a discussion of the winter crab dredge fishery that this resource supports. This report is also included in appendix C.

Threatened and Endangered Species

Sea Turtles

4.02 Chesapeake Bay is a major feeding ground and vital habitat for juvenile sea turtles which are on the Federal Endangered Species list. Four species of sea turtles are annual migrants to the area: the Atlantic Loggerhead (Caretta caretta), Kemp's ridley (Lepidochelys kempi), and to a lesser extent, the Atlantic leatherback (Dermochelys coriacea) and the green turtle (Chelonia mydas). The turtles are unable to remain in the bay due to temperature extremes during winter. The turtles migrate to the Bay annually in May and June as sea surface temperatures warm to approximately 18 degrees C, forage throughout the estuary during the summer, then emigrate in the fall.

4.03 The following narrative concerning sea turtles in the Chesapeake Bay and vicinity is taken from the Virginia Journal of Science, Volume 38, Number 4, dated Winter, 1987, entitled "Aspects of the Biology of Virginia's Sea Turtles: 1979-1986" (Keinath, et al., 1987):

4.04 "The four species (that the Virginia Institute of Marine Science has) documented in Virginia's waters, in order of increasing abundance, are green

turtles, leatherbacks, ridleys, and loggerheads. Few verifiable green turtle records from Virginia or adjacent waters exist. The leatherback is the third most abundant species in Virginia but is considered uncommon. Leatherbacks subsist on jellyfish and other soft bodied creatures (Carr, 1952). Two species of jellyfish are extremely abundant in the Bay and flush to the Bay mouth where leatherbacks may congregate to feed."

4.05 "Kemp's ridley is the second most abundant turtle (VIMS has) observed in Virginia. Juvenile Kemp's ridleys appear to use the Chesapeake Bay as a major developmental habitat. There are few places along the Atlantic seaboard where such large concentrations of immature ridleys have been reported. Kemp's ridley is the world's most endangered species of sea turtle (Carr,1977)."

4.06 "Loggerhead turtles are the most abundant sea turtle of coastal United States and likewise in Virginia. Since 1979, VIMS has recorded 853 dead loggerheads and 171 live specimens from Chesapeake Bay and adjacent shores. Because of their abundance, most of (VIMS) studies have focused on loggerheads."

4.07 "Population estimates have been made for loggerhead turtles within Chesapeake Bay using densities obtained from aerial survey counts (Byles, et al., MS). It is estimated that between 2,000 and 10,000 juvenile loggerheads inhabit the Bay south of the Potomac River each summer. Since loggerheads do not inhabit water less than 4 m deep, this estimate is based on 1383 km^2 of water in the lower Bay that is greater than 4 m deep. Turtle densities in Chesapeake Bay obtained from aerial surveys were multiplied by an adjustment factor of 18.8 to account for submerged turtles."

4.08 "Offshore aerial surveys between Cape Hatteras, NC, and Cape Henry, VA, during 1985 and 1986 showed that loggerheads migrated from south of Cape Hatteras into Chesapeake Bight in April and May. Densities of turtles in offshore waters remained relatively constant during summer."

4.09 "Continued stomach content analysis and recent biotelemetric studies (Byles, MS) support the contention that ridleys and loggerheads partition available habitat and food resources in the Chesapeake Bay. Loggerheads are found primarily in river mouths and deeper (>4 m) channels, where they feed on abundant horseshoe crabs. Ridleys forage in shallower waters, such as seagrass beds, which are nursery grounds for their predominant prey, blue crabs (Orth and Heck, 1980)."

4.10 (In summary,) "...Virginia's waters provide important habitat for large numbers of loggerhead sea turtles during the summer. Chesapeake Bay in particular is an important developmental habitat for juvenile loggerhead and Kemp's ridley turtles. Although much has been learned in recent years about sea turtles in Virginia (including species size, sex ratios, stranding statistics and cause of death, diving behavior, migration patterns, age and growth, and blood chemistry), much still needs investigation. Critical information is needed on

energetics, cost of migration, mechanisms of migration, and overwintering habitat."

5. Environmental Impact of the Proposed Action:

5.01 Environmental impacts would result from dredging activities and dredged material placement. The most obvious impact from dredging would be the direct destruction or displacement of benthic macroinvertebrates, i.e., worms, crabs, and mollusks, in the path of the dredge. Past studies have shown that recolonization of a deepened channel by benthic organisms may occur within 2 weeks to 2 years. Even though the original biomass may be attained in that period, recolonization is usually by opportunistic species which may be less valuable to the food chain. Original species diversity is gradually attained and, consequently, the number of bottom-feeding fish, within a relatively short period of time, attains pre-dredging abundance and species diversity. Species type and diversity in the deepened channel may be influenced, to a degree, by the substrate type that is uncovered in the dredged channel. In most cases, bottom sediments will be similar to the pre-dredging conditions. Decreased oxygen supply in and above the substrate may also influence species diversity, but this phenomena will be short-lived. The most important species associated with the lower York River is the blue crab, a species which due to its high mobility is adept at rapidly replacing stock which has been removed by dredging, commercial harvesting, or other similar methods.

5.02 During the dredging operation, bottom sediments would be disturbed and a small percentage placed in suspension. When excessive, turbidity can reduce the penetration of light necessary for photosynthesis by phytoplankton and macrophytes, thus reducing the oxygen supply in the water column. Suspended sediment could cause adverse impacts on filter-feeding organisms. In filter feeders, heavy suspended sediment loads could cause abrasion of gill filaments, clogging of gills, impaired respiration, impaired feeding, reduced pumping rates, retarded egg development, and reduced growth and survival of larvae. Similar impacts could occur to zooplankton, larval fish, and larval blue crabs. These impacts would not readily affect adult fish because of their mobility. However, filter-feeding fish could be affected more than non-filter-feeding fish. Dredging could also result in chemical changes in the water column such as decreased dissolved oxygen levels due to increased oxygen demand resulting from resuspension of nutrients and sediments. Low oxygen levels in the water column could have a compounding effect because the York River has experienced periods of low oxygen levels during summer due to the "red tide" effect caused by high concentrations of dinoflagellates. All conventional dredges generate turbidity in the vicinity of the dredge to a varying degree depending on the type of dredge, the nature of the sediment, and the dredging and placement methods adopted. The turbidity is usually of short duration and normal conditions are restored in a short time. Hopper dredges, because they usually traverse several thousand feet while loading, have the potential to produce a widespread plume. Clamshell dredges are relatively stationary and as a result produce a more localized plume. The levels of

turbidity from either dredging method, however, are comparable and would not produce significant adverse effects.

5.03 The proposed dredging and dredged material placement was evaluated for the likely presence or absence of Hazardous, Toxic, and Radioactive Wastes (HTRW) in the project area in accordance with ER 1165-2-132, "Hazardous, Toxic, and Radioactive Waste Guidance for Civil Works Projects", dated 26 June 1992. This ER [paragraph 4.a. (2)] indicates that "...Dredged material and sediments beneath navigable waters proposed for dredging qualify as HTRW only if they are within the boundaries of a site designated by the EPA or a state for a response action (either a removal action or a remedial action) under CERCLA, or if they are part of a National Priority List (NPL) site under CERCLA." Historical records indicate that York River sediments at the river mouth have not been contaminated by any documented spills. A review of existing and past land uses in the project area do not indicate any HTRW risk nor any CERCLA regulated or NPL sites near the proposed dredging. Near the project, most land areas are residential, wetlands, or are otherwise undeveloped. The Amoco Refinery is the closest industry to the navigation channel. Located approximately 4 miles upstream of the York River mouth, the refinery is approximately 8 miles west of the eastern terminus of the navigation channel.

5.04 The impacts associated with overboard dredged material placement would be similar to those resulting from dredging, except the impact area would be larger. The most obvious and most significant impact from overboard dredged material placement would be direct burial and loss of benthic organisms. There is also the potential for temporary habitat degradation if dredging or dredged material placement results in a significant change in bottom type. Similarity of materials is the single most important factor in determining the potential of an area to regain its predredged material placement biota composition. It has been determined that, for the most part, there will be minimal dissimilarities between present bottom types in the Wolf Trap (Alternate) Disposal Site and dredged materials from the York River Entrance Channel. Any potential adverse impacts to the aquatic system will be minimized by employing such measures as controlled placement of dredged materials within the placement area. Repopulation, by most estimates, would require approximately 2 years. By the second season after each dredging cycle, the population should be nearing its pre-dredged material placement number.

5.05 Between the fall of 1987 and the summer of 1989, approximately 15 million cubic yards of dredged material from the York Spit Channel was placed in the Wolf Trap (Alternate) Disposal Site. Under contract to the Baltimore District Corps of Engineers, the site was intensively monitored by both the Virginia Institute of Marine Science (VIMS) and the U.S Army Corps of Engineers, Waterways Experiment Station (WES). For the purposes of monitoring and dredged material placement, the site was divided into six compartments (figure 2). The major questions which the Baltimore District and the VIMS biologists were attempting to answer were: (1) how do various thicknesses of dredged material influence benthic community structure in a

subtidal, polyhaline estuarine habitat; and (2) following dredged material placement, what are the rates of benthic community recovery along a gradient of dredged material overburden?

5.06 With these objectives in mind, the sampling methodology for benthos conducted by VIMS was as follows:
(1) Community structure was monitored at two dredged material placement cells and two control stations;
(2) Stations within each cell were sampled quarterly for 1 year following dredged material placement, and then in spring for 2 succeeding years (quarterly sampling periods were February, May, August, and November);
(3) For Cell B, sampling was initiated November 1987;
(4) For Cell C, sampling was initiated May 1989;
(5) Control stations (Control 1 and Control 2) were sampled quarterly from November 1987 through May 1990, and again in May 1991.

5.07 The conclusions of the VIMS investigations at Wolf Trap (Alternate) Disposal Site are as follows:
(1) The impacts of dredged material on community structure were greatest for the deepest overburden of dredged material and least for no to low overburdens;
(2) For individual species, response to various dredged material overburdens varies depending on the organism's functional characteristics;
(3) Recovery processes differed at each placement site, but the varying effects of year and season of placement, sediment grain size, and other changes in the environment cannot be evaluated for this study;
(4) Assemblages within dredged material placement cells were indistinguishable from assemblages at control sites within 2-3 years of the initiation of placement activities.

5.08 Norfolk and Baltimore District representatives met with Dr. Linda Schaffner and Dr. Robert Diaz of VIMS on October 3, 1991 to discuss their monitoring and recommendations for future site use. Several recommendations which came out of this meeting are: (1) If possible, dredged material should be placed in a relatively thin layer, this allows for better and more rapid recruitment of benthic organisms; (2) Patchy thickness is preferred over a homogeneous thick layer; (3) Keep depth of placement site at about 9 to 10 meters, resource value is lower for crabs and other, more sedentary organisms at shallower than 9 meters (but, probably would <u>not</u> be of lower value than site was originally...a trough of low resource value). The VIMS recommendations will be adhered to as thoroughly as possible during the use of the Wolf Trap (Alternate) Disposal Site for the proposed York River Entrance Channel dredging.

5.09 If the 1.0 m.c.y. of dredged material were to be placed uniformly over the entire 2,300-acre (4,500 acres with buffer zone) Wolf Trap (Alternate) Disposal Site, it would cover the bottom with approximately 0.3 foot of dredged material. In reality, material will be less uniformly deposited, but would not be placed as a homogeneously thick layer.

5.10 A complete and comprehensive report on the monitoring at the Wolf Trap (Alternate) Disposal Site is being prepared for the Baltimore District Corps of Engineers. The completed report should be available during calendar year 1992.

5.11 State Water Quality Certification pursuant to Section 401 of the Clean Water Act has been applied for and received from the Commonwealth of Virginia. A permit was applied for and received from the Virginia Marine Resources Commission (VMRC) in compliance with Section 62.1-3 of the Code of Virginia (encroachment in, on or over State-owned subaqueous bottoms). A condition of the VMRC permit requires that "No overboard disposal of dredged material shall be performed during the period from November 15 through March 30 of any calendar year in order to minimize potential impacts to overwintering blue crabs and the crab dredge fishery."

5.12 The Corps has consulted with the National Marine Fisheries Service (NMFS) and the Virginia Institute of Marine Science (VIMS) regarding the disposition of sea turtles in the York River and associated waters of the lower Chesapeake Bay. VIMS has conducted biotelemetry (tracking) studies on turtles since 1981. These studies indicate that sea turtles, when present, congregate just outside the river mouths of the lower bay. They are likely to be present within the project area from mid-May through mid-November (water temperatures of 18 degrees C and above), when they migrate to the warmer waters of the Atlantic. None are present in the winter months because the lower water temperatures would be lethal. Only loggerheads have been tagged with transmitters and tracked, but it is suspected that Kemp's Ridleys may also be present on a limited basis. While in the area, they appear to passively drift with the ebb and flood of the tide foraging the bottom for food.

5.13 The biology of the turtles is such that they would not be adversely affected by overboard dredged material placement. Although they are typically below the surface for periods of 1 to 2 hours, they are mobile air breathers capable of avoiding the placement; therefore, they are not subject to the usual form of aquatic suffocation.

5.14 Historically, sea turtles were not a major issue with dredging activities until 1980. During the 1980 maintenance dredging of the Canaveral Harbor entrance channel (Florida), approximately 2 million cubic yards of material was removed by hopper dredge and placed in the designated ocean disposal site. Seventy-one sea turtle mortalities directly attributed to the dredging were documented. Recognizing the need to address this issue the Sea Turtle/Dredging Task Force was formally established by the Jacksonville District in May 1981. In addition to acquiring more information on the biology and behavior of sea turtles, this task force is also working in cooperation with the Corps Waterways Experiment Station (WES) on dredge modifications to reduce turtle take.

5.15 As mentioned in Section 4, and confirmed by previously documented encounters with sea turtles in Florida and other east coast locations, there is a

potential to adversely impact sea turtles with use of a hopper dredge. In the Chesapeake Bay, the most critical period is mid-May to mid-November when the turtles are present in the bay. There have been no previously recorded takings of sea turtles in the Chesapeake Bay by hopper dredges, however, the dredges have not been intentionally monitored for such an occurrence.

Endangered Species Act, Section 7 Consultation

5.16 The Section 7 Consultation process was initiated for this project by letter sent to Douglas Beach, Northeast Region, National Marine Fisheries Service, dated November 1, 1983. A copy of the Draft EA (May 1992) was sent to the Northeast Region office for comment at the same time the document was sent out for general agency coordination. Section 7 Consultation was re-initiated by Corps letter dated June 18, 1992. NMFS letter of response dated July 6, 1992 states that "...Hopper dredging of the York River entrance channel during the warmer months (May through November) may affect listed species... Formal consultation, requiring Biological Assessments, will be required for those projects for which hopper dredges may be utilized from May through November." Based upon the NMFS letter and the knowledge that hopper dredging may occur during the restricted period, Formal consultation was requested by Corps letter to NMFS dated July 9, 1992 in which the Norfolk District states that "...Because it appears that we will (hopper) dredge during the protected window for sea turtles, we are requesting, by this letter, that Formal Consultation pursuant to Section 7 of the Endangered Species Act be initiated immediately."

5.17 Section 7 Consultation has further led to the NMFS recommending time-of-year restrictions to protect sea turtles. As presented to NMFS in the Corps letter dated July 9, 1992, if any dredging must take place "...during the time period which is restricted for sea turtles (mid-May through mid-November), precautions would be taken to avoid impacts to sea turtles." A meeting between the Corps and NMFS on September 16, 1992, has led to these recommendations:

(1) Avoidance of the annual time period during which sea turtles inhabit the Chesapeake Bay (approximately mid-May to mid-November).
(2) Use of dredging equipment other than a hopper dredge.
(3) If 1 and 2 are not possible, initiation of an observer program with on-board biologists to document the take of sea turtles by the dredge, and the modification of gear to screen discharge ports for the presence of sea turtle parts.
(4) Also, if 1 and 2 are not possible, issuance of (and adherence to by the Corps) an "Incidental Take Statement" by NMFS.

Because of time-of-year restrictions for overwintering crabs (paragraph 5.11), it is not possible to completely avoid dredging during the time period when sea turtles are occupying the bay. The critical time period will be avoided to the greatest extent possible. Hopper dredging is the more commonly used method for channel dredging in an open water environment such as the lower

Chesapeake Bay. Dredging by the clamshell method, while not used as often as hopper dredging in this environment, is also a technically and economically feasible option for this project. It is anticipated that potential contractors would be allowed the choice of either dredging method, which could lead to more competitive bids when the project is advertised. Since there is the potential that a hopper dredge will be used and some hopper dredging will take place while turtles are in the bay, there is a potential to adversely effect sea turtles with construction of the York River entrance channel without proper precautions taken. NMFS recommendations 3 and 4, therefore, would apply to this project when hopper dredging must take place during the time that sea turtles are in the bay.

5.18 The NMFS issuance of a Biological Opinion and an Incidental Take Statement in response to the proposals presented in the Corps July 9 letter and this Final EA would constitute completion of the Formal Consultation process as required by Section 7 of the Endangered Species Act (ESA). The Incidental Take Statement is provided with biological opinions (by NMFS) when the activity may incidentally take individuals of a listed species but not so many as to jeopardize their continued existence. If the action (in this case hopper dredging) proceeds in compliance with the terms and conditions of the Incidental Take Statement, then any resulting incidental takings are exempt from the prohibitions of Section 4 (d) or 9 of the ESA. The NMFS does not condone the take of any threatened or endangered species. The Incidental Take Statement is simply a means of exempting the Corps and its contractors from prosecution if an endangered or threatened species is taken, assuming that all possible steps to minimize the impacts of Corps activities to listed species have been implemented.

5.19 With the implementation of the previously discussed safeguards (avoidance of the critical time period to the greatest extent possible, and use of special screening equipment and observers on board the hopper dredge) and the adherence to the Biological Opinion and Incidental Take Statement rendered by NMFS, it is not anticipated that there would be any significant adverse impact to sea turtles and therefore the Finding of No Significant Impact (FONSI) has been made.

5.20 Use of a clamshell dredge, which would have no impact on sea turtles, could be used to continue dredging in the event that hopper dredging must be halted to comply with the "Incidental Take Statement." Potential contractors would also have the option of basing their bid on the use of the clamshell method and thus, preclude the need for protective measures related to sea turtles.

6. Environmental Statutes:

6.01 As discussed previously, while there may be threatened and/or endangered sea turtles in the project area if dredging takes place during mid-May to mid-November, with appropriate safeguards in place on the hopper

dredge as recommended by the NMFS, the proposed project should not adversely impact endangered species or their habitat, as specified by the Endangered Species Act of 1973, as amended. Endangered Species Act, Section 7 consultation has been initiated regarding impacts to sea turtles and will be completed with NMFS review and comment on this Final EA and issuance of their Biological Opinion.

6.02 A Section 404 (b) (1) Evaluation (Public Law 92-500, as amended) has been prepared for this project and appears following this assessment. The evaluation describes the impact to water quality as required by the Clean Water Act. Water quality may be impacted by construction, but this impact should be short lived and minor. Water quality impacts will cease immediately upon project completion. State Water Quality Certification under Section 401 of the Clean Water Act, as amended, has been applied for and obtained from the State Water Control Board (SWCB). The 401 Certification appears in Appendix D to this document.

6.03 The relationship of the proposed dredging and dredged material placement to various environmental requirements and protection statutes is summarized in the following narrative.

COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

1. Preservation of Historic and Archaeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: The State Historic Preservation Officer (SHPO) and the Virginia Department of Historic Resources (DHR) have been contacted concerning historic and /or archaeological resources in the project area. Coordination of this document with DHR and the SHPO, where required, signifies compliance.

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

Compliance: Submission of this report to the Regional Administrator of the Environmental Protection Agency for review pursuant to Sections 176c and 309 of the Clean Air Act signifies compliance.

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

Compliance: A Section 404(b)(1) Evaluation and Compliance Review have been incorporated into this report. State Water Quality Certification pursuant to Section 401 of the Clean Water Act has been applied for and received from the Commonwealth of Virginia.

4. Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1431 et seq.

Compliance: Coordination of this document with the Virginia Council on the Environment, CZM coordinators for the Commonwealth, signifies compliance.

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

Compliance: Coordination with the U.S. Fish Wildlife Service (F&WS) has yielded no formal consultation requirements pursuant to Section 7 of the Endangered Species Act. Coordination with NMFS has led to formal consultation pursuant to Section 7 of the Endangered Species Act for sea turtles if hopper dredging is to take place during the time period that turtles are present in the bay. To allow for the potential use of a hopper dredge, formal consultation requirements will be completed with the review and approval of this EA and issuance of a Biological Opinion by NMFS.

6. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: The proposed dredging and dredged material placement in the Wolf Trap (Alternate) Disposal Site are in compliance with this act.

7. 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, relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this act.

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

Compliance: Coordination with the F&WS, National Marine Fisheries Service (NMFS) and Virginia Department of Game and Inland Fisheries signifies compliance with this act.

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

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

10. Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401 et seq.

Compliance: Not applicable; project does not involve the transportation or placement of dredged material in ocean waters pursuant to Sections 102 and 103 of the act, respectively.

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

Compliance: Coordination with the State Historic Preservation Officer (SHPO) and the Department of Historic Resources fulfills the requirements of this act.

12. National Environmental Policy Act of 1969, as amended, 42 U.S.C. 432 et seq.

Compliance: Preparation of this report and Final EA signifies compliance with NEPA. Full compliance is noted with the signing and issuing of the Finding of No Significant Impact (FONSI).

13. Rivers and Harbors Appropriation Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: The proposed dredging and dredged material placement in the Wolf Trap (Alternate) Disposal Site are in compliance with this act.

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

Compliance: The proposed project will not adversely impact any component of the Virginia Scenic Rivers System. Coordination with the National Park Service (NPS) and the Virginia Department of Conservation and Recreation, relative to the Virginia Scenic Rivers System, signifies compliance with this act.

15. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 USC 9601-9675.

Compliance: Project has been evaluated in reference to this act. No hazardous or toxic wastes are involved with the construction of this navigation project.

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 enhance development in the flood plain. Circulation of this report for public review fulfills the requirements of Executive Order 11988, Section 2(a)(2).

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

Compliance: No wetlands will be impacted by the proposed navigation project. Circulation of this report for public review fulfills the requirements of Executive Order 11990, Section 2(b).

Executive Memorandum

1. Analysis of Impacts of Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: Not applicable; project does not involve or impact agricultural lands.

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

Table 1. SIGNIFICANT EQ (Environmental Quality) EFFECTS

Significant Resources	Effects on EQ Attributes
Wetlands	No effect.
Finfish	Some minor disturbance and short-term (indirect) impacts; temporary loss of food organisms at construction site(s).
Benthos	Temporary loss at site of dredging and dredged material placement; complete recovery forecast within 1-2 years. The overwintering crab fishery will be protected by time-of-year restrictions.
Water Quality	Temporary turbidity increases will not be in violation of Section 401 of the Clean Water Act; effects will be minor and short lived.
Endangered Species	Sea turtles may be affected if dredging by hopper dredge takes place during mid-May to mid-November. Safeguards will be implemented, as recommended by NMFS, to reduce and avoid impacts. Impacts may be avoided by using a clamshell dredge.

7. Conclusion:

7.01 There is no known information that would indicate a potential for the project, as proposed, to cause any long-term, major adverse effects on water or sediment quality within the dredging or dredged material placement project vicinity.

7.02 No special measures will be employed to reduce potential impacts to the non-commercial benthic community because no evidence indicates that the entrance channel area or the Wolf Trap (Alternate) Disposal Site harbors any unique characteristics or exceptionally diverse or productive communities of such benthos. Recent monitoring at the placement site indicates fairly rapid recolonization, with benthic assemblages restored to existing levels within 1-2 years.

7.03 Shellfish resources will not be significantly impacted by any of the project options. Commercially exploitable concentrations of oyster resources in the lower York River and the lower Chesapeake Bay are not present due to destructive impacts of MSX virus and predatory oyster drills. Hard clams are present only at low density within the project area. Commercially exploitable quantities are sufficiently distant from the impact area so that no adverse impacts to this resource are anticipated. Finfish resources, whether commercial or sport oriented, are not expected to be adversely affected by project activities. Commercially exploitable crabs overwinter in the Wolf Trap site according to VIMS. A time-of-year restriction will be adhered to in order to avoid impacts to this fishery.

7.04 There should be no significant adverse impacts to wetland habitats due to any of the project options under consideration. The closest SAV beds are located more than 1 mile away from the channel. Dredged material placement is not expected to raise bottom elevations to the extent that they would no longer be within their existing aquatic habitats, i.e., intertidal or subtidal.

7.05 Endangered and threatened sea turtles may be present in the project area from mid-May to mid-November. Because of the potential impact to sea turtles resulting from operation of a hopper dredge during this time period, safeguards will be implemented to minimize and avoid these impacts. These safeguards include: (1) avoiding the critical time period to the greatest extent possible; (2) use of a clamshell dredge to avoid any impacts; (3) use of special screening equipment on the hopper dredge as applicable; (4) use of observers on board the hopper dredge to monitor for the incidental take of sea turtles; and (5) adherence to NMFS's Biological Opinion and "Incidental Take Statement."

7.06 In summary, the impacts associated with the action are expected to be relatively minor, of short duration, and, as proposed, will not create any significant or controversial adverse environmental effects; therefore, the preparation of an Environmental Impact Statement is not considered to be necessary.

8. Coordination:

8.01 Permits have been applied for and received from the Virginia Marine Resources Commission (VMRC) and the State Water Control Board in compliance with Section 404 and 401 of the Clean Water Act. These permits appear in appendix D to this report. The Fish and Wildlife Service was coordinated with on this project under the directives of the Fish and Wildlife Coordination Act. The Service states in its letter of comment on the Draft EA, which appears in appendix D, that this letter "... constitutes the report of the Service and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et. seg.)." The Draft EA has been coordinated with at least the following agencies and their comments on the Draft EA and Corps responses appear in appendix D to this report.

Federal

U.S. Environmental Protection Agency
U.S. Department of Commerce, National Marine Fisheries Service
U.S. Department of the Interior, Fish and Wildlife Service

State

Governor's Council on the Environment
Marine Resources Commission
Department of Game and Inland Fisheries
Division of Parks and Recreation
Virginia Institute of Marine Science
State Water Control Board
Department of Historic Resources

York River, Virginia (Entrance Channel)
SECTION 404 (b) (1) EVALUATION

I. Project Description

a. **Location:** The York River flows southeasterly, with no meandering, from the confluence of the Pamunkey and Mattaponi Rivers at West Point and empties into the bay approximately 34 miles north of Norfolk, Virginia. The York River parallels the James and Piankatank Rivers which are south and north of the York River, respectively. The Federal navigation system on the York River consists of a 22-foot river channel and an entrance channel.

In 1951-52, the Corps of Engineers deepened and widened the natural entrance channel portion of the Federal Civil Works project on the York River to serve the national defense needs of the U. S. Navy. The resultant channel, sometimes referred to as the "Navy Channel" was requested and funded by the Department of the Navy to serve naval vessels taking on munitions and supplies at the Naval Weapons Station at Yorktown, Virginia. Original military project dimensions provided for a 39-foot-deep, 750-foot wide, and approximately 11-mile long channel extending from the 39-foot contour in the Chesapeake Bay to a point about 4 miles east of the mouth of the York River. The incremental depth and width of the entrance channel below 22 feet and beyond 300 feet, respectively, are not authorized components of the Federal Civil Works project on the York River.

b. **General Description:** The Corps of Engineers proposes to modify the existing Federal Civil Works project on the York River to further improve the entrance channel under Section 107 of the 1960 River and Harbor Act, as amended, with an authorized depth of 37 feet and bottom width of 750 feet. This channel, to be referred to as the York River Entrance Channel, would extend from the 38-foot contour (37-foot project depth plus 1-foot of required overdredging) in the Chesapeake Bay to a point adjacent to the piers at the Yorktown Naval Weapons Station, approximately 8 miles above the river mouth. The segment of the entrance channel identified as requiring dredging at this time to provide the desired project dimensions is the approximately 11-mile long segment between the 38-foot contour in the Chesapeake Bay and a point about 4 miles east of the mouth of the river. This plan is the National Economic Development plan and addresses the essential needs of general commerce and meets the specific national defense needs of the United States Navy.

c. **Authority and Purpose:** Initial and maintenance dredging of the existing channel to a project depth of 37 feet and bottom width of 750 feet would be accomplished under authority of Section 107 of the 1960 River and Harbor Act, as amended. The plan would provide for the safe and efficient movement of commercial commodities and military munitions and stores.

II. Factual Determinations

a. Physical Substrate Determinations:

(1) **Substrate elevation and slope:** The area is relatively flat with bathymetry ranging between -32 to -37 feet mean low water.

(2) **Sediment type:** Soft, saturated, high-plastic clays, and soft, high-plastic clays with traces of sand to clean beach samples.

(3) **Dredged/fill material movement:** The Wolf Trap (Alternate) Disposal Site was used and intensively monitored recently without any documented significant, long-term adverse effects. The plan for long-term use of this site shows no potential for significant effect from movement of this material.

(4) **Physical effects on benthos:** Same as II. a. (3) above.

(5) **Other effects:** No other effects are anticipated.

(6) **Actions taken to minimize impacts:** Crabbers will be notified prior to dredging in order to remove any harvestable crabs.

b. Water Circulation, Fluctuation, and Salinity Determinations:

(1) **Water - Consider effects on:**

(a) Salinity - none
(b) Water chemistry - none
(c) Clarity - temporary rise in turbidity at dredged material placement site
(d) Color - only effect will be from turbidity
(e) Odor - none
(f) Taste - not applicable
(g) Dissolved gas levels - none
(h) Nutrients - none
(i) Eutrophication - none
(j) Others as appropriate - none

(2) **Current patterns and circulation:**

(a) Current patterns and flow - not studied
(b) Mean velocity - not studied
(c) Stratification - not studied
(d) Hydrologic regime - not studied

(3) **Normal water level fluctuations:** Normal tidal range is 2.3 feet (spring tide is 2.9 feet; rises several more feet during storm events).

(4) **Salinity gradients:** At the mouth of the York River, surface salinity ranges between 14 ppt and 21 ppt. The average salinity at the bottom is about 16 ppt.

(5) Actions that will be taken to minimize impacts: none required.

c. **Suspended Particulates/Turbidity Determinations:**

(1) **Expected changes in suspended particulates and turbidity levels in vicinity of dredged material placement site:** Temporary increase once every 10 years.

(2) **Effects (degree and duration) on chemical and physical properties of the water column:**

(a) Light penetration - temporary reduction from temporary increase in suspended particulates
(b) Dissolved oxygen - no expected change
(c) Toxic metals and organics - no expected change
(d) Pathogens - no expected change
(e) Aesthetics - no change

(3) **Effects on biota:**

(a) Primary production, photosynthesis - temporary reduction
(b) Suspension/filter feeders - temporary adverse effects
(c) Sight feeders - most will leave area during dredged material placement activities.

(4) **Actions taken to minimize impacts:** None

d. Contaminant Determinations: No known contaminants or HTRW's

e. Aquatic Ecosystem and Organism Determinations:

(1) Effects on plankton - no long-term effects
(2) Effects on benthos - no long-term effects
(3) Effects on nekton - no long-term effects
(4) Effects on aquatic food web - no long-term effects
(5) Effects on special aquatic sites - no sites identified
(6) Threatened and endangered species - no anticipated effects
(7) Other wildlife - no effects
(8) Actions to minimize impacts - The overwintering season for crabs will be avoided. If hopper dredging takes place during the restricted period for turtles (mid-May to mid-November, precautions would be taken to avoid impacts to sea turtles. These precautions would include initiation of an observer program with on-board biologists to document the take of sea turtles by the dredge, and the modification of gear to screen discharge ports for the presence of sea turtle parts. Dredging during the restricted period will be avoided to the

greatest extent possible. A clamshell dredge may be used in order to avoid any potential impacts completely.

f. **Proposed Dredged Material Placement Site Determinations:**

(1) **Mixing zone determinations:** Mixing zone extent would be less than 5% of total estuary size and would be an influencing factor for approximately 5 months once every 10 years.

(2) **Determination of compliance with applicable water quality standards:** All standards have been complied with.

(3) **Potential effects on human use characteristics:**

(a) Municipal and private water supply - no effect
(b) Recreational and commercial fisheries - no effect
(c) Water-related recreation - no adverse effect
(d) Aesthetics - no effect
(e) Parks, national and historical monuments, national seashores, wilderness areas, etc. - no effect

g. **Determination of Cumulative Effects on the Aquatic Ecosystem:** There are no expected cumulative adverse effects.

h. **Determination of Secondary Effects on the Aquatic Ecosystem:** There are no expected secondary effects.

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

1. No significant adaptations of the Section 404 (b)(1) Guidelines were made relative to this evaluation.

2. Alternatives to overboard dredged material placement were examined. These included upland and beach dredged material placement. Placement on an upland site would have minimal to no impacts on the aquatic environment if the dredged material placement area were properly constructed. However, this alternative would adversely impact existing upland habitat at the site. Direct impacts of beach dredged material placement are based on the abundance and kinds of organisms present, the quantity and quality of the dredged material, and the time of year it is placed on the beach. The major impacts to a beach community are the direct mortality of benthic infauna and their larvae due to burial by dredged material; avoidance of the area by these species due to high turbidity levels; reduction in predators in the area such as crabs, finfish, and shore birds due to loss of food sources; and loss of suitable habitat due to changes in grain size and beach face slope.

3. There is a potential to adversely impact endangered and threatened sea turtles with use of a hopper dredge in the project area during the time period of

mid-May to mid-November. Safeguards described in this EA, including avoiding the critical time period to the greatest extent possible, and the use of observers on-board the dredge, will be employed during the critical time period to avoid impacts to endangered/threatened species of sea turtles. A clamshell dredge may be used in order to avoid potential impacts to sea turtles completely.

4. The proposed placement of material at Wolf Trap (Alternate) Disposal Site 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. Significant adverse effects would not occur to aquatic ecosystem diversity, productivity, and stability or to recreational, aesthetic, and economic values.

5. Appropriate steps to minimize potential adverse impacts of the placement of dredged material on aquatic systems include time-of-year restrictions to avoid the overwintering crab fishery and notification of construction to crabbers prior to dredging so they may remove any harvestable crabs.

6. On the basis of the guidelines, the proposed dredged material placement site for the placement of material is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

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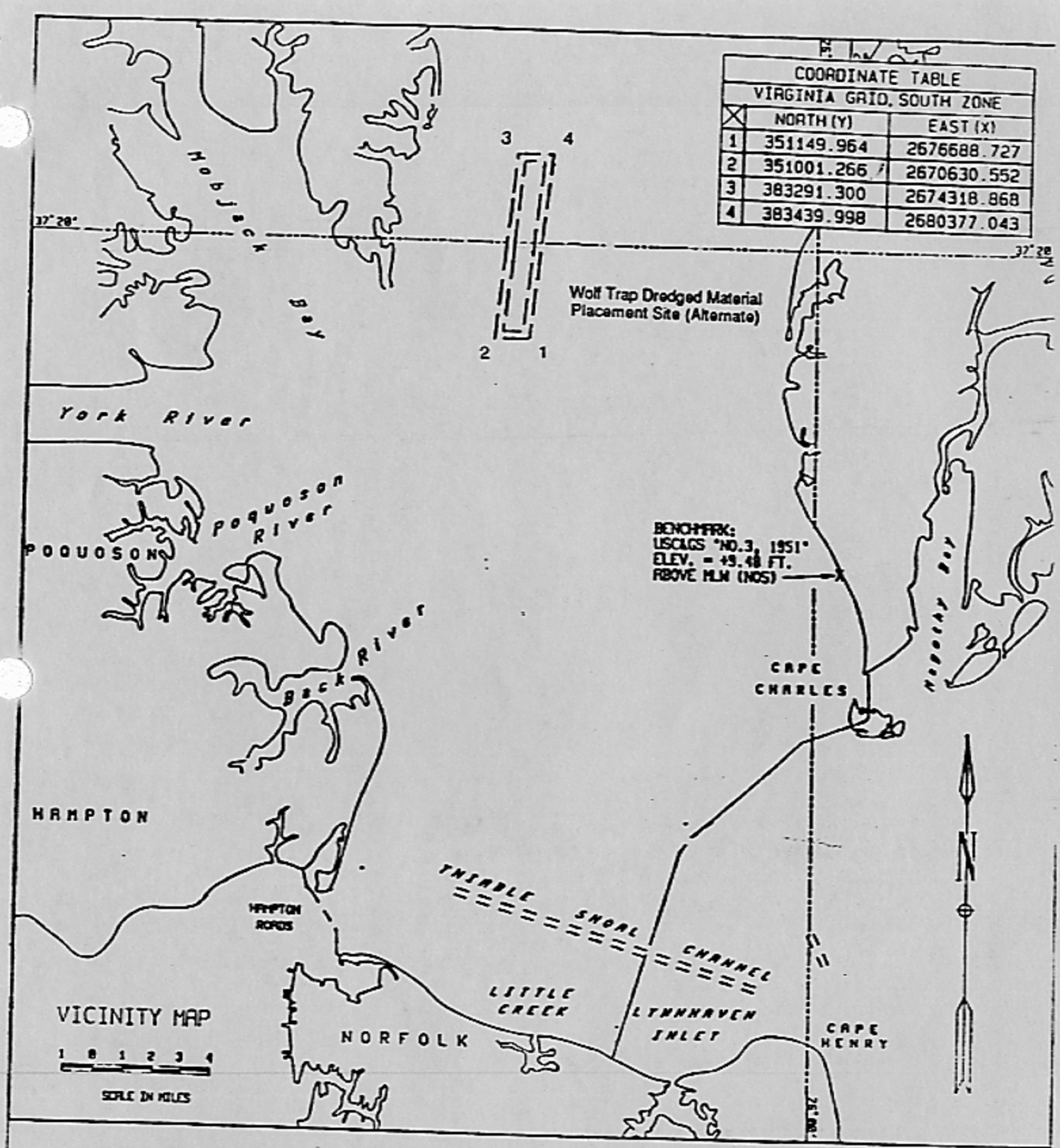

YORK RIVER ENTRANCE CHANNEL

NORFOLK DISTRICT CORPS OF ENGINEERS

WOLF TRAP DREDGED MATERIAL PLACEMENT SITE ALTERNATE NO. 2

Figure 1.

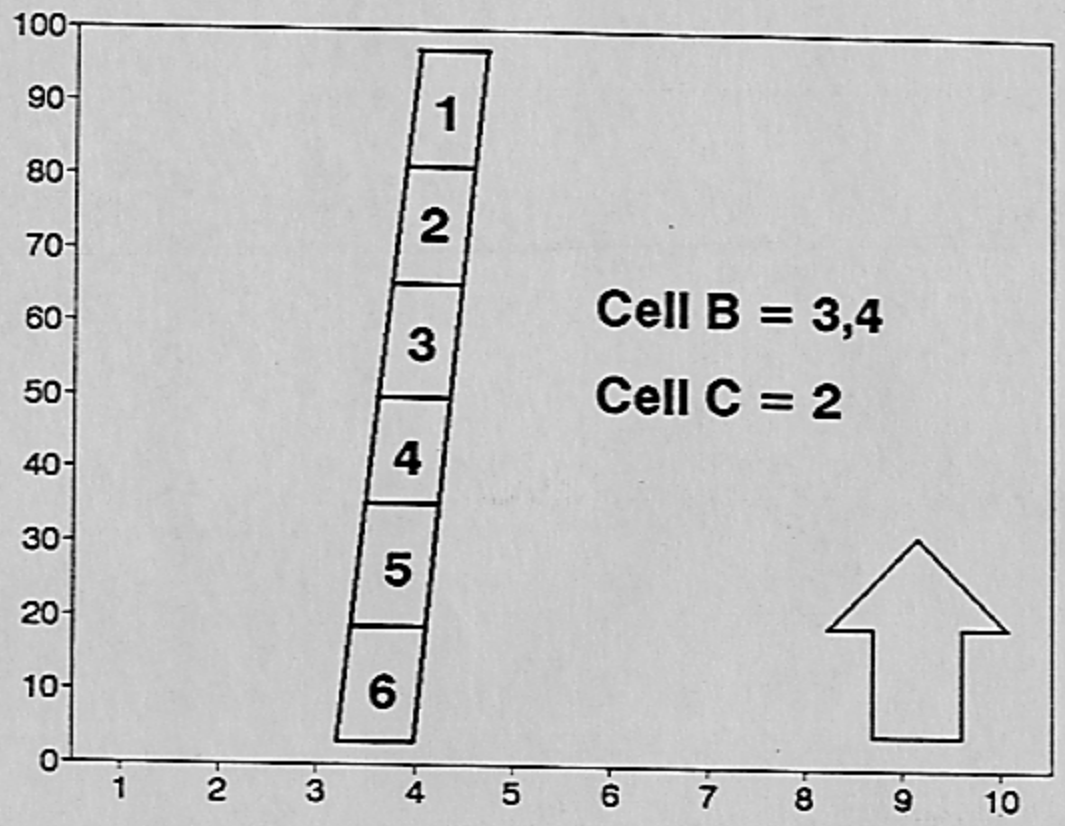

Figure 2. Wolf Trap (Alternate) Disposal Site - Monitoring Compartments

SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

The Draft Detailed Project Report and Environmental Assessment was coordinated with the appropriate agencies and groups in spring 1992. Comments from those agencies and groups and Norfolk District responses are included in Appendix D, Pertinent Correspondence, Coordination Comments, and District Responses.

CONCLUSIONS

The navigational problems and needs of the lower York River, Virginia, have been reviewed and evaluated with regard to the overall public interest and with consideration to engineering, economic, environmental, social, and cultural concerns. The conclusions drawn by this study are as follows:

a. Significant navigation problems exist on the lower York River waterway which impact the efficient and safe movement of commercial and naval vessels.

b. The selected plan, consisting of the adoption of the existing entrance channel as a Federal Civil Works project with a project depth of 37 feet and a project bottom width of 750 feet under Section 107 of the 1960 River and Harbor Act, as amended, is the best means of addressing those navigation problems.

c. The selected plan is economically, engineeringly, environmentally, culturally, and socially feasible and has a benefit-to-cost ratio of 1.85 to 1.

d. The selected plan is supported by the non-Federal sponsor, the Virginia Port Authority, which has the capability to provide the necessary non-Federal requirements presented in the "Division of Plan Responsibilities" section of this report.

RECOMMENDATIONS

In view of the conclusions presented above, I recommend the adoption and implementation of modifications to the existing Federal Civil Works project on the York River, Virginia, under Section 107 of the 1960 River and Harbor Act, as amended, to further improve the entrance channel in accordance with the selected plan described in this report, at an estimated first cost to the United States of $3,185,000.

I further recommend that $510,000 for the preparation of plans and specifications for the recommended project be allotted to the Norfolk District.

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

R. C. Johns
Colonel, Corps of Engineers
District Engineer

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and implementation funding. The local sponsor, interested Federal and state agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

HYDROGRAPHIC SURVEYS, GEOTECHNICAL INVESTIGATIONS, AND BASIS FOR THE DEVELOPMENT OF COSTS FOR THE SELECTED PLAN

A P P E N D I X A

APPENDIX A

HYDROGRAPHIC SURVEYS, GEOTECHNICAL INVESTIGATIONS, AND BASIS FOR THE DEVELOPMENT OF ESTIMATES OF COSTS FOR THE SELECTED PLAN

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A-7	LOCATION OF SELECTED CHANNEL PROFILES	A-5
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LIST OF EXHIBITS

No.	Title
1	GRADATION CURVES
2	LABORATORY TEST NOTES
3	PERTINENT COST INFORMATION ON THE SELECTED PLAN WITH DREDGING BY HOPPER METHOD

LIST OF EXHIBITS
(Cont'd)

No.	Title
4	PERTINENT COST INFORMATION ON THE SELECTED PLAN WITH DREDGING BY CLAMSHELL METHOD
5	CONSTRUCTION ABSTRACTS - THIMBLE SHOAL AND CAPE HENRY CHANNELS

LIST OF PLATES

No.	Title
A-1, -2, -3, -4, -5	CORE LOCATIONS

APPENDIX A

HYDROGRAPHIC SURVEYS, GEOTECHNICAL INVESTIGATIONS, AND BASIS FOR THE DEVELOPMENT OF ESTIMATES OF COSTS FOR THE SELECTED PLAN

INTRODUCTION

1. This appendix presents the results of geotechnical investigations and hydrographic surveys accomplished in conjunction with the study of the York River Entrance Channel.

CHANNEL SURVEYS

2. A hydrographic survey of the York River Entrance Channel and the Navy Placement Site was accomplished in 1984 in conjunction with the 1986 feasibility study. The channel profiles were spaced approximately every 500 feet and the placement site profiles were spaced about every 800 feet. Representative channel profiles from the 1984 survey are shown in figures A-1 through A-6, with the approximate locations shown in figure A-7. The survey data were supplemented with information provided on National Ocean Survey nautical charts number 12241 and 12222.

3. Surveys of 1951, 1952, 1966, 1988, and 1989 are also available for the York River Entrance Channel. The 1951 survey was accomplished before the channel was dredged in 1951-52 for the Navy, while the 1952 survey was made after the dredging was completed. The 1966, 1988, and 1989 surveys are condition surveys. The 1989 survey was reported to navigation interests on the river and represents the existing condition of the channel.

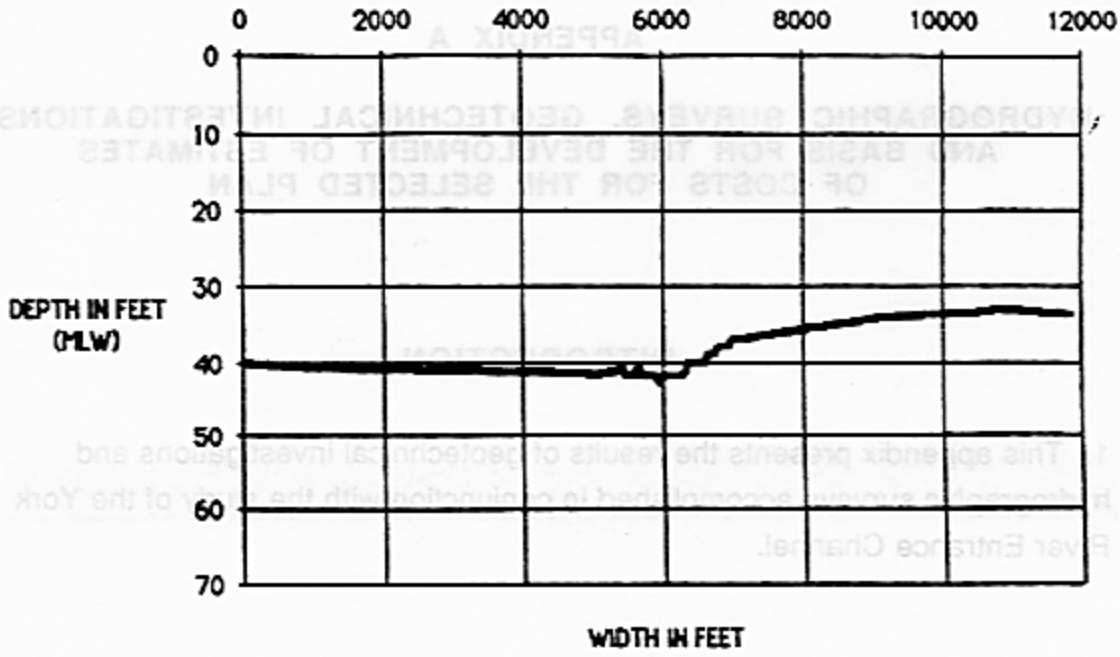

Figure A-1. Channel Profile No. 1 (near buoys No. 1 and 2)

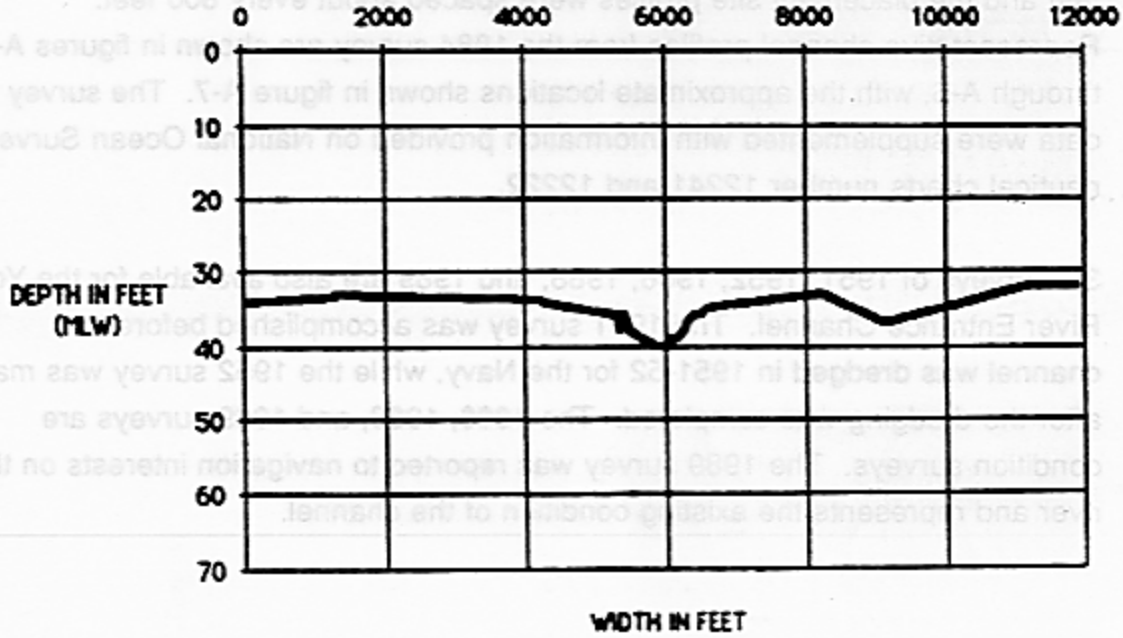

Figure A-2. Channel Profile No. 2 (near buoys No. 5 and 6)

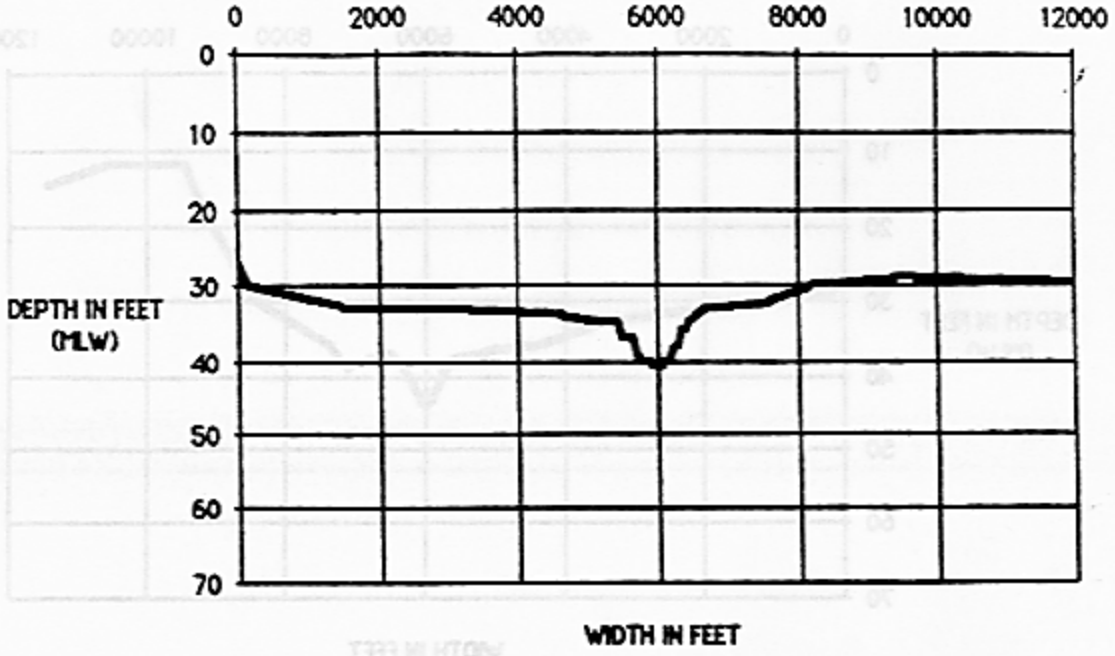

Figure A-3. Channel Profile No. 3 (near buoys No. 9 and 10)

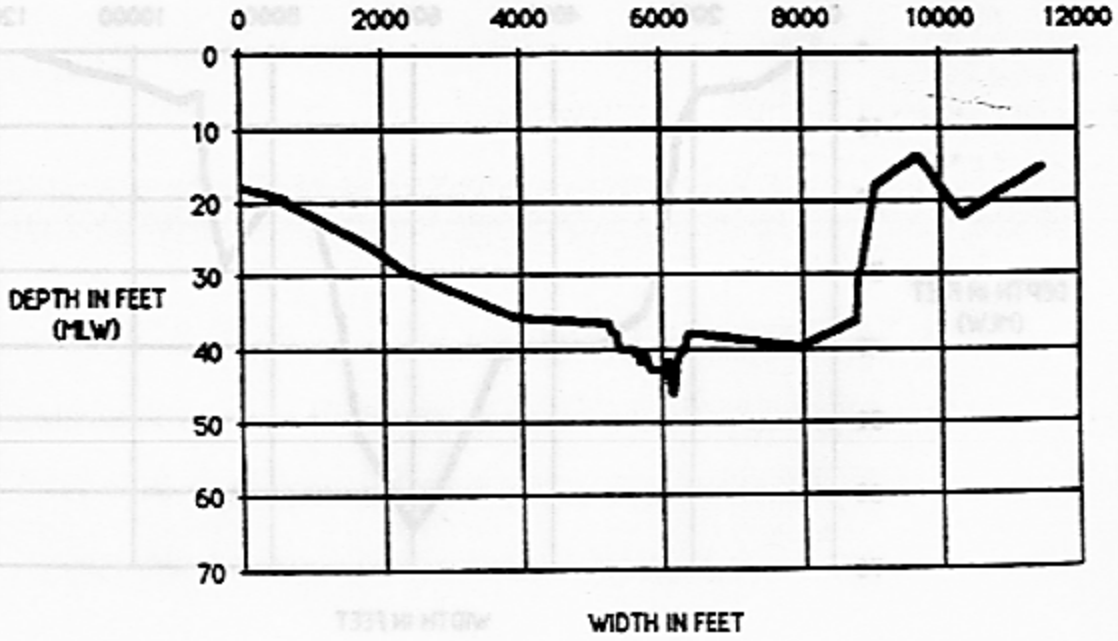

Figure A-4. Channel Profile No. 4 (near buoys No. 13 and 14)

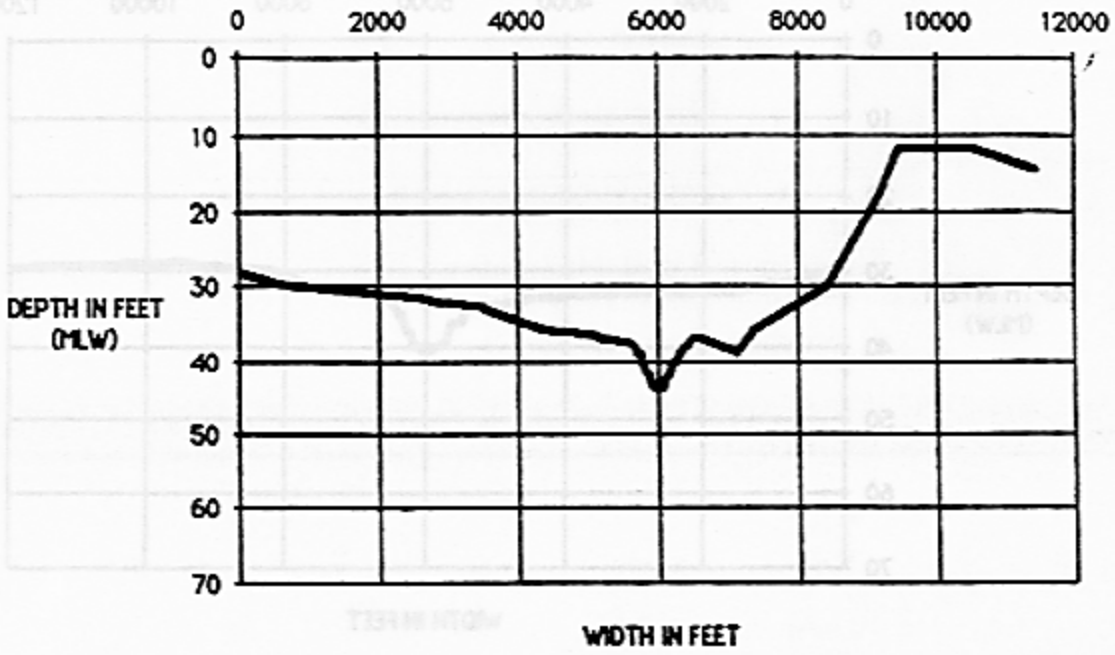

Figure A-5. Channel Profile No. 5 (near buoys No. 17 and 18)

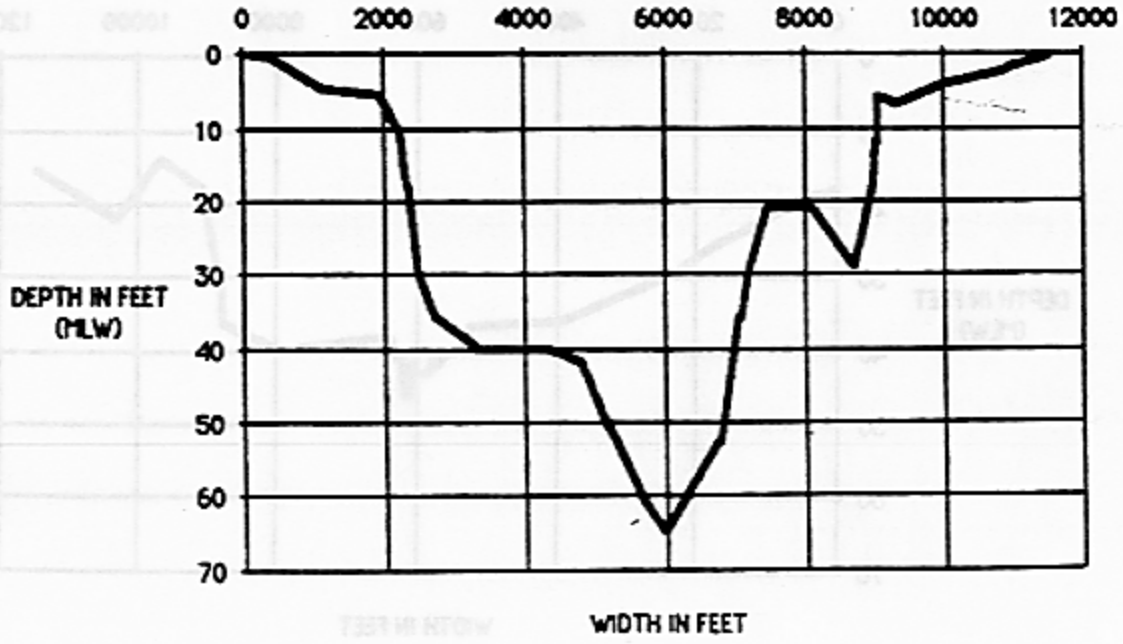

Figure A-6. Channel Profile No. 6 (at river mouth between Tue Point and Sandy Point).

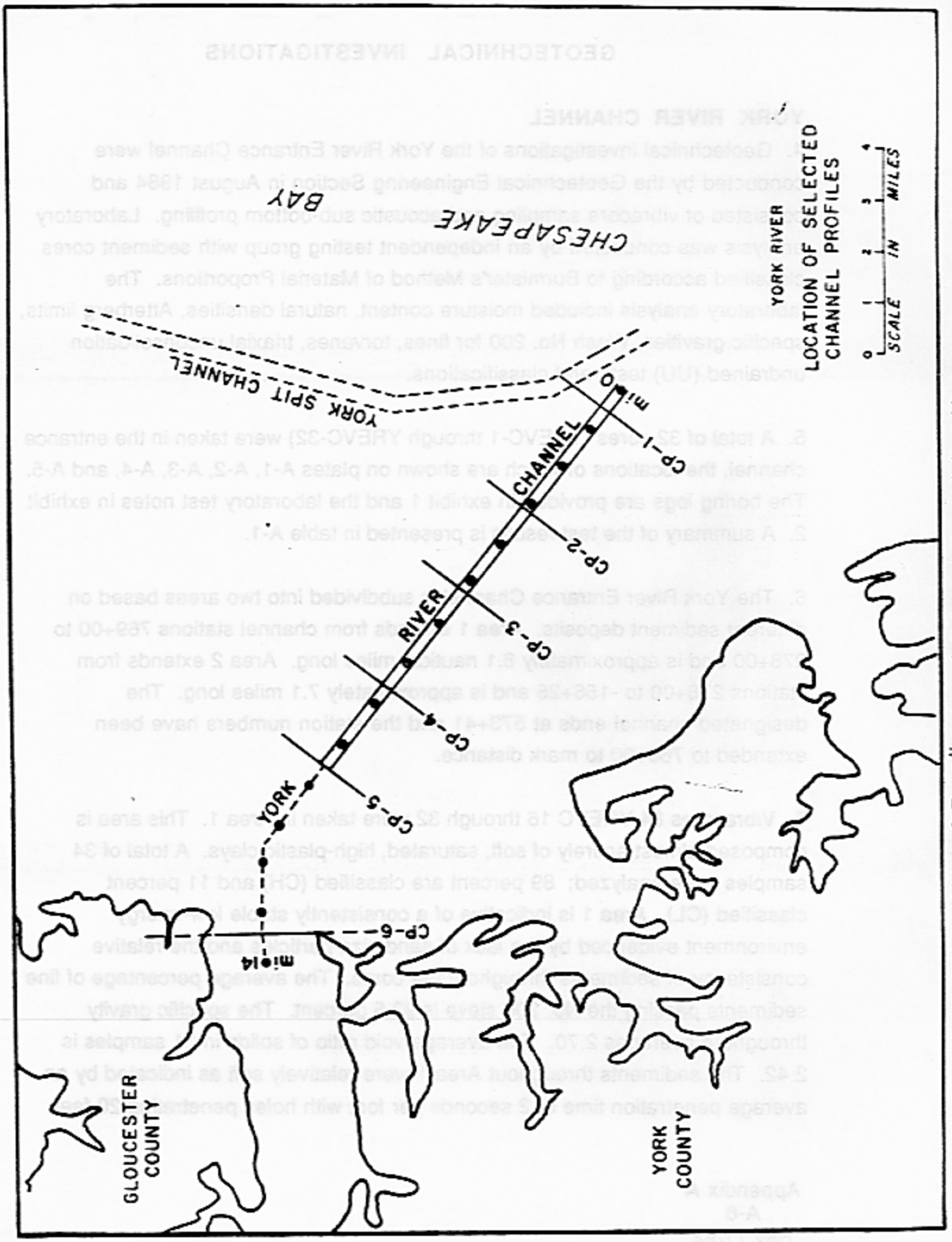

Figure A-7. Location of Selected Channel Profiles

GEOTECHNICAL INVESTIGATIONS

YORK RIVER CHANNEL

4. Geotechnical investigations of the York River Entrance Channel were conducted by the Geotechnical Engineering Section in August 1984 and consisted of vibracore sampling and acoustic sub-bottom profiling. Laboratory analysis was conducted by an independent testing group with sediment cores classified according to Burmister's Method of Material Proportions. The laboratory analysis included moisture content, natural densities, Atterberg limits, specific gravities, Wash No. 200 for fines, torvanes, triaxial unconsolidation undrained (UU) tests and classifications.

5. A total of 32 cores (YREVC-1 through YREVC-32) were taken in the entrance channel, the locations of which are shown on plates A-1, A-2, A-3, A-4, and A-5. The boring logs are provided in exhibit 1 and the laboratory test notes in exhibit 2. A summary of the test results is presented in table A-1.

6. The York River Entrance Channel is subdivided into two areas based on different sediment deposits. Area 1 extends from channel stations 769+00 to 278+00 and is approximately 8.1 nautical miles long. Area 2 extends from stations 278+00 to -156+25 and is approximately 7.1 miles long. The designated channel ends at 573+41 and the station numbers have been extended to 769+00 to mark distance.

7. Vibracores 84 YREVC 16 through 32 were taken in Area 1. This area is composed almost entirely of soft, saturated, high-plastic clays. A total of 34 samples were analyzed; 89 percent are classified (CH) and 11 percent classified (CL). Area 1 is indicative of a consistently stable low-energy environment evidenced by the lack of sand size particles and the relative consistency of sediments throughout the cores. The average percentage of fine sediments passing the No. 200 sieve is 93.5 percent. The specific gravity throughout averages 2.70. The average void ratio of solids in 31 samples is 2.42. The sediments throughout Area 1 were relatively soft as indicated by an average penetration time of 2 seconds per foot with holes penetrating 20 feet.

Table A-1. SUMMARY OF TEST RESULTS

Project Name Lower York Entrance Channel

Location Virginia

Project No. 83-1118

Date November 12, 1984

Sheet 3 of 6

BORING NO.	SAMPLE NO.	DEPTH	VISUAL DESCRIPTION		NATURAL WATER CONTENT	NATURAL DRY DENSITY	LIQUID LIMIT	PLASTICITY INDEX	PERCENT FINES	SPECIFIC GRAVITY
YREVC-15	1	0.0-1.0	Gray CLAY, trace Sand	CH	65.0%	56.0PCF	56.0	34.5	94.0	2.70
	2	5.0-6.0	Brown SAND, trace fines	SP	11.0	107.5			5.0	
YREVC-16	1	0.0-1.0			-	-				
	2	6.0-7.0	Gray CLAY, some Sand	CL	64.0	65.0	41.0	22.5	78.5	2.70
YREVC-17	1	0.0-1.0	Gray CLAY, trace Sand	CH	81.0	42.5	61.5	37.0	95.5	2.70
	2	5.5-6.5	Gray CLAY, trace Sand	CH	66.0	58.5	62.5	39.0	95.0	2.69
YREVC-18	1	0.0-1.0	Gray CLAY, trace Sand	CH	104.0	44.5	60.5	37.5	96.5	2.71
	2	4.5-5.5	Gray CLAY, trace Sand	CH	62.5	64.0	66.0	44.0	95.0	2.72
YREVC-19	1	0.0-1.0	Gray CLAY, trace Sand	CH	93.0	49.5	57.0	33.5	94.0	2.71
	2	6.0-7.0	Gray CLAY, trace Sand	CH	69.0	58.5	58.5	36.0	92.5	2.69
YREVC-20	1	0.0-1.0	Gray CLAY, trace Sand	CH	147.0	34.5	92.0	62.5	97.0	2.69
	2	6.0-7.0	Gray CLAY, trace Sand	CH	72.5	56.5	66.5	42.0	95.0	2.72
YREVC-21	1	0.0-1.0	Gray CLAY, trace Sand	CH	112.5	34.0	79.5	50.0	95.5	2.70
	2	5.7-6.7	Gray CLAY, trace Sand	CH	74.5	55.5	64.0	40.5	97.0	2.68

Table A-1. SUMMARY OF TEST RESULTS

Project Name: Lower York Entrance Channel
Location: Virginia

Project No.: 83-1118
Date: November 12, 1984
Sheet 4 of 6

BORING NO.	SAMPLE NO.	DEPTH	VISUAL DESCRIPTION		NATURAL WATER CONTENT	NATURAL DRY DENSITY	LIQUID LIMIT	PLASTICITY INDEX	PERCENT FINES	SPECIFIC GRAVITY
YREVC-22	1.	0.0-1.0	Gray CLAY, trace Sand	CH	115.5%	39.0PCF	87.0	59.0	92.5	2.68
	2	5.5-6.5	Gray CLAY, trace Sand	CH	68.0	56.0	67.0	44.5	94.0	2.69
YREVC-23	1	0.0-1.0	—		-	-				
	2	4.5-5.5	Gray CLAY, trace Sand	CL	51.5	62.5	43.0	24.0	91.0	2.69
YREVC-24	1	0.0-1.0	Gray CLAY, trace Sand	CH	161.5	30.5	93.0	61.5	98.0	2.69
	2	4.2-5.2	Gray CLAY, trace Sand	CH	63.5	62.0	66.5	43.0	91.0	2.68
YREVC-25	1	0.0-1.0	Gray CLAY, trace Sand	CH	137.5	35.5	86.5	56.0	97.5	2.69
	2	4.4-5.4	Gray CLAY, little Sand	CH	56.0	63.0	53.5	33.5	88.0	2.69
YREVC-26	1	0.0-1.0	Gray CLAY, little Sand	CH	85.0	47.0	69.0	45.5	85.5	2.68
	2	4.2-5.2	Gray CLAY, trace Sand	CH	55.5	64.0	51.5	32.5	95.5	2.74
YREVC-27	1	0.0-1.0	Gray CLAY, trace Sand	CH	103.5	44.0	77.0	50.5	91.0	2.69
	2	4.5-5.5	Gray CLAY, trace Sand	CL	55.0	64.5	48.0	29.0	91.5	2.71
YREVC-28	1	0.0-1.0	Gray CLAY, trace Sand	CH	86.0	51.0	68.5	47.0	93.5	2.71
	2	4.0-5.0	Gray CLAY, trace Sand	CH	61.0	62.0	55.0	36.5	92.0	2.72

Table A-1. SUMMARY OF TEST RESULTS

Project Name: Lower York Entrance Channel
Location: Virginia
Project No.: 83-1118
Date: November 12, 1984
Sheet 5 of 6

BORING NO.	SAMPLE NO.	DEPTH	VISUAL DESCRIPTION		NATURAL WATER CONTENT	NATURAL DRY DENSITY	LIQUID LIMIT	PLASTICITY INDEX	PERCENT FINES	SPECIFIC GRAVITY
YREVC-29	1	0.0-1.0	—		-	-				
	2	4.5-5.5	Gray CLAY, trace Sand	CH	59.5%	60.5PCF	50.5	29.0	90.0	2.69
YREVC-30	1	0.0-1.0	Gray CLAY, trace Sand	CH	102.0	47.5	81.5	58.0	97.5	2.70
	2	5.5-6.5	Gray CLAY, trace Sand	CH	93.5	47.0	86.5	59.5	99.0	2.71
YREVC-31	1	0.0-1.0	Gray CLAY, trace Sand	CH	135.5	34.5	120.0	86.5	98.0	2.65
	2	5.5-6.5	Gray CLAY, trace Sand	CH	77.5	53.0	64.5	44.5	95.5	2.71
YREVC-32	1	0.0-1.0	Gray CLAY, trace Sand	CH	101.5	43.0	68.0	44.5	90.5	2.70
	2	5.5-6.5	Gray CLAY, trace Sand	CH	75.5	54.5	66.5	45.0	96.0	2.65

Table A-1. SUMMARY OF TEST RESULTS

Project Name: Lower York Entrance Channel
Location: Virginia
Project No.: 83-1118
Date: November 12, 1984
Sheet 6 of 6

BORING NO.	SAMPLE NO.	DEPTH	VISUAL DESCRIPTION		TORVANE TSF					
YREVC-4	2	6.0-7.0	Gray Clayey SAND	SC	0.30					
YREVC-6	1	0.0-1.0	Gray Sandy SILT	CL-ML	0.16					
YREVC-10	1	0.0-1.0	Gray Sandy CLAY	CL	0.12					
YREVC-13	1	0.0-1.0	Gray Sandy CLAY	CL	0.07					
YREVC-16	2	6.0-7.0	Gray CLAY, some Sand	CL	0.10					
YREVC-18	2	4.5-5.5	Gray CLAY, trace Sand	CH	0.12					
YREVC-20	2	6.0-7.0	Gray CLAY, trace Sand	CH	0.10					
YREVC-23	2	4.5-5.5	Gray CLAY, trace Sand	CL	0.15					
YREVC-25	2	4.4-5.4	Gray CLAY, little Sand	CH	0.10					
YREVC-27	2	4.5-5.5	Gray CLAY, trace Sand	CH	0.13					
YREVC-29	2	4.5-5.5	Gray CLAY, trace Sand	CH	0.15					
YREVC-31	2	5.5-6.5	Gray CLAY, trace Sand	CH	0.15					
YREVC-32	2	5.5-6.5	Gray CLAY, trace Sand	CH	0.13					

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8. Contrasts in moisture, density, torvane, and limits were noted in near surface samples and samples taken at 4.5 to 7.0 feet. Moisture content was greatest in samples near the surface and decreased with depth. The surface samples taken within 1 foot of the sediment-water interface averaged 115.5 percent while samples obtained at depth averaged 66.2 percent moisture. Dry densities of surface sediments averaged 42 pounds per cubic foot (PCF) and 56 PCF with depth. A total of 28 torvane tests were conducted. Eight torvanes in the surface averaged 0.07 tons per square foot (TSF) and 20 tests averaged 0.12 TSF in the deeper samples. The liquid limit and plastic limit of surface sediments averaged 79 and 28, respectively. The deeper soils averaged 60 and 24.

9. The high moisture content in relation to the liquid limit found in the surface samples indicated an underconsolidated soil. Increasing overburden pressure with depth reduces the moisture and increases dry densities as the sediment approaches a normally consolidated state.

10. Vibracores 84 YREVC 1 through 15 were taken in Area 2. This expanse reflects an energetic and varied placement environment. Sediments range from soft high plastic clays and 6 percent sand to clean beach samples composed of 99 percent sand. A total of 29 samples were classified as follows:

Number of Samples	Percentage of Total	Classification
7	24.2	(SP)
5	17.2	(SC)
8	27.6	(SM)
5	17.2	(CH)
4	13.8	(CL)
29	100.0	

11. Generally, samples were well compacted and composed of various proportions of sands, silts, and clays. No particular sediment type was continuous throughout the length of Area 2. Since the sediment types varied

widely, the test results cannot be grouped together in Area 2 as they were in Area 1. In the following paragraphs, each sediment classification is discussed for more specific sediment characteristics.

12. Seven samples were classified poorly graded clean sands (SP). They are composed primarily of fine to medium sands with occasional gravel. The amount of material in each sample passing through a No. 200 sieve ranges from 1 percent to 12 percent with an average of 6.4 percent fines. The natural water content ranges from 10.5 percent to 24.5 percent averaging 15.2 percent. The dry density measured in pounds per cubic foot averaged 105.6 percent PCF with extremes of 91.5 to 117.5 PCF. Boring 84 YREVC 5 contained the greatest single concentration of (SP) sediments with 9 feet of thickness. Stations 143+50 through 264+00 contained an apparent continuous layer of sand from 1 to 6 feet in thickness. The upper contact ranged in depth from the surface to 3 feet.

13. A total of five samples were classified medium plastic clayey sand (SC). Atterberg limits were obtained on the fines for three samples. The moisture content averaged 24.4 percent while the liquid limit and plastic limit averaged 30.5 and 17.0, respectively. Specific gravity and void ratio of solids averaged 2.69 and 0.68, respectively, for three samples. The dry density averaged 101.3 PCF for five samples. Borings 84 YREVC 1, 3, and 4 contained 20 percent fines. The (SC) samples were soft and easily penetrated by the coring tube. Boreholes 8 and 9 contained (SC) sediments which were more resistant to penetration and contained an average of 36 percent fines.

14. The most common sediment classification in Area 2 was (SM). A total of eight samples were designated silty sand with the percentage of fines ranging from 19 percent to 49 percent with an average of 34 percent. The moisture percentage ranged from 20 percent to 32.5 percent averaging 27.8 percent. The dry density had extremes of 89 to 107.5 PCF with mean density of 96.4 PCF. Tests for Atterberg limits were conducted on two samples, results for both tests were nonplastic. The silty sand samples found in holes 2, 3, 4, 5, and 9 were concentrated in the upper 10 feet of the cores. The samples were soft and easily penetrated by the vibracorer. The (SM) sediments were most abundant in holes 10 through 15 with sediments becoming increasingly stiff with depth.

The most densely packed sediments were found in holes 10, 12, and 13, which resulted in penetration refusal and the holes were prematurely terminated.

15. Five samples are classified high-plastic clay (CH). There is an apparent continuous layer of clay between stations -156+25 and station 24+00. This clay layer, varying in thickness from 2 to 12 feet, is well compacted and found at depths greater than 7 feet. Torvane tests on the stiff high-plastic clays in holes 84 YREVC 6 and 7 yielded values of 0.85 and 0.68 TSF, respectively. Penetration by the coring tube in these stiff clays averaged 104 seconds per foot. Moisture content in boreholes 6 and 7 was 38 percent and 37 percent, respectively. This low moisture content for clays indicates a high degree of compaction.

16. Softer, high-plastic clays found in boreholes 13, 14, and 15 were located from the surface to a 3-foot depth. The moisture content averaged 57 percent and penetration averaged 2 seconds per foot. Boring 84 YREVC 3 was significant because it was the only site in Area 2 which remained easily penetrable to a depth of 17.5 feet.

17. The five (CH) samples tested have an average specific gravity of 2.67, a void ratio of 0.98, and an average dry density of 84.0 PCF. The liquid limit averaged 53 and the plastic limit 21.5 for four clay samples. The average of fines was 81 percent for all (CH) samples.

18. Only four samples in Area 2 were classified low plastic (CL). These samples were all found at the surface to a depth of 4 feet in boreholes 84 YREVC 6, 7, 8, and 10. The clays were easily penetrated and average torvane values were 0.13 TSF. The average percent moisture was 37.5. The plastic limit averaged 29.3 and the liquid limit 21.5 for three samples tested. There were significant amounts of sand in the (CL) samples, the percentage of fines ranged from 55 percent to 61.5 percent averaging 57 percent.

NAVY PLACEMENT SITE

19. In October 1984, grab samples were taken by the Geotechnical Engineering Section in the then considered Navy Placement Site. This 1,100-acre site was previously used for the placement of dredged material resulting from the original dredging of the entrance channel and is located at the southeast end of the entrance channel as shown in figure A-8. Samples were retrieved with a Peterson Grab Sampler. The following table presents the results of the analysis of the samples.

Table A-2. SUMMARY OF LABORATORY DATA ON NAVY PLACEMENT SITE

Sample	Sand (%)	Symbol	Description
1	77	SC	Fine sand, trace shell, some fines
2	79	SC	Fine sand, trace shell, some fines
3	76	SC	Fine sand, trace shell, some fines
4 (a)	47	CH	Slightly organic clay & silt, and fine sand
5	80	SC	Fine sand, trace shell, some fines
6	75	SC	Fine sand, trace shell, some fines
7	76	SC	Fine sand, trace shell, some fines
8	94	SP-SC	Fine sand, trace shell, trace fines
9	91	SP-SC	Fine sand, trace shell, trace fines
10	83	SC	Fine sand, trace shell, little fines

(a) High plastic.

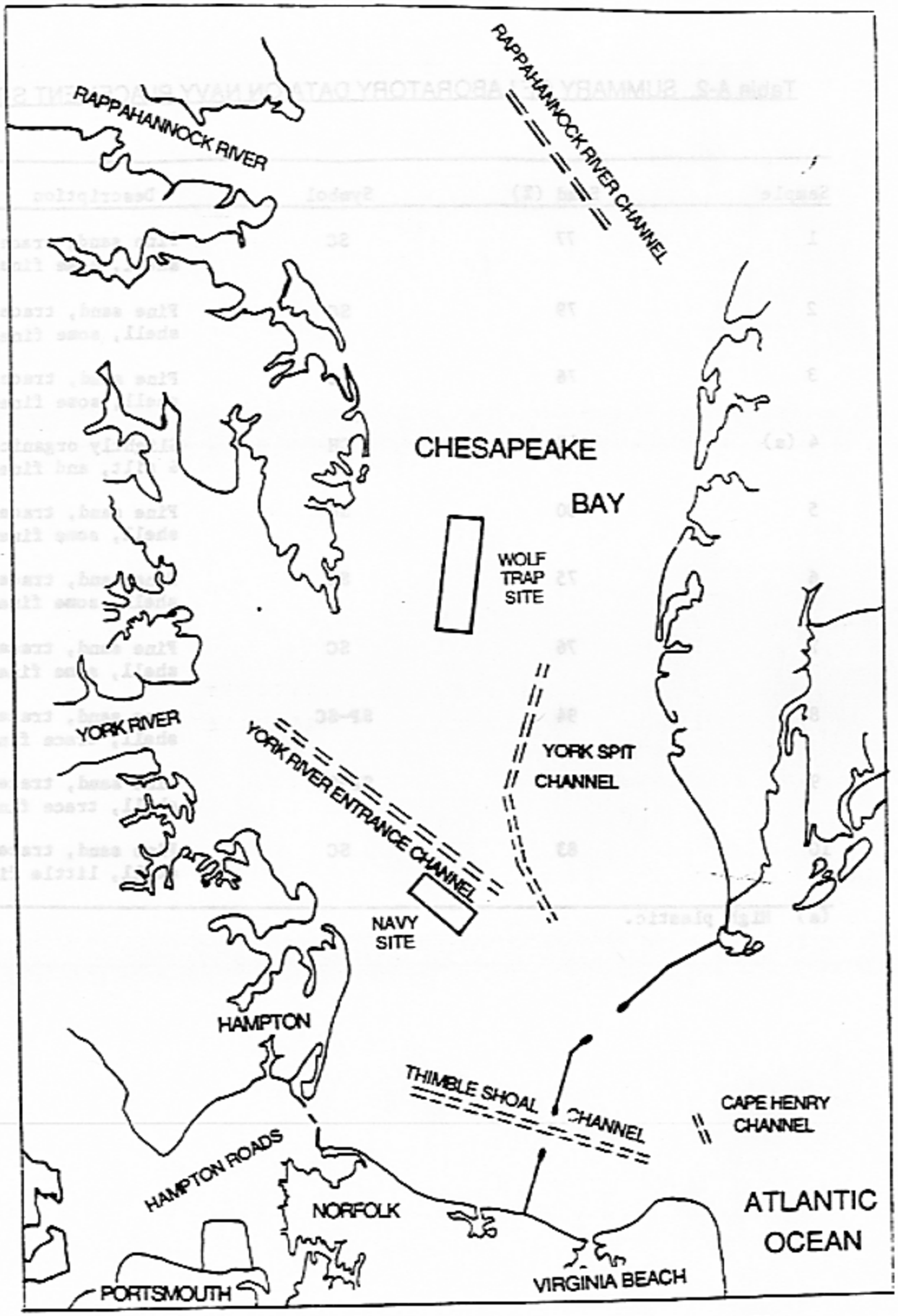


Figure A-8. Location of Wolf Trap and Navy Placement Sites

WOLF TRAP (ALTERNATE) DISPOSAL SITE

20. After detailed investigation, it was determined that the Wolf Trap (Alternate) Disposal Site represents the best means for the placement of material resulting from the dredging of the York River Entrance Channel. This 2,300-acre site (4,500 acres with buffer zone) is located in the Chesapeake Bay east of New Point Comfort and south of Wolf Trap light and is relatively close to the York River project area, as shown in figure A-8. The site is the authorized placement area for dredged material resulting from the maintenance of the York Spit Channel, which is part of the Baltimore Harbor Channel system.

21. Between the fall of 1987 and the summer of 1989, approximately 18,000,000 cubic yards of dredged material from the York Spit Channel were placed in the Wolf Trap (Alternate) Disposal Site. Based on a review of the results of geotechnical investigations conducted by the Baltimore District in 1985, the channel material varied from mostly gray silty sand to gray sandy silt with traces of shell fragments. The sand ranged from well graded to poorly graded and contained fines of low plasticity. The silt also exhibited low plasticity.

22. The information presently available on the character of the sediments within the Wolf Trap site is preliminary and was developed by the Virginia Institute of Marine Science (VIMS) in conjunction with its extensive monitoring effort at the site, under a contract with the Baltimore District Corps of Engineers. For the purposes of monitoring and dredged material placement, VIMS divided the site into six compartments, as shown in figure A-9. The physical data presented in table A-3 represent sediments found within cells C and B.

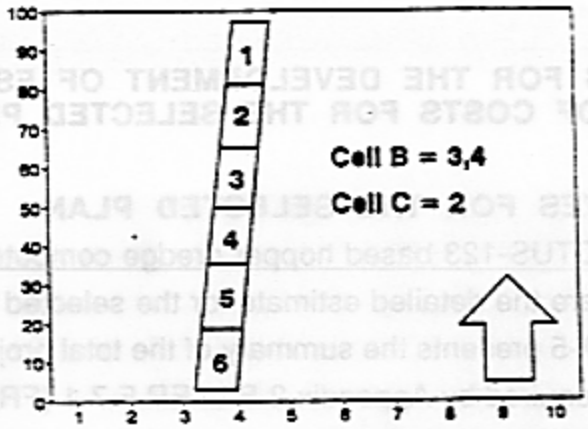


Figure A-9. Wolf Trap (Alternate) Site Compartments

Table A-3. PRELIMINARY INFORMATION ON THE PHYSICAL CHARACTER OF WOLF TRAP SEDIMENTS

Relative portion of total sediment	Depth of water (meters)	Grain size (phi)
CELL B		
None	11-13	3.2-5.2
Low	11-13	3.9-4.7
Moderate	11-13	2.5-4.9
High	11-13	2.2-4.5
CELL C		
None	10-12	2.7-3.2
Low	10-12	3.0-3.5
Moderate	11-12	3.2-3.6
High	11-13	3.2-3.5

Source: VIMS, Gloucester Point, Virginia.

23. The information presented in table A-3 indicates that the major portion of the sediment is classified as fine sand (Wentworth size class, 2.0 to 3.0) and very fine sand (Wentworth size class, 3.0 to 4.0). Those sediments with phi values greater than 4.0 fall within the coarse silt class.

24. A complete and comprehensive report on the monitoring at the Wolf Trap (Alternate) Disposal Site is being prepared by VIMS for the Baltimore District. The completed report should be available during calendar year 1993.

BASIS FOR THE DEVELOPMENT OF ESTIMATES OF COSTS FOR THE SELECTED PLAN

COST ESTIMATES FOR THE SELECTED PLAN

25. The Corps LOTUS-123 based hopper dredge computer estimating program was used to prepare the detailed estimate for the selected plan as presented in table A-4. Table A-5 presents the summary of the total project cost of the selected plan as required by Appendix 2-B of ER 5-7-1 (FR). Pertinent cost information is presented in exhibit 3.

26. An alternative estimate of the cost to construct the selected plan by clamshell dredging method was developed using the Corps LOTUS-123 based clamshell dredge computer estimating program. The cost estimate is presented in table A-5 and pertinent information is presented in exhibit 4.

ASSUMPTIONS USED IN COST ESTIMATE

27. The following assumptions were used to develop the estimates of costs for the selected plan.

a. **Scope and design of project:** The present project design will provide an entrance channel for deep draft access from the Chesapeake Bay at the York Spit Channel to the naturally deep waters within the York River. The channel will follow the course of the existing marked channel constructed for the Navy in the 1950's. Channel design dimensions are 750 feet wide (same as existing channel) and 37 feet deep. Based on a survey performed in 1984 for the feasibility study, it is assumed that adequate deep water to provide the 37 feet depth is available within the area upstream of the existing marked channel. The availability of deep water upstream of station 573+41 (buoys 17 & 18) of the entrance channel will be verified by surveys during the implementation phase. The cost estimate for the selected plan provides for dredging only within the existing entrance channel.

Table A-4. THE SELECTED PLAN - ESTIMATED FIRST COST BY HOPPER DREDGE METHOD

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
12.-.-.-	NAVIGATION PORTS & HARBORS				
12.1.-.-	PORTS				
12.1.A.-	Mobilization and Demobilization	1	LS	314,000.00	314,000
12.1.3.-	Hopper Dredging	1,000,000	CY	3.30	3,300,000
	Subtotal, Ports				3,614,000
12.1.2.-	Contingencies				436,000
12.-.-.-	Navigation Ports and Harbors Total				4,050,000
29.-.-.-	LOCAL COOPERATION AGREEMENTS				
29.-.-.-	Local Cooperation Agreement	1	LS	20,000.00	20,000
	Subtotal, Local Cooperation Agreements				20,000
29.0.Z.-	Contingencies				3,000
29.-.-.-	Local Cooperation Agreements Total				23,000
30.-.-.-	ENGINEERING AND DESIGN				
30.D.-.-	Environmental and Regulatory Activities	1	LS	5,000.00	5,000
30.H.-.-	Plans and Specifications	1	LS	15,000.00	15,000
30.J.-.-	Design Related Engineering				
30.J.1.-	Supplemental Geotech Investigations	1	LS	5,000.00	5,000
30.J.4.-	Obstruction Investigation Surveys	1	LS	138,000.00	138,000
30.J.9.-	Channel Survey, Sta. -16+00 to 740-00	1	LS	92,000.00	92,000
30.J.9.-	Placement Site Survey - Wolf Trap	1	LS	110,000.00	110,000
30.P.-.-	Cost Engineering	1	LS	3,000.00	3,000
30.Q.-.-	Construction Contract Award Activities	1	LS	2,000.00	2,000
30.S.-.-	Engrg & Design Phase Technical Mgmt	1	LS	30,000.00	30,000
30.Z.-.-	Miscellaneous Activities	1	LS	23,500.00	23,500
	Subtotal, Engineering and Design				423,500
30.0.Z.-	Contingencies				63,500
30.-.-.-	Engineering and Design Total				487,000
31.-.-.-	CONSTRUCTION MANAGEMENT				
31.B.-.-	Contract Administration	1	LS	60,000.00	60,000
31.E.-.-	Inspection and Quality Assurance	1	LS	60,000.00	60,000
31.E.3.-	Quantity Surveys and Estimates	1	LS	170,000.00	170,000
31.Z.- -	Miscellaneous Expenses	1	LS	5,000.00	5,000
	Subtotal, Construction Management				295,000
31.0.Z.	Contingencies				45,000
31.-.-.-	Construction Management Total				340,000
	TOTAL PROJECT COSTS				4,900,000

Table A-5. TOTAL CONTRACT COST SUMMARY

THIS ESTIMATE IS BASED ON THE CONCEPT DRAWINGS, DATED: 10 MAY 1993

DISTRICT: NORFOLK
P.O.C.: JOHN MAZUCH, CHIEF, COST ENGINEERING

PROJECT: YORK RIVER ENTRANCE CHANNEL, SECTION 107 STUDY
LOCATION: YORK RIVER, VIRGINIA

CURRENT MCACES ESTIMATE PREPARED: JUN FY 92
EFFECTIVE PRICING LEVEL: JUN FY 93

AUTHORIZ/BUDGET YEAR: MAR FY 95
EFFECT PRICING LEVEL: MAR FY 95

ACCOUNT NUMBER	FEATURE DESCRIPTION	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	OHB (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FEATURE MID PT	OHB (%)	COST ($K)	CNTG ($K)	FULL ($K)
										.....FULLY FUNDED ESTIMATE.....				
12---	NAVIGATION PORTS & HARBORS	3,614	436	12%	4,050	5.6%	3,816	458	4,274	MAYFY95	0.59%	3,839	461	4,300
	TOTAL CONSTRUCTION COSTS ==========>	3,614	436	12%	4,050		3,816	458	4,274			3,839	461	4,300
29---	LOCAL COOPERATION AGREEMENT	20	3	15%	23	5.6%	21	3	24	MAYFY95	0.59%	21	3	24
30---	PLANNING, ENGINEERING AND DESIGN	423	64	15%	487	5.6%	447	67	514	MAYFY95	0.59%	450	68	518
31---	CONSTRUCTION MANAGEMENT	295	45	15%	340	5.6%	312	47	359	MAYFY95	0.59%	314	47	361
	TOTAL PROJECT COSTS ==========>	4,352	548	13%	4,900		4,596	575	5,171			4,624	579	5,203
	TOTAL FEDERAL COSTS ==========>													3,382
	TOTAL NON-FEDERAL COSTS ==========>													1,821

THE MAXIMUM PROJECT COST IS ========> $ N/A

THIS TPCS REFLECTS A PROJECT COST CHANGE OF $ N/A

DISTRICT APPROVED:

_____ CHIEF, COST ENGINEERING
_____ CHIEF, REAL ESTATE
_____ CHIEF, PLANNING
_____ CHIEF, ENGINEERING
_____ CHIEF, CON-OPS
_____ CHIEF, PROGRAMS MANAGEMENT
_____ PROJECT MANAGER
_____ DDE (PM)

DIVISION APPROVED:

_____ CHIEF, COST ENGINEERING
_____ CHIEF, REAL ESTATE
_____ CHIEF, PROGRAMS MANAGEMENT
_____ DIRECTOR OF PPMD

APPROVED DATE: _____

Table A-6. THE SELECTED PLAN - ESTIMATED FIRST COST BY CLAMSHELL METHOD

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
12.-.-.-	NAVIGATION PORTS & HARBORS				
12.1.-.-	PORTS				
12.1.A.-	Mobilization and Demobilization	1	LS	279,657.00	280,000
12.1.3.-	Mechanical Dredging	1,000,000	CY	2.65	2,650,000
	Subtotal, Ports				2,930,000
12.1.2.-	Contingencies				733,000
12.-.-.-	Navigation Ports and Harbors Total				3,663,000
29.-.-.-	LOCAL COOPERATION AGREEMENTS				
29.-.-.-	Local Cooperation Agreement	1	LS	20,000.00	20,000
	Subtotal, Local Cooperation Agreements				20,000
29.0.Z.-	Contingencies				3,000
29.-.-.-	Local Cooperation Agreements Total				23,000
30.-.-.-	ENGINEERING AND DESIGN				
30.D.-.-	Environmental and Regulatory Activities	1	LS	5,000.00	5,000
30.H.-.-	Plans and Specifications	1	LS	15,000.00	15,000
30.J.-.-	Design Related Engineering				
30.J.1.-	Supplemental Geotech Investigations	1	LS	5,000.00	5,000
30.J.4.-	Obstruction Investigation Surveys	1	LS	138,000.00	138,000
30.J.9.-	Channel Survey, Sta. -16+00 to 740-00	1	LS	92,000.00	92,000
30.J.9.-	Placement Site Survey - Wolf Trap	1	LS	110,000.00	110,000
30.P.-.-	Cost Engineering	1	LS	3,000.00	3,000
30.Q.-.-	Construction Contract Award Activities	1	LS	2,000.00	2,000
30.S.-.-	Engrg & Design Phase Technical Mgmt	1	LS	30,000.00	30,000
30.Z.-.-	Miscellaneous Activities	1	LS	23,500.00	23,500
	Subtotal, Engineering and Design				423,500
30.0.Z.-	Contingencies				63,500
30.-.-.-	Engineering and Design Total				487,000
31.-.-.-	CONSTRUCTION MANAGEMENT				
31.B.-.-	Contract Administration	1	LS	60,000.00	60,000
31.E.-.-	Inspection and Quality Assurance	1	LS	60,000.00	60,000
31.E.3.-	Quantity Surveys and Estimates	1	LS	170,000.00	170,000
31.Z.- -	Miscellaneous Expenses	1	LS	5,000.00	5,000
	Subtotal, Construction Management				295,000
31.0.Z.	Contingencies				45,000
31.-.-.-	Construction Management Total				340,000
	TOTAL PROJECT COSTS				4,513,000

Table A-5. TOTAL CONTRACT COST SUMMARY

THIS ESTIMATE IS BASED ON THE CONCEPT DRAWINGS, DATED: 10 MAY 1993

PROJECT: YORK RIVER ENTRANCE CHANNEL, SECTION 107 STUDY
LOCATION: YORK RIVER, VIRGINIA

DISTRICT: NORFOLK
P.O.C.: JOHN MAZUCH, CHIEF, COST ENGINEERING

		CURRENT MCACES ESTIMATE PREPARED: JUN FY 92 / EFFECTIVE PRICING LEVEL: JUN FY 93				AUTHORIZ/BUDGET YEAR: MAR FY 95 / EFFECT PRICING LEVEL: MAR FY 95				.....FULLY FUNDED ESTIMATE.....				
ACCOUNT NUMBER	FEATURE DESCRIPTION	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	OMB (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FEATURE MID PT	OMB (%)	COST ($K)	CNTG ($K)	FULL ($K)
12---	NAVIGATION PORTS & HARBORS	3,614	436	12%	4,050	5.6%	3,816	458	4,274	MAYFY95	0.59%	3,839	461	4,300
	TOTAL CONSTRUCTION COSTS ==========>	3,614	436	12%	4,050		3,816	458	4,274			3,839	461	4,300
29---	LOCAL COOPERATION AGREEMENT	20	3	15%	23	5.6%	21	3	24	MAYFY95	0.59%	21	3	24
30---	PLANNING, ENGINEERING AND DESIGN	423	64	15%	487	5.6%	447	67	514	MAYFY95	0.59%	450	68	518
31---	CONSTRUCTION MANAGEMENT	295	45	15%	340	5.6%	312	47	359	MAYFY95	0.59%	314	47	361
	TOTAL PROJECT COSTS ==========>	4,352	548	13%	4,900		4,596	575	5,171			4,624	579	5,203

TOTAL FEDERAL COSTS ==========> 3,382

TOTAL NON-FEDERAL COSTS ==========> 1,821

THIS TPCS REFLECTS A PROJECT COST CHANGE OF $ N/A

THE MAXIMUM PROJECT COST IS ========> $ N/A

DISTRICT APPROVED:

_____ CHIEF, COST ENGINEERING
_____ CHIEF, REAL ESTATE
_____ CHIEF, PLANNING
_____ CHIEF, ENGINEERING
_____ CHIEF, CON-OPS
_____ CHIEF, PROGRAMS MANAGEMENT
_____ PROJECT MANAGER
_____ DDE (PM)

DIVISION APPROVED:

_____ CHIEF, COST ENGINEERING
_____ CHIEF, REAL ESTATE
_____ CHIEF, PROGRAMS MANAGEMENT
_____ DIRECTOR OF PPMD

APPROVED DATE: _____

Table A-6. THE SELECTED PLAN - ESTIMATED FIRST COST BY CLAMSHELL METHOD

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
12.-.-.-	NAVIGATION PORTS & HARBORS				
12.1.-.-	PORTS				
12.1.A.-	Mobilization and Demobilization	1	LS	279,657.00	280,000
12.1.3.-	Mechanical Dredging	1,000,000	CY	2.65	2,650,000
	Subtotal, Ports				2,930,000
12.1.2.-	Contingencies				733,000
12.-.-.-	Navigation Ports and Harbors Total				3,663,000
29.-.-.-	LOCAL COOPERATION AGREEMENTS				
29.-.-.-	Local Cooperation Agreement	1	LS	20,000.00	20,000
	Subtotal, Local Cooperation Agreements				20,000
29.0.Z.-	Contingencies				3,000
29.-.-.-	Local Cooperation Agreements Total				23,000
30.-.-.-	ENGINEERING AND DESIGN				
30.D.-.-	Environmental and Regulatory Activities	1	LS	5,000.00	5,000
30.H.-.-	Plans and Specifications	1	LS	15,000.00	15,000
30.J.-.-	Design Related Engineering				
30.J.1.-	Supplemental Geotech Investigations	1	LS	5,000.00	5,000
30.J.4.-	Obstruction Investigation Surveys	1	LS	138,000.00	138,000
30.J.9.-	Channel Survey, Sta. -16+00 to 740-00	1	LS	92,000.00	92,000
30.J.9.-	Placement Site Survey - Wolf Trap	1	LS	110,000.00	110,000
30.P.-.-	Cost Engineering	1	LS	3,000.00	3,000
30.Q.-.-	Construction Contract Award Activities	1	LS	2,000.00	2,000
30.S.-.-	Engrg & Design Phase Technical Mgmt	1	LS	30,000.00	30,000
30.Z.-.-	Miscellaneous Activities	1	LS	23,500.00	23,500
	Subtotal, Engineering and Design				423,500
30.0.Z.-	Contingencies				63,500
30.-.-.-	Engineering and Design Total				487,000
31.-.-.-	CONSTRUCTION MANAGEMENT				
31.B.-.-	Contract Administration	1	LS	60,000.00	60,000
31.E.-.-	Inspection and Quality Assurance	1	LS	60,000.00	60,000
31.E.3.-	Quantity Surveys and Estimates	1	LS	170,000.00	170,000
31.Z.- -	Miscellaneous Expenses	1	LS	5,000.00	5,000
	Subtotal, Construction Management				295,000
31.0.Z.	Contingencies				45,000
31.-.-.-	Construction Management Total				340,000
	TOTAL PROJECT COSTS				4,513,000

unit cost of dredging was increased to provide for the expense of observers and installation of the screens. For the York River project, with an estimated dredging quantity of 1,000,000 cubic yards of material, the expenses for the observer program, including overhead and profit, increase the estimated unit cost of dredging by $0.15 from $3.15 to $3.30 per cubic yard (see page 7 of Exhibit 3).

The clamshell dredging cost estimate was based on the use of a clamshell dredge with a bucket having a nominal capacity of 18 cubic yards working in connection with two scows, each with a nominal capacity of 3,000 cubic yards. A work tug would be utilized to maneuver the dredge within the dredging area and a towing vessel would be utilized to take the loaded scows to the placement site and return them to the dredge. Sediment is dumped at the placement site by the opening of the scows' bottom doors. The towing vessel and scows would remain underway while dumping is taking place. There are no special restrictions on the use of a clamshell dredging plant.

QUANTITIES AND ASSOCIATED COSTS FROM SIMILAR PROJECTS AND UNCERTAINTIES

28. The District has available much estimating and bid data, as well as good production data, to support the use of the hopper method as the basis for the development of the York River project cost estimate. These data are the result of at least 10 hopper dredging operations which have been accomplished within the past 6 years at four deep-draft channels in the lower Chesapeake Bay. These channels are Rappahannock Shoal, York Spit, Cape Henry, and Thimble Shoal. The York River Channel, the remaining deep-draft channel in the lower Chesapeake Bay, is in a similar environment and is expected to have conditions similar to the other channels.

29. Two similar projects which were performed in recent years by hopper dredge are the maintenance dredging of Thimble Shoal Channel, opened 16 June 1989, and the maintenance dredging of Cape Henry Channel, opened 7 January 1992. Copies of the abstracts are provided as exhibit 5. Pertinent information is also presented in table A-7. As may be seen from the tabulated data and the bid abstracts, there are uncertainties associated with both of the bid items. For similar hopper dredge projects which should have similar

mobilization and demobilization expenses due to their geographic proximity, the prices bid for mobilization/demobilization have varied from $0.00 to $600,000. The plant and equipment required for each of these projects are virtually the same, and the hauling distances and load cycle times are the same order of magnitude. One would expect very similar unit prices; however, they have varied from $1.83 to $5.49.

30. The cost of mobilization and demobilization associated with the hopper dredging of the York River project is based on a hopper dredge mobilizing within a 1,000-mile radius of the project area. A contingency factor of 15% has been applied to the mobilization cost to allow for uncertainty of the location of the hopper dredge at bid time. A contingency factor of 12% has been applied to the units of the non-pay yardage for the hopper dredge. The District cost engineer advises that for hopper dredge projects, with only a limited number of capable firms available to bid, other factors such as the bidding climate and competition can greatly influence the bids. The District cost engineer recommended the addition of at least 15% contingencies on the mobilization/demobilization bid item and 10% contingencies on the dredging bid item, with resulting composite level of contingencies of approximately 13%.

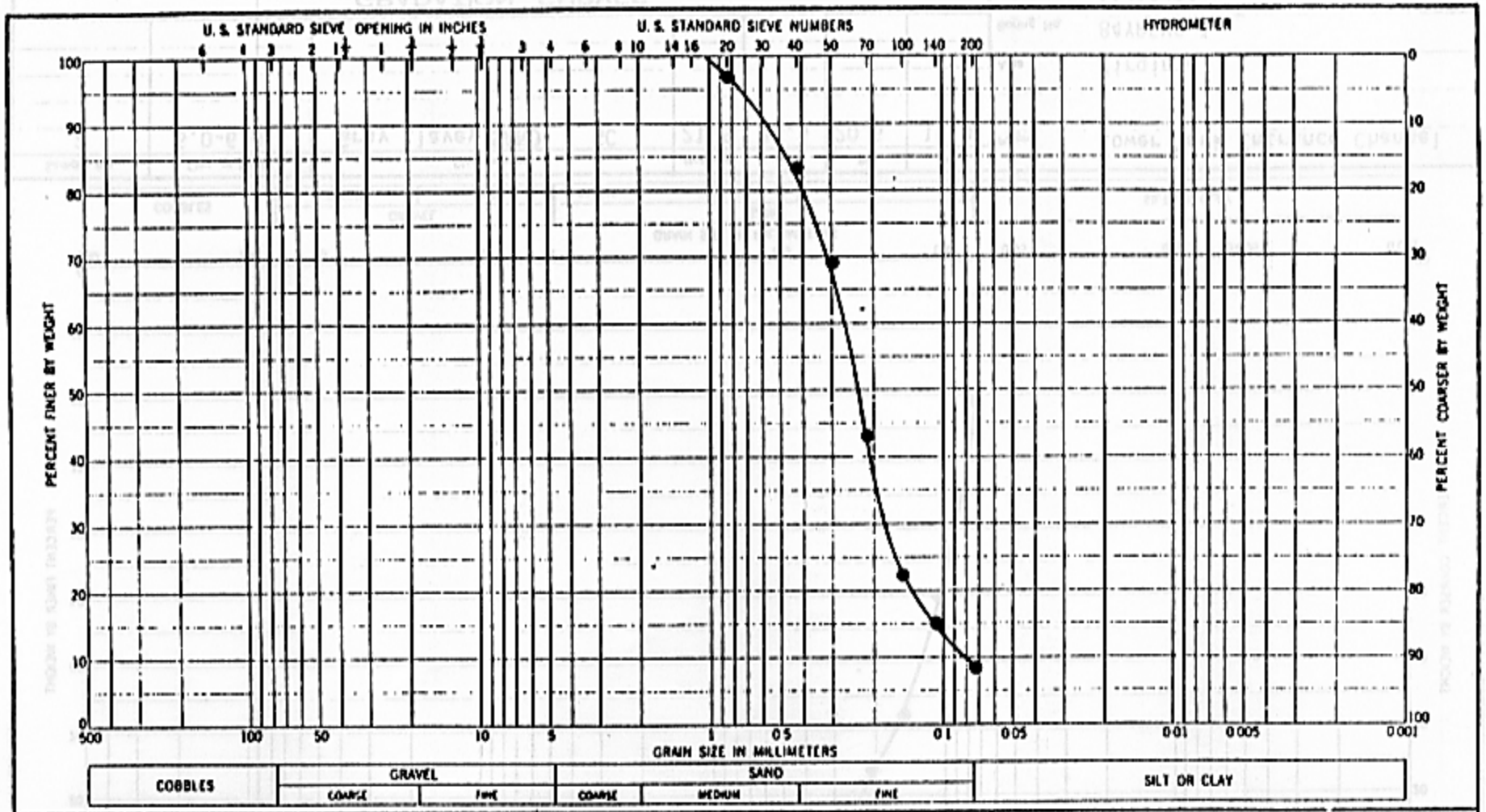
31. Data available to the District to serve as the basis for the development of a clamshell dredging estimate for the York River project are limited to one deep-draft clamshell dredging operation in the lower Chesapeake Bay. This operation consisted of limited clamshell dredging accomplished as part of the deepening of the Thimble Shoal Channel in 1987-1988. While this work demonstrated that the clamshell method can be a practicable and productive means of dredging in the open water environment of the lower Chesapeake Bay, there are only a few clamshell-scow systems suited and available for such operation. When the selected project is advertised for bid, it is anticipated that the limited availability of suitable clamshell dredges would lead to, at best, only one company bidding solely on the basis of a clamshell dredging plant. Conversely, it is anticipated that 2 to 4 companies would bid on the basis of available hopper dredging plants.

Table A-7. PERTINENT INFORMATION ON SIMILAR PROJECTS

Project	Quantity	Haul dist.	Mob./demob.	Unit price
Thimble Shoal opened 6/16/89	300,000 cy	20 mi.		
		Govt. Est. (w/o profit)	$307,092	$3.45/cy
		Bid No. 1 (low)	$600,000	$1.83/cy
		Bid No. 2 (3rd low)	$ 27,000	$5.49/cy
		Bid No. 3 (2nd low)	$300,000	$4.49/cy
		Average of 3 bids	$309,000	$3.94/cy
Cape Henry opened 1/7/92	408,200 cy	13 mi.		
		Govt. Est. (w/o profit)	$357,224	$3.00/cy
		Bid No. 1 (2nd low)	$130,000	$2.95/cy
		Bid No. 2 (3rd low)	$ 0	$3.67/cy
		Bid No. 3 (low)	$ 59,200	$2.25/cy
		Average of 3 bids	$ 63,000	$2.96/cy
York River June 1992	1,000,000 cy	12 mi.		
		Study Est. (with profit)	$314,000	$3.15/cy

32. The cost of mobilization and demobilization associated with the clamshell dredging of the York River project is based on a clamshell dredge mobilizing within a 500-mile radius of the project area. A contingency factor of 15% has been applied to the mobilization cost to allow for uncertainty of the location of the clamshell dredge at bid time. A contingency factor of 25% has been applied to the units of the non-pay yardage for the clamshell dredge. For clamshell dredging projects, with the possibility of only one firm available to bid, the District cost engineer recommended the addition of at least 15% contingencies on the mobilization/demobilization bid item and 26% contingencies on the dredging bid item, with resulting composite level of contingencies of approximately 25%.

33. Although the cost estimate for dredging the selected project by clamshell method is shown to be less costly than dredging by hopper method, it is considered very risky to base the project cost estimate on dredging by clamshell method because of limited available data and limited available clamshell dredging plants. It is considered much less of a risk to base the project cost estimate on the hopper dredge method. In this regard, the District has chosen to base the project estimate on the hopper dredge method.



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
1	0.0-1.0	Gray SAND, tr. Silt SP-SM	13.5	NP		

Project: Lower York Entrance Channel

Area: Virginia

Boring No.: 84YREVC-1

Date: 11/12/84

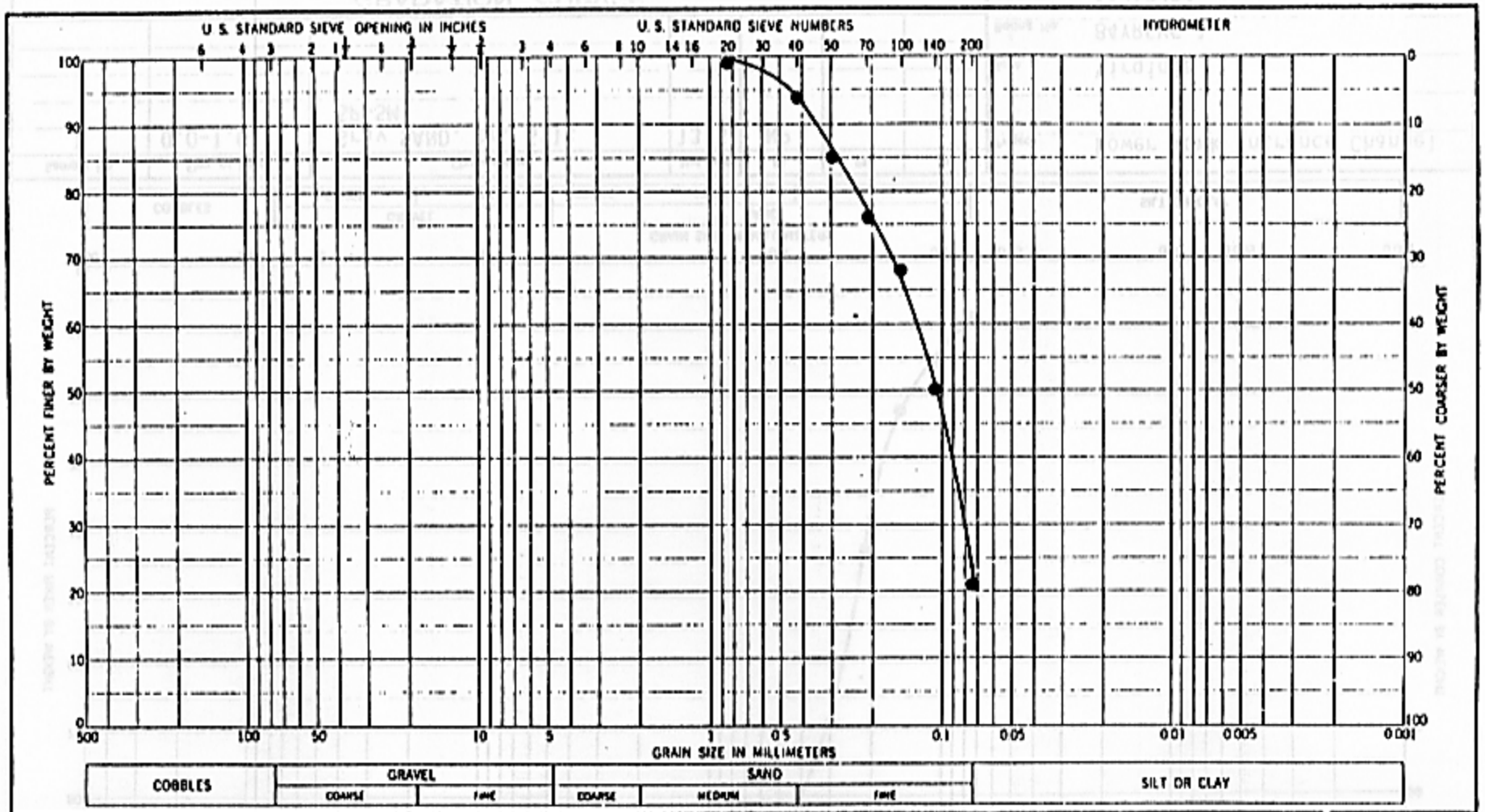
GRADATION CURVES

Exhibit 1

ENG FORM 1 MAY 63 2087

CEI 83-1118

Exhibit 1
2



Sample No.	Elev or Depth	Classification		Nat w %	LL	PL	PI
2	5.0-6.0	Gray clayey SAND	SC	21.5	35.5	20.5	15.0

Project: Lower York Entrance Channel

Area: Virginia

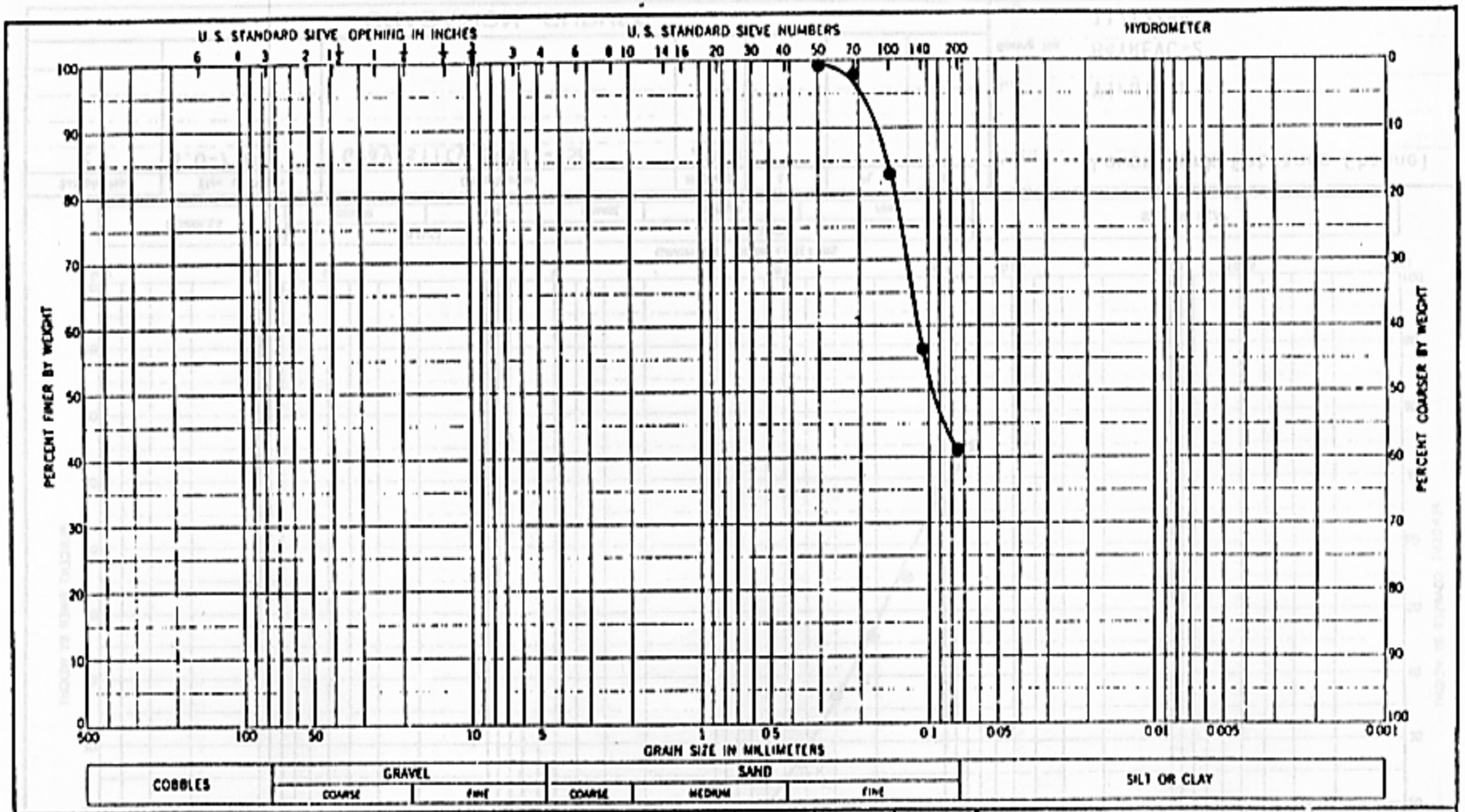
Boring No.: 84YREVC-1

Date: 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118



Sample No.	Elev or Depth	Classification		Nat w %	LL	PL	PI
1	0.0-1.0	Gray silty SAND	SM	32.0			

GRADATION CURVES

Project: Lower York Entrance Channel

Area: Virginia

Boring No.: 84YREVC-2

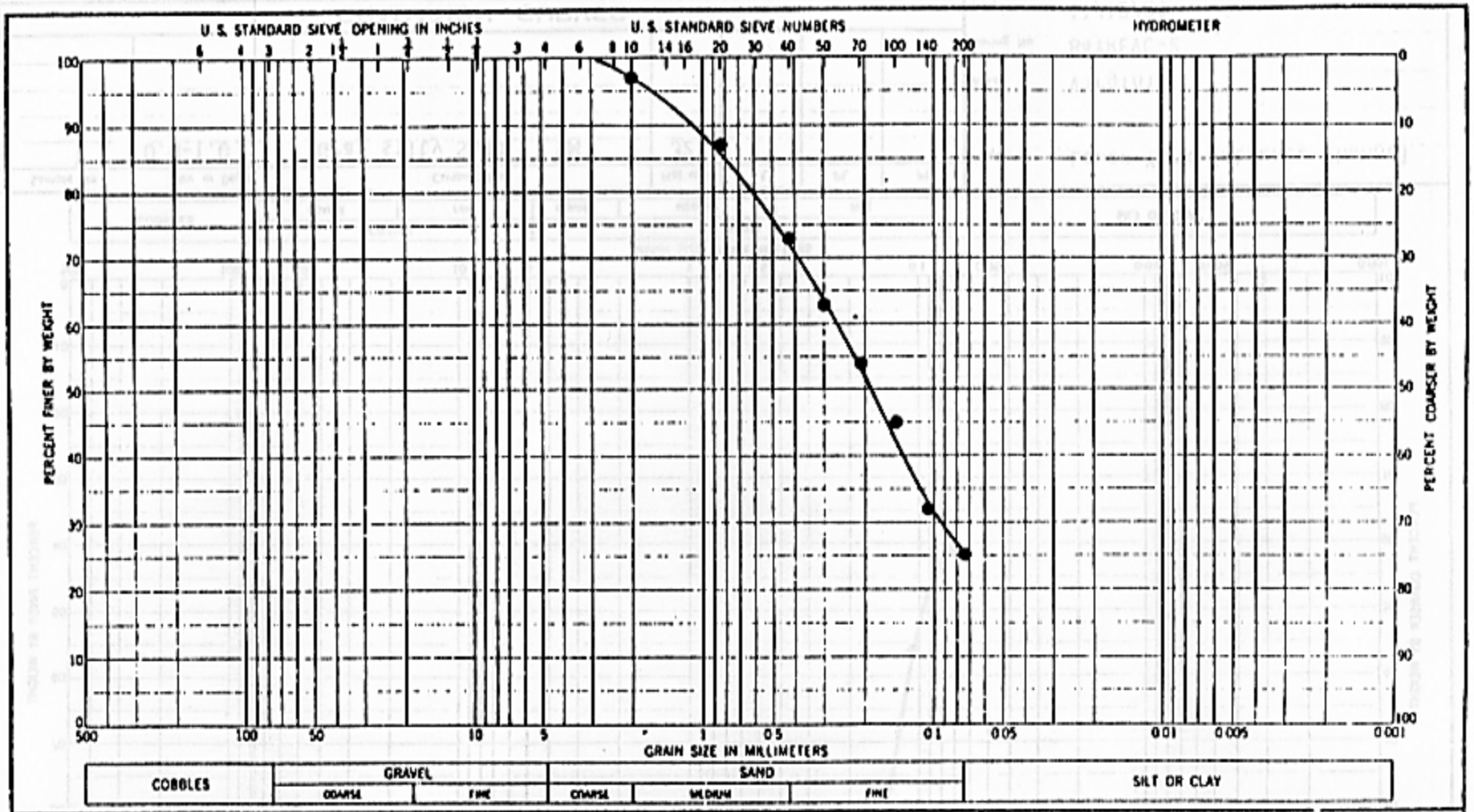
Date: 11/12/84

ENG FORM 1 MAY 63 2087

CEI 83-1118

Exhibit 1
3

Exhibit 1
4



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	6.0-7.0	Gray silty SAND - SM	20.0			

Project: Lower York Entrance Channel

Area: Virginia

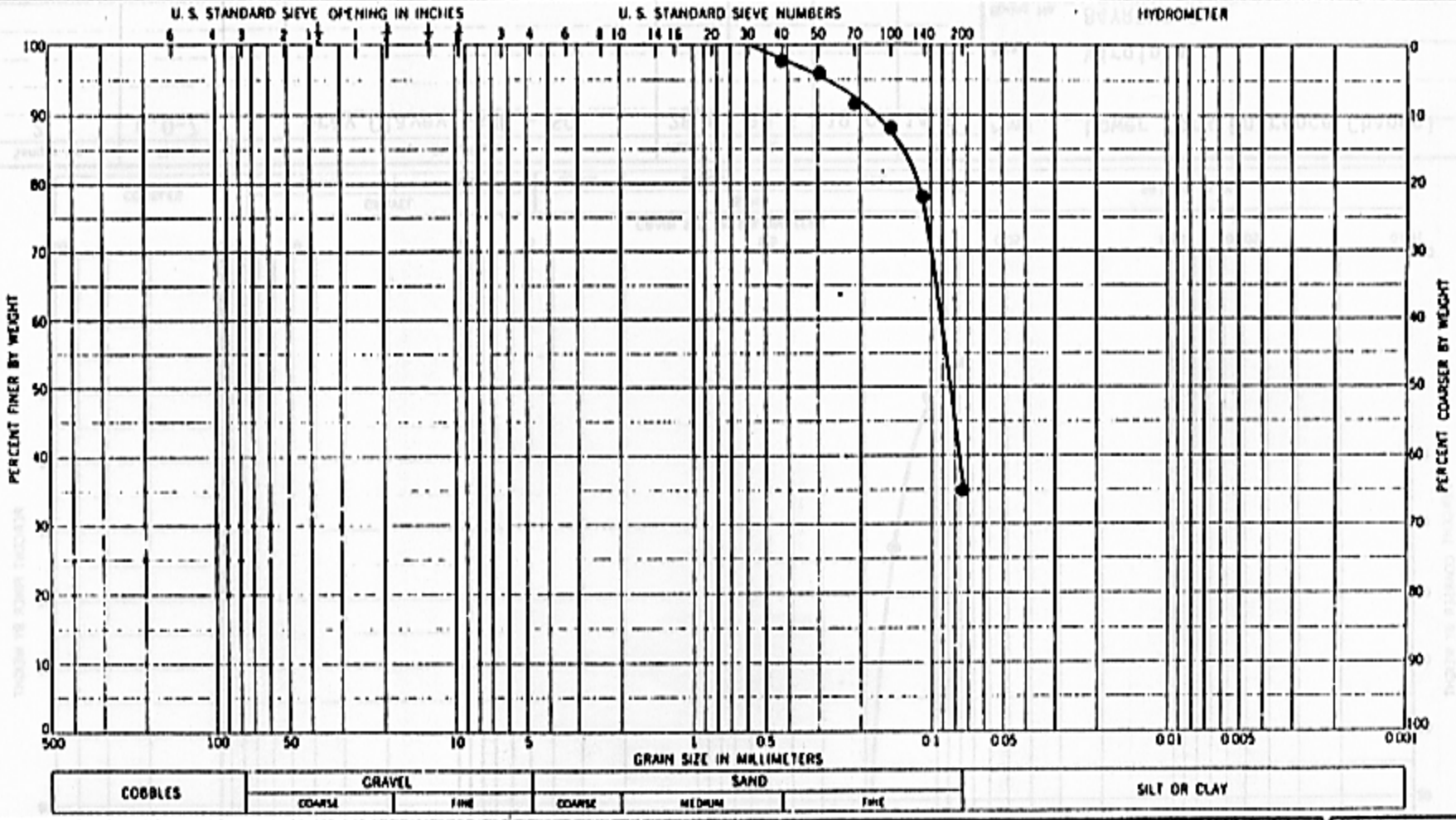
Boring No.: 84YREVC-2

Date: 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
1	0.0-1.0	Gray Silty SAND - SM	23.5			

Project: Lower York Entrance Channel

Area: Virginia

Boring No. B4YREVC-3

Date: 11/12/84

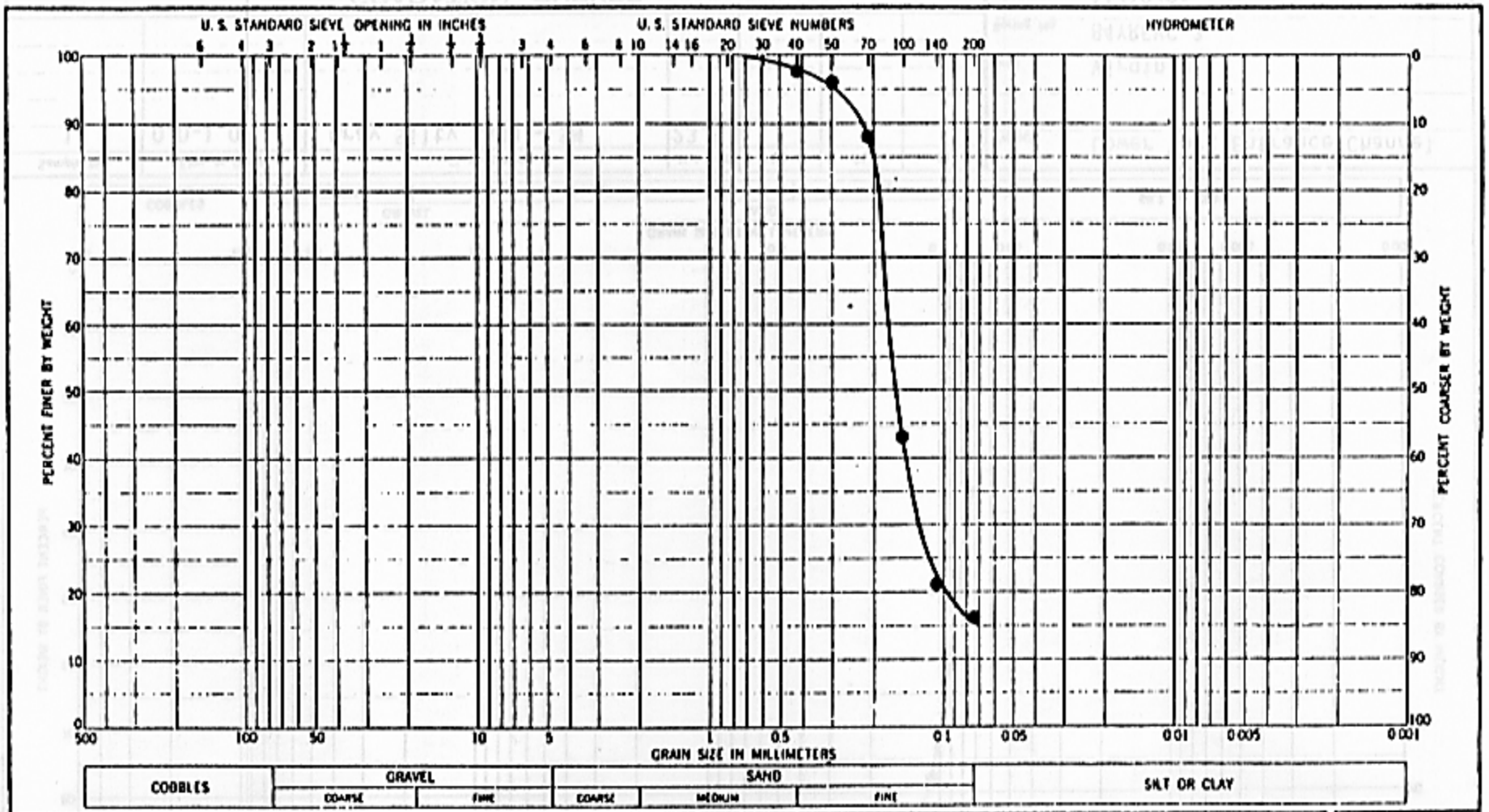
GRADATION CURVES

CEI 83-1118

ENG FORM 1 MAY 65 2087

Exhibit 1
5

Exhibit 1
6



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	6.0-7.0	Gray Clayey SAND - SC	28.0	32.5	18.0	14.5

Project Lower York Entrance Channel

Area Virginia

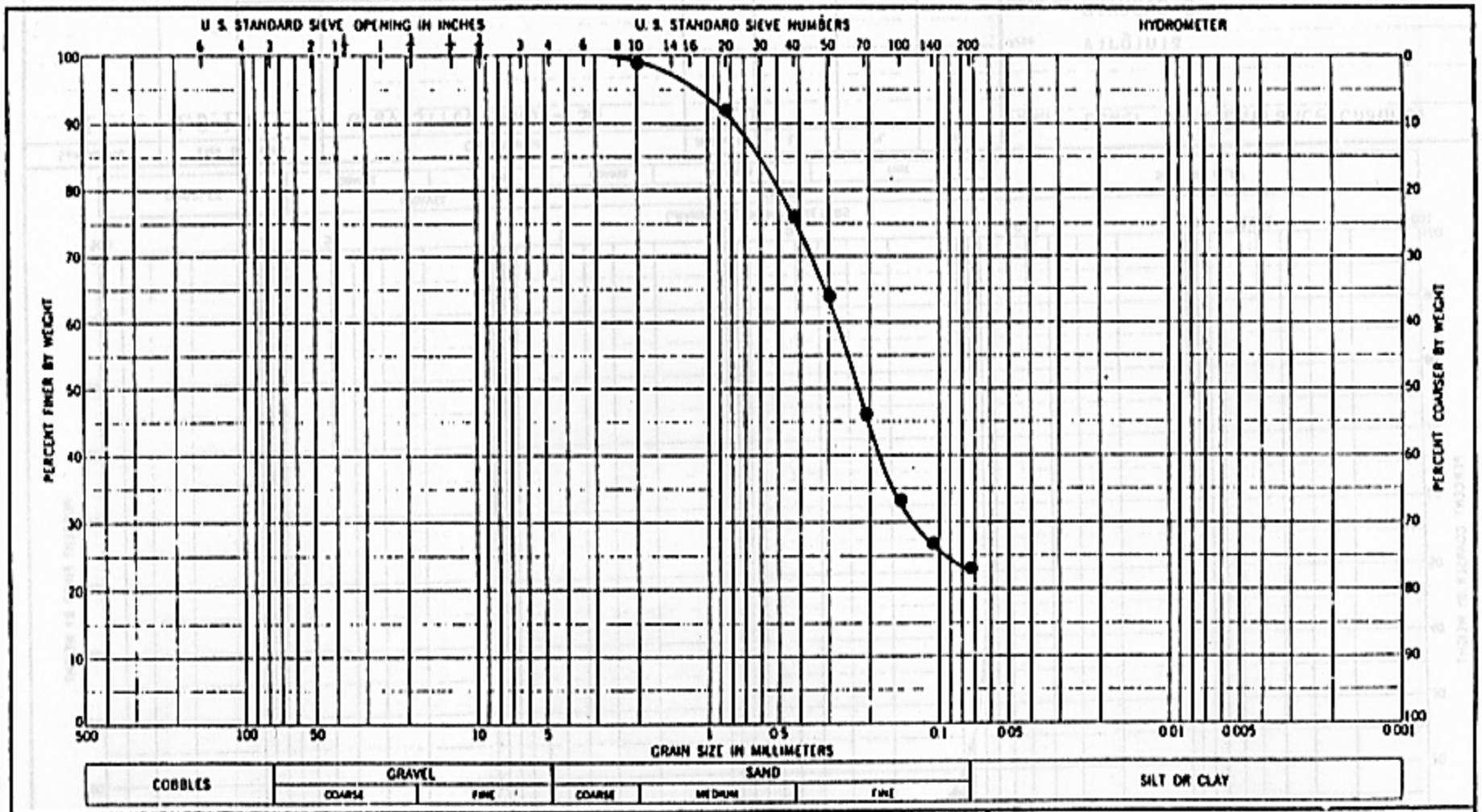
Boring No. 84YREVC-3

Date 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	6.0-7.0	Gray Clayey SAND - SC	20.5	23.5	12.5	11.0

Project: Lower York Entrance Channel

Area: Virginia

Boring No. 84YREVC-4

Date: 11/12/84

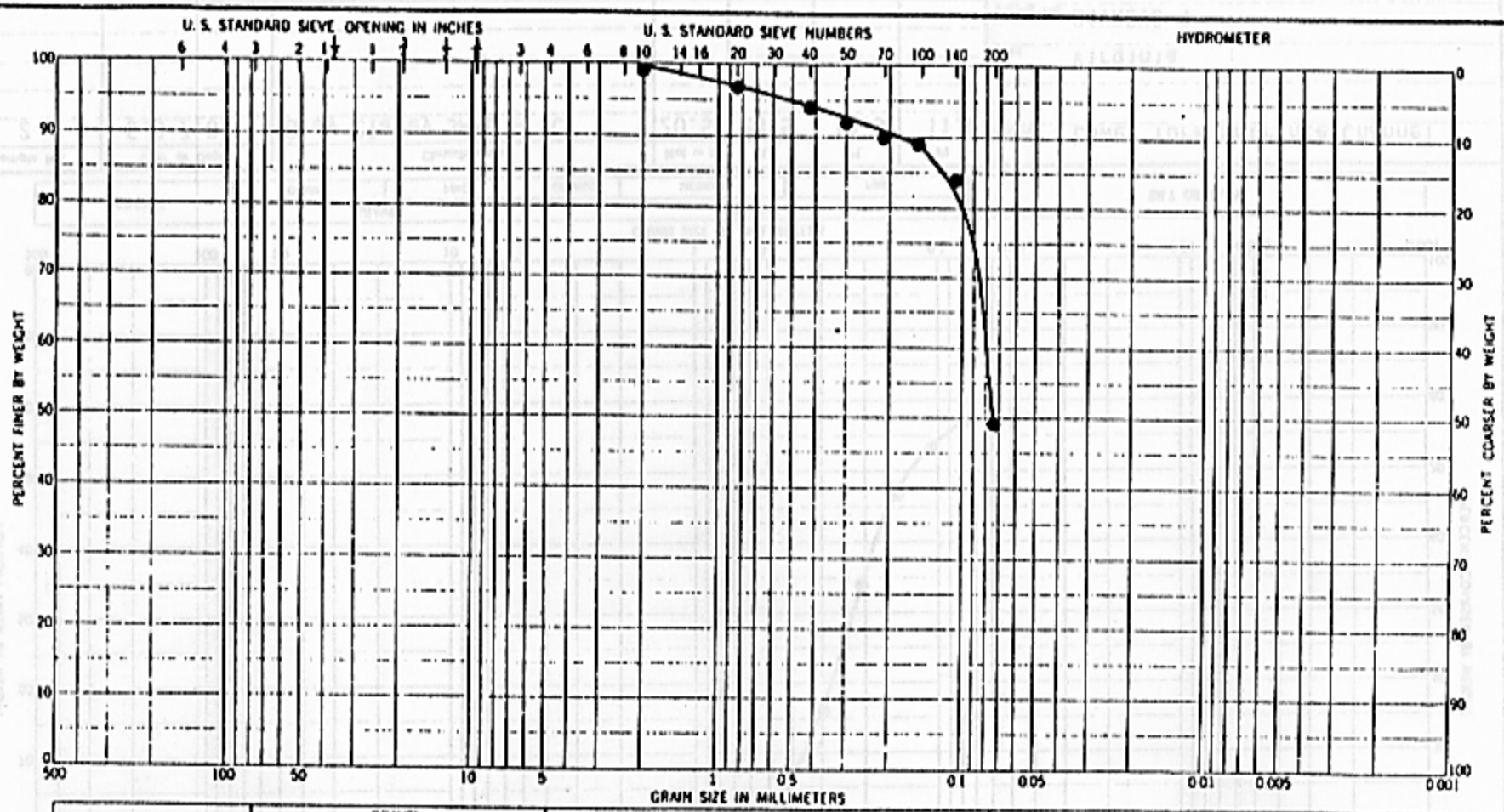
GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118

Exhibit 1
7

Exhibit 1
8 pages



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
1	0.0-1.0	Gray Silty SAND - SM	27.0			

Project: Lower York Entrance Channel

Area: Virginia

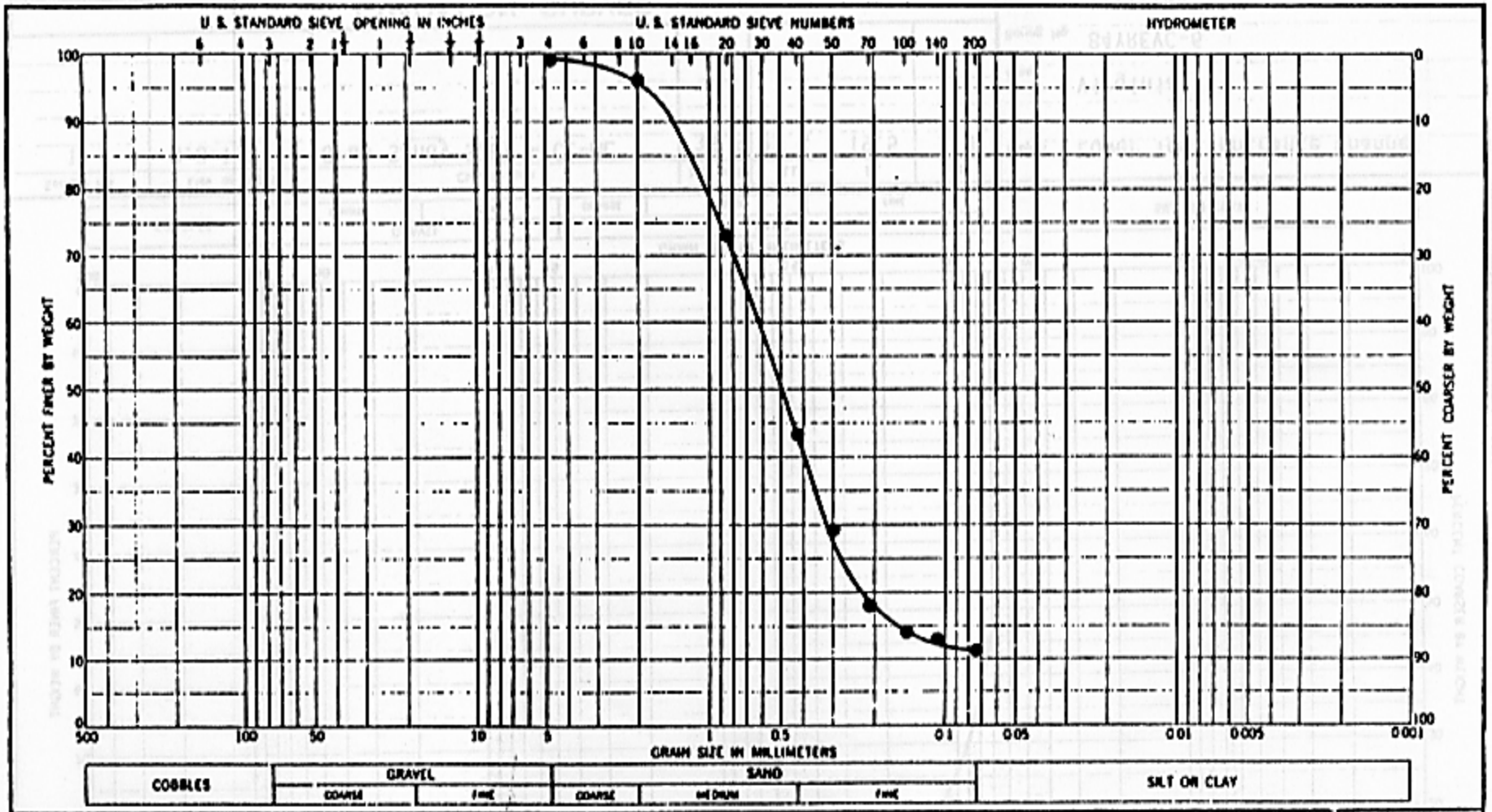
Boring No: 84YREVC-5

Date: 11/12/84

GRADATION CURVES

ENG FORM (MAY 61) 2087

CEI 83-1118



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	6.0-7.0	Gray Silty SAND - SP-SM	17.5			

Project: Lower York Entrance Channel

Area: Virginia

Boring No. 84YREVC-5

Date: 11/12/84

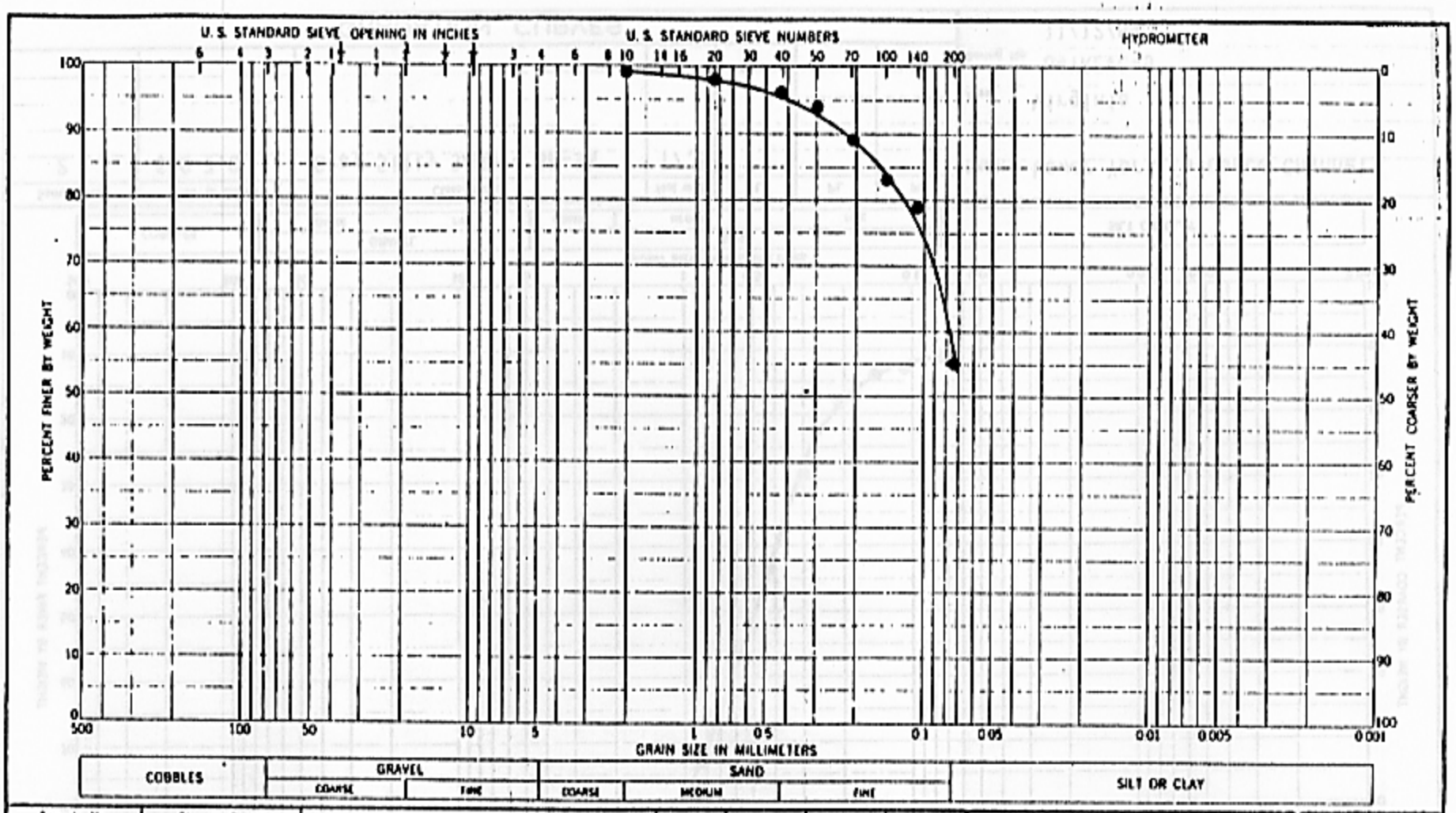
GRADATION CURVES

ENG FORM (MAY 69) 2087

CEI 83-1118

Exhibit 1
9

Exhibit 1
10



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
1	0.0-1.0	Gray Sandy SILT - CL-ML	35.5	22.5	19.5	3.0

Project: Lower York Entrance Channel

Area: Virginia

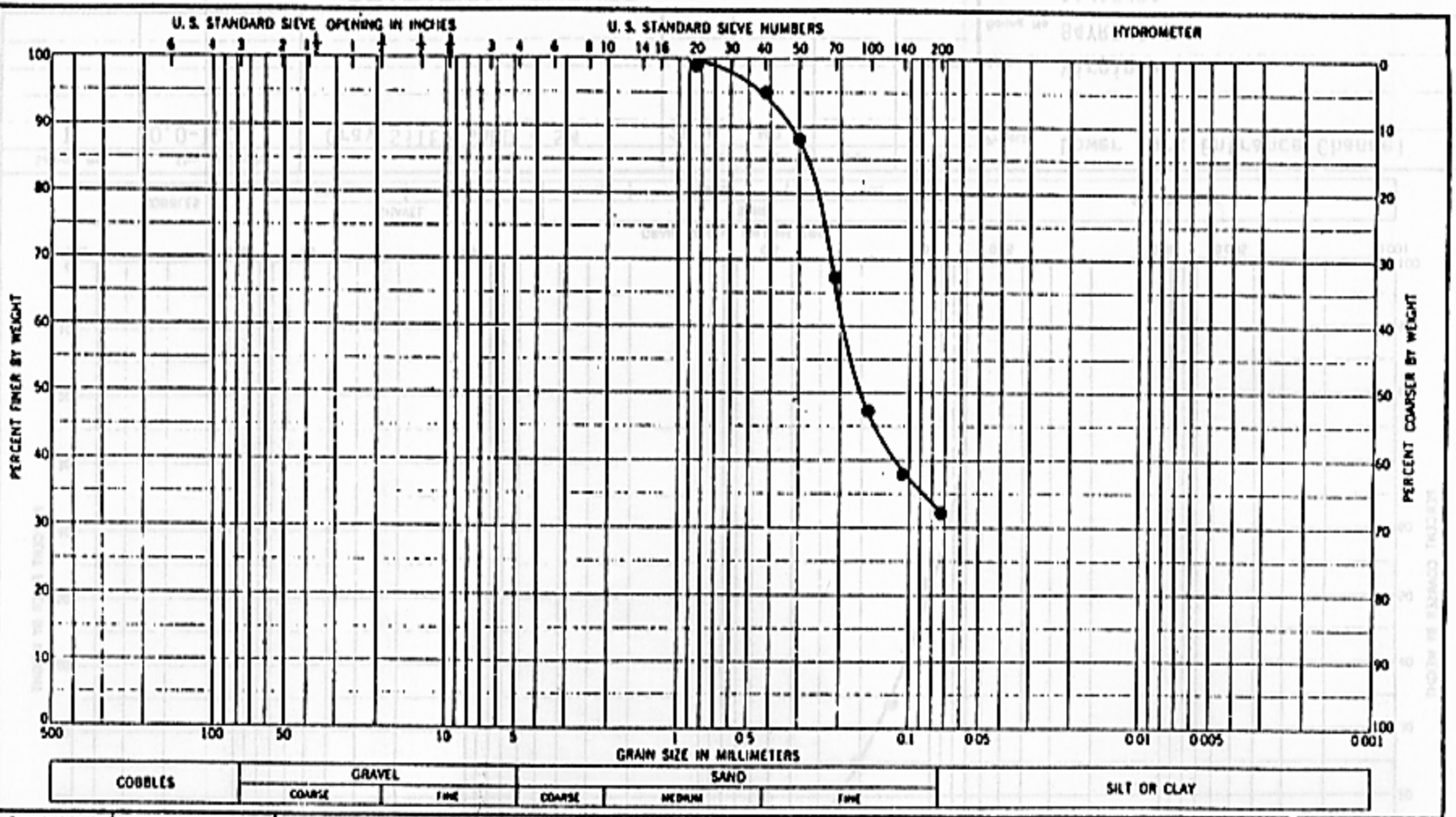
Boring No: 84YREVC-6

Date: 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	6.0-7.0	Gray Clayey SAND - SC	26.0			

Project: Lower York Entrance Channel

Area: Virginia

Boring No. 84YREVC-8

Date: 11/12/84

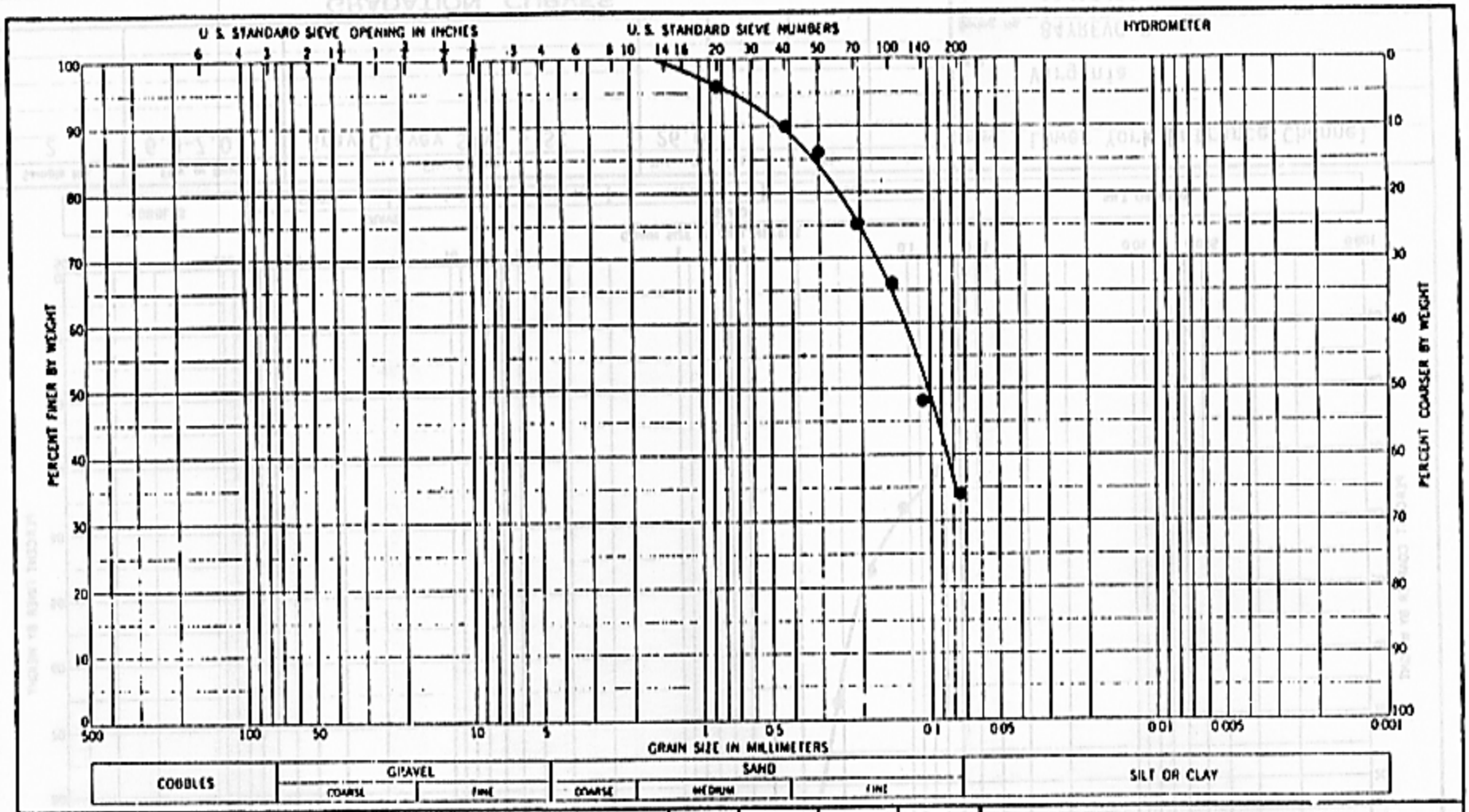
GRADATION CURVES

Exhibit 1
11

ENG FORM 1 MAY 83 2087

CEI 83-1118

Exhibit 1
12



Sample No.	Elev. or Depth	Classification	Nat. w %	LL	PL	PI
1	0.0-1.0	Gray Silty SAND - SM	29.0	NP		

Project: Lower York Entrance Channel

Area: Virginia

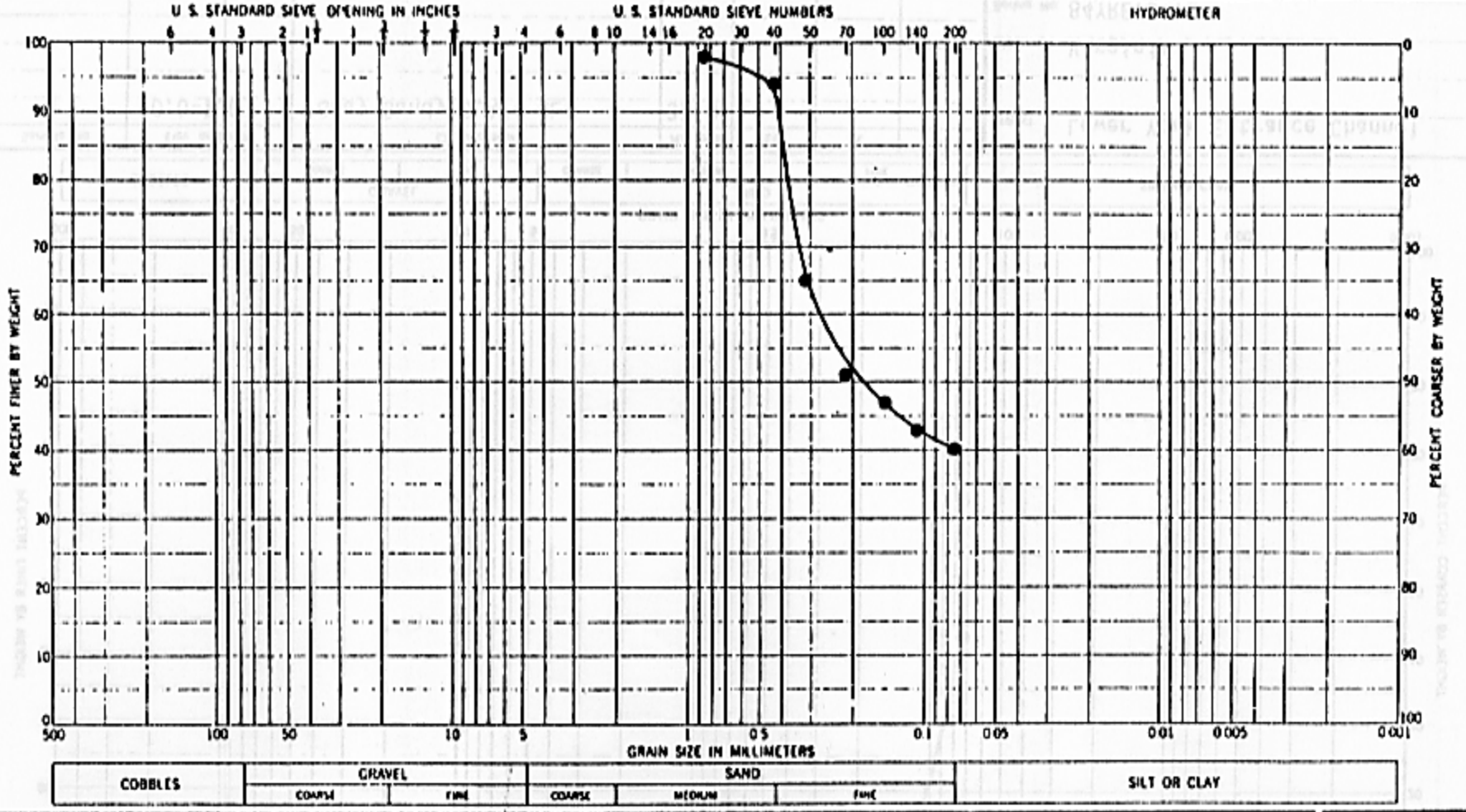
Boring No. 84YREVC-9

Date: 11/12/84

GRADATION CURVES

CEI 83-1118

ENG FORM (MAY 63) 2087



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	5.0-6.0	Gray Clayey SAND - SC	25.0			

Project: Lower York Entrance Channel

Area: Virginia

Boring No. 84YREVC-9

Date: 11/12/84

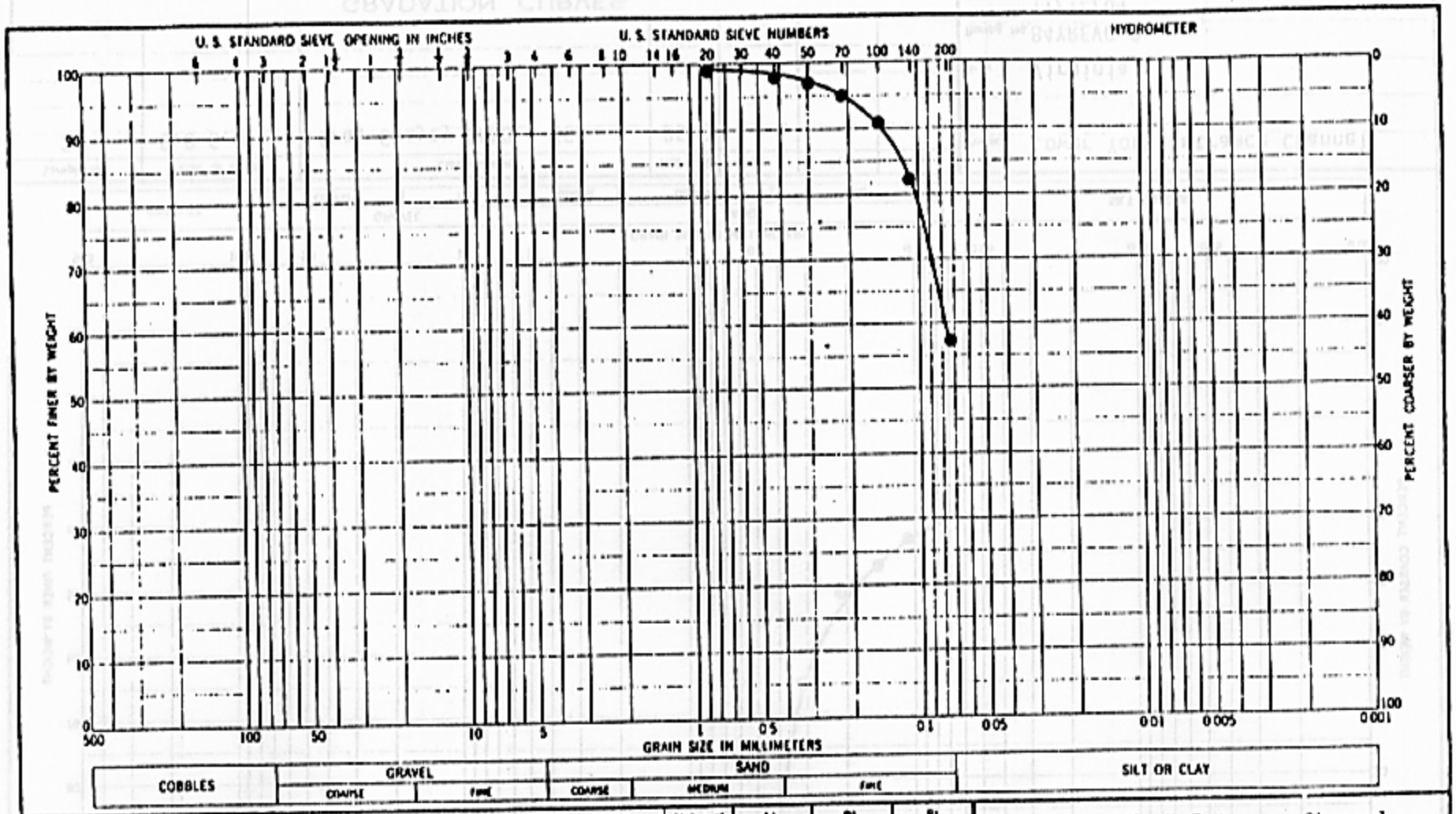
GRADATION CURVES

Exhibit 1
13

ENG FORM 1 MAY 63 2087

CEI 83-1118

Exhibit 1
14



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
1	0.0-1.0	Gray Sandy CLAY- CL	37.0			

Project: Lower York Entrance Channel

Area: Virginia

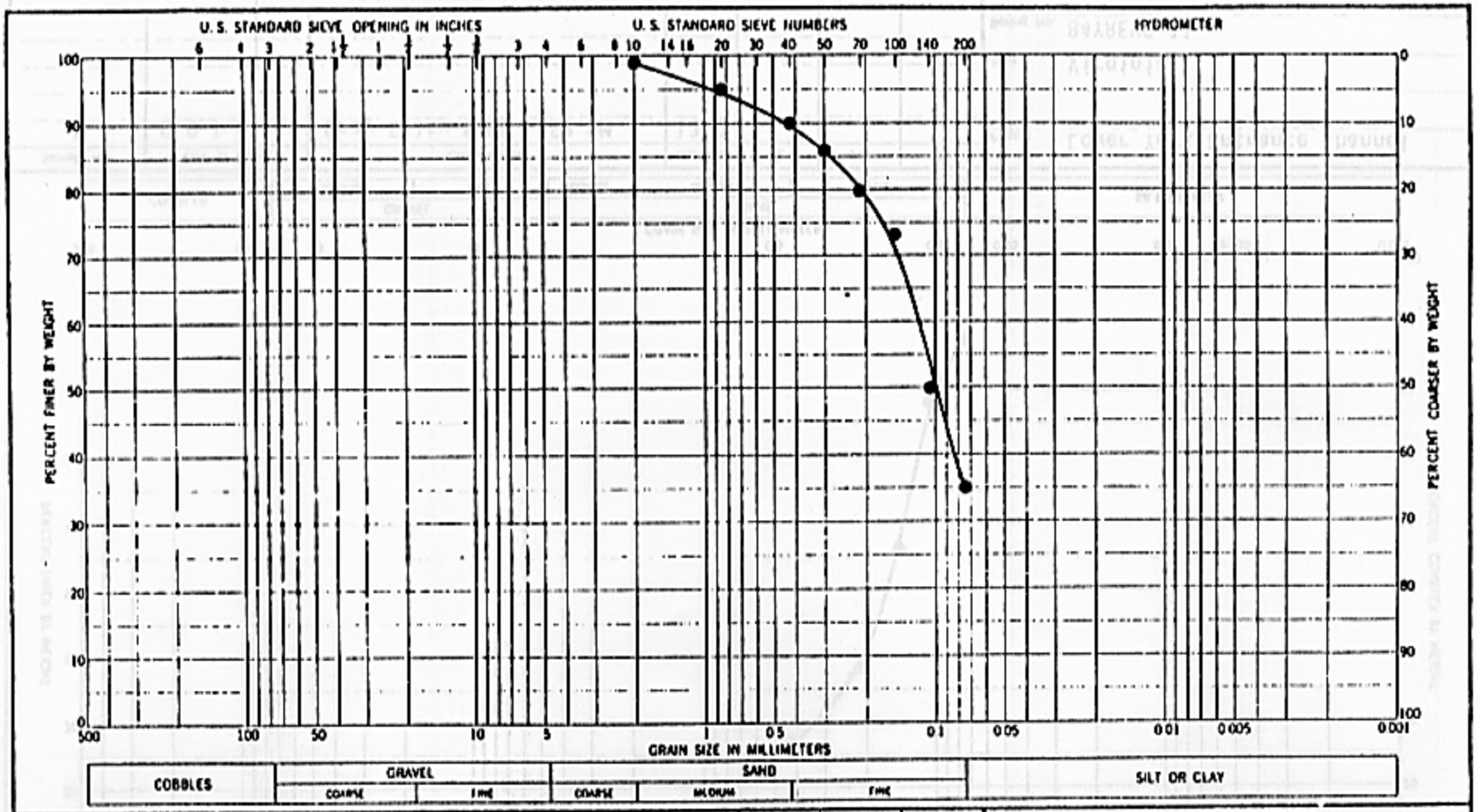
Boring No. 84YREVC-10

Date: 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 83 2087

CEI 83-1118



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	6.0-7.0	Gray Silty SAND - SM	29.5			

Project: Lower York Entrance Channel

Area: Virginia

Boring No. 84YREVC-10

Date: 11/12/84

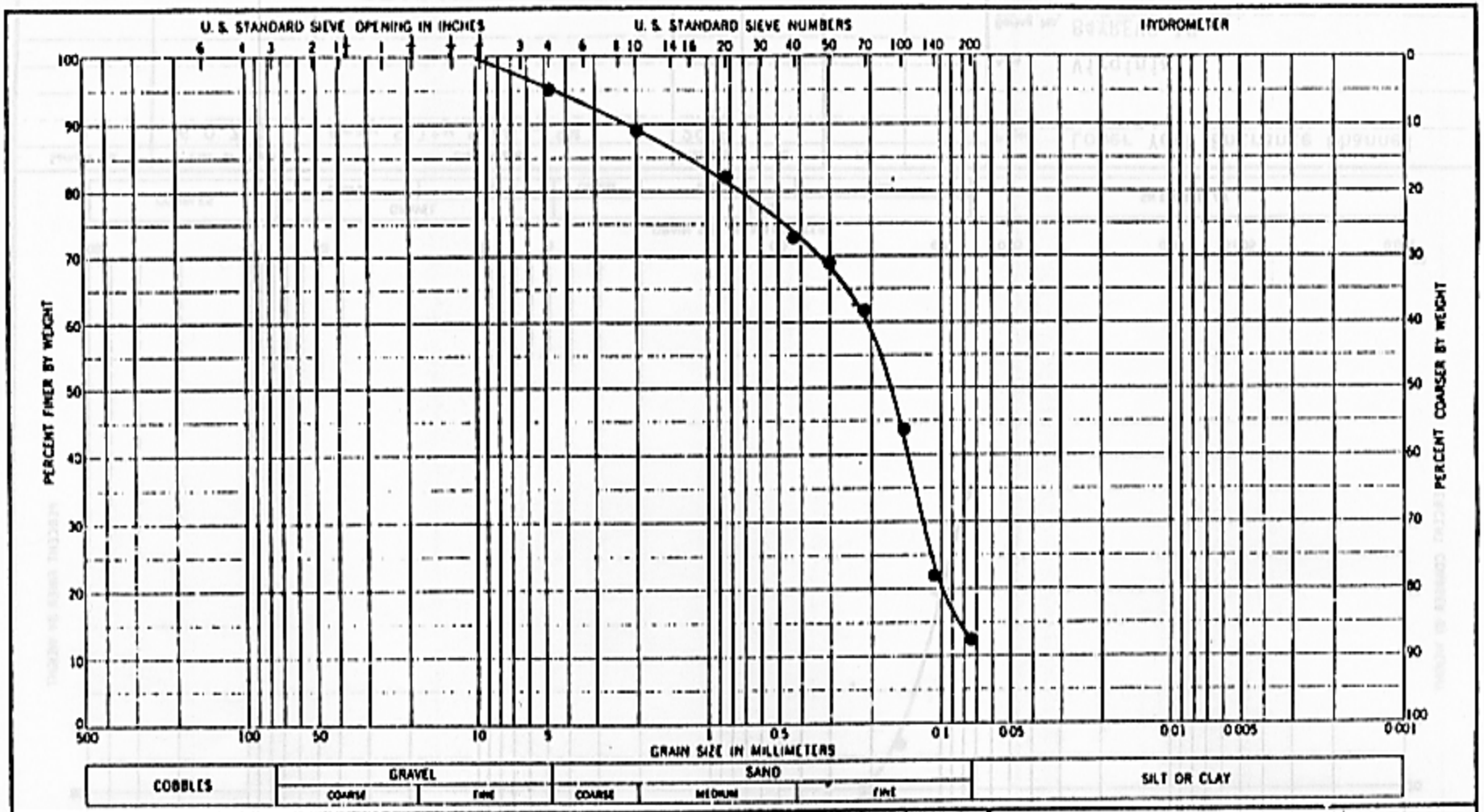
GRADATION CURVES

CEI 83-1118

ENG FORM 1 MAY 63 2087

Exhibit 1
15

Exhibit 1
16



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
1	0.0-1.0	Gray Silty SAND - SP-SM	13.0			

Project: Lower York Entrance Channel

Area: Virginia

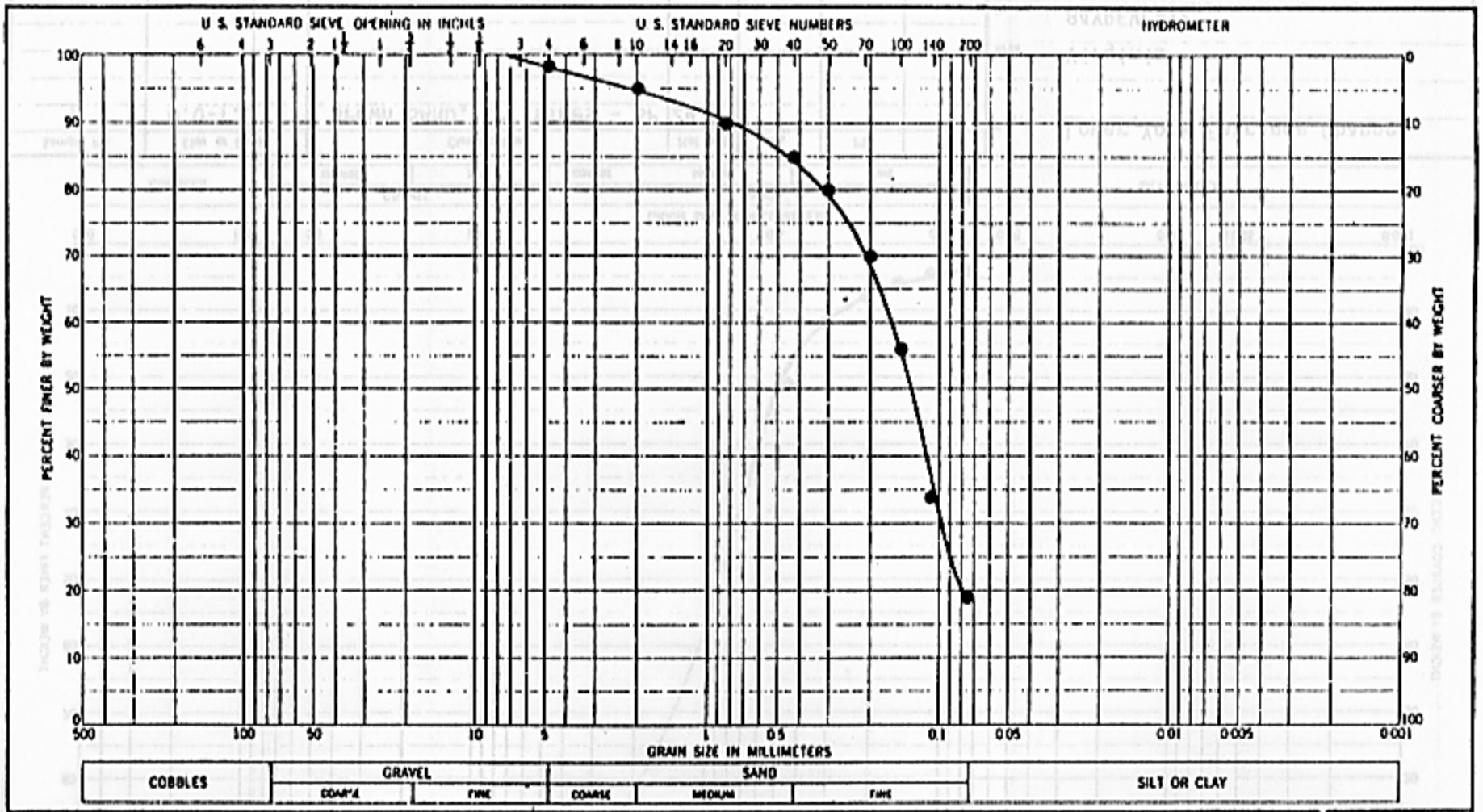
Boring No. 84YREVC-11

Date: 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	5.0-6.0	Gray Silty SAND - SM	29.0			

Project Lower York Entrance Channel

Area Virginia

Boring No. 84YREVC-11

Date 11/12/84

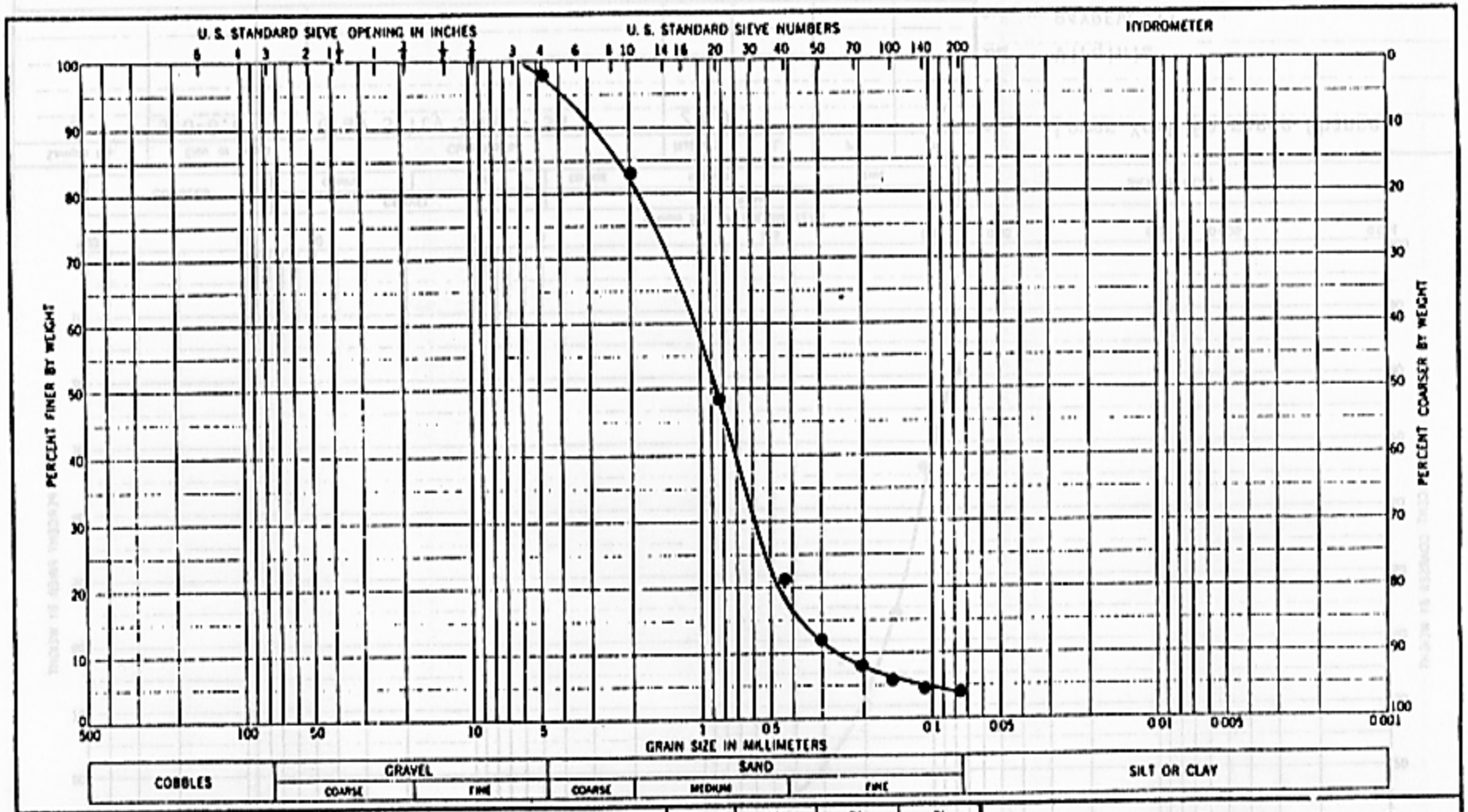
GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118

Exhibit 1
17

Exhibit 1
18



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
1	0.0-1.0	Brown SAND, tr./fines - SP	24.5			

Project: Lower York Entrance Channel

Area: Virginia

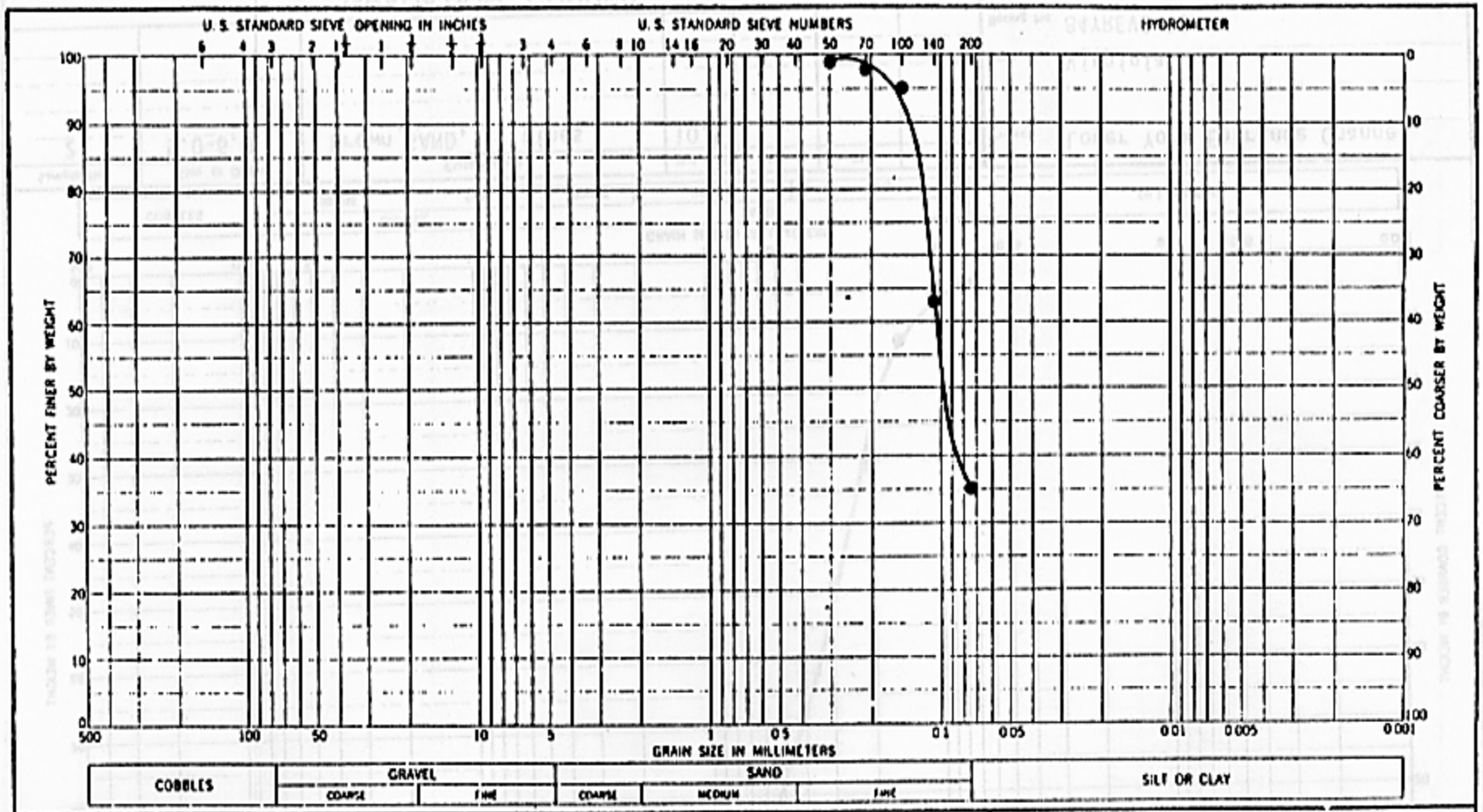
Boring No: 84YREVC-12

Date: 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 81 2087

CEI 84-1118



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	4.5-5.5	Gray Silty SAND - SM	32.5			

Project: Lower York Entrance Channel

Area: Virginia

Boring No. 84YREVC-12

Date: 11/12/84

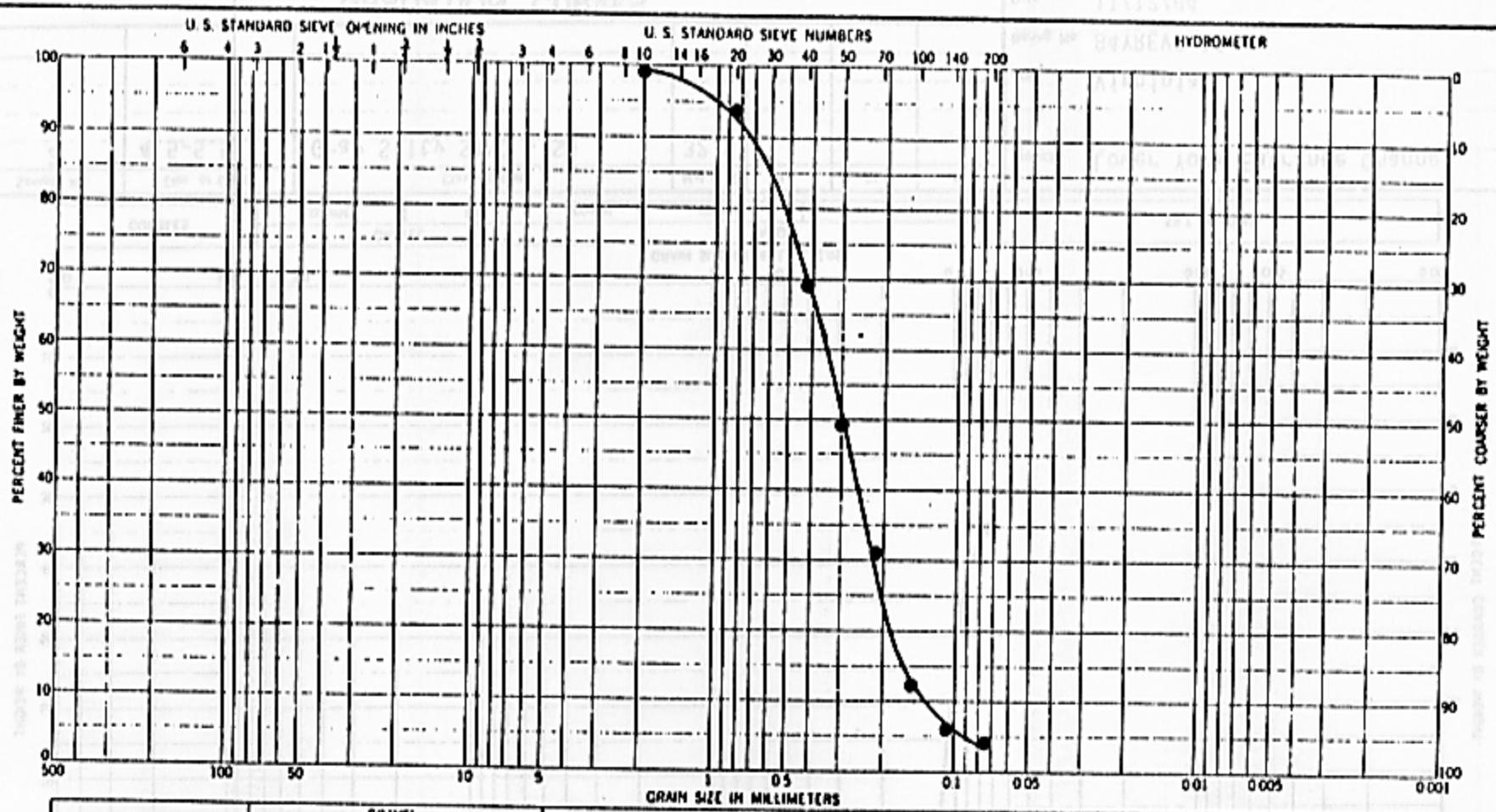
GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118

Exhibit 1
-19

Exhibit 1
20



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	5.0-6.0	Brown SAND, tr. fines	10.5			

Project: Lower York Entrance Channel

Area: Virginia

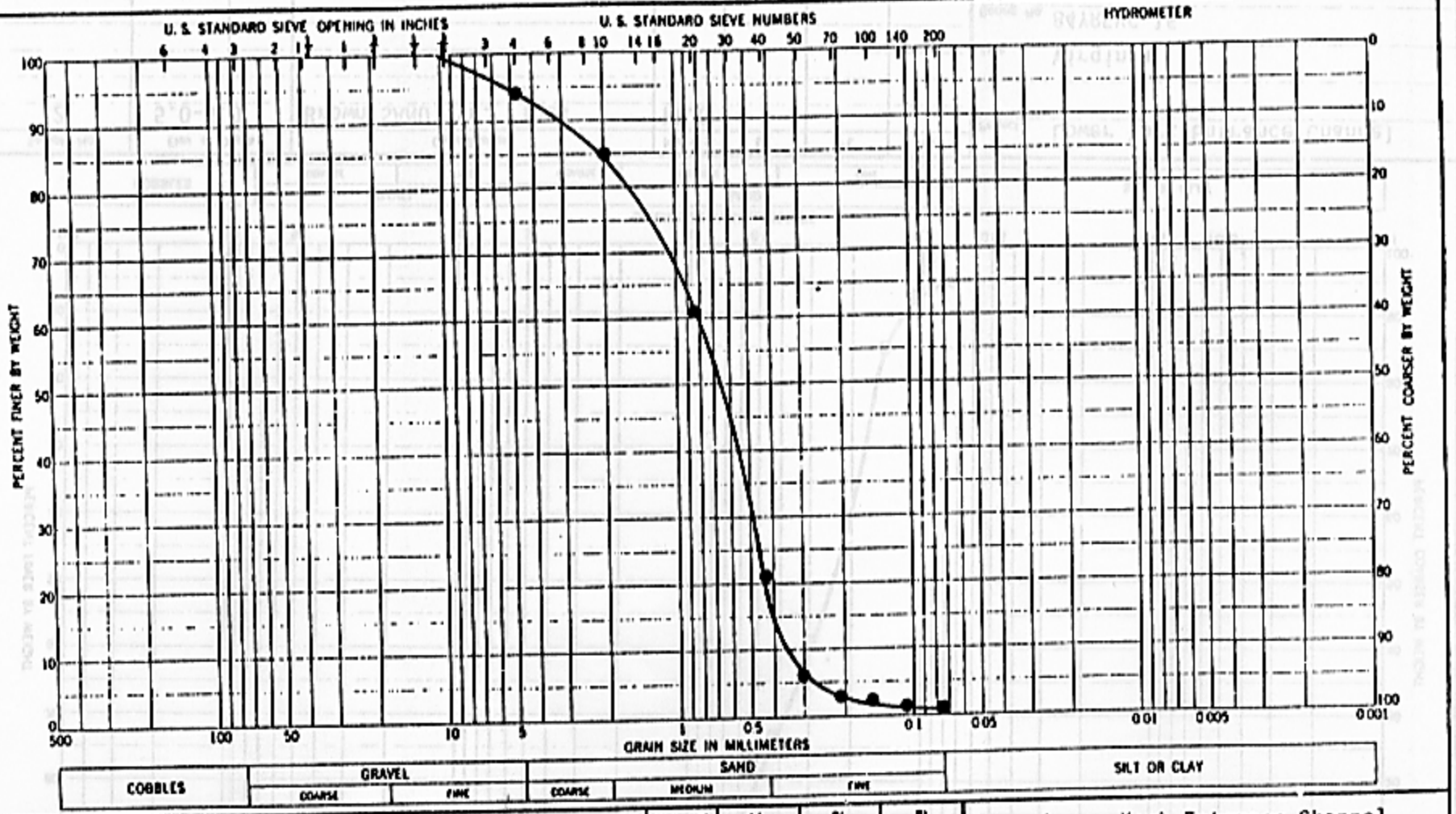
Boring No. 84YREVC-13

Date: 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 63 2087

CEI 83-1118



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	4.5-5.5	Brown SAND, tr. fines - SP	16.5			

Project: Lower York Entrance Channel

Area: Virginia

Boring No. 84YREVC-14

Date: 11/12/84

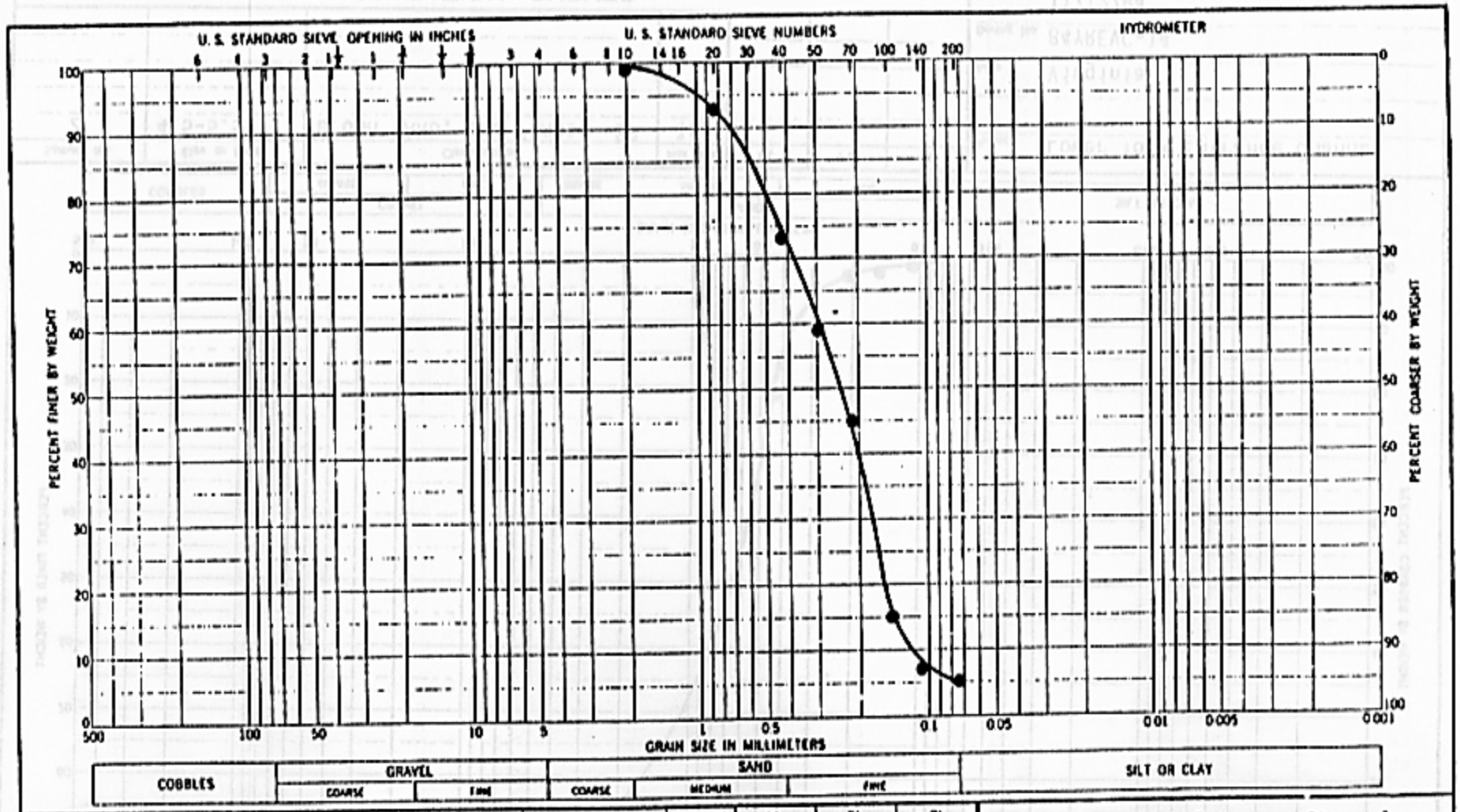
GRADATION CURVES

CEI 83-1118

ENG FORM 1 MAY 63 2087

Exhibit 1
21

Exhibit 1
22



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
2	5.0-6.0	Brown SAND, tr. fines	11.0			

Project Lower York Entrance Channel

Area Virginia

Boring No. 84YREVC-15

Date 11/12/84

GRADATION CURVES

ENG FORM 1 MAY 83 2087

CEI 83-1118

LABORATORY TEST NOTES

1. The moisture content (w) was performed according to ASTM D2216. Natural or Moist Unit Weights (γm) and Dry Unit Weights (γd) were determined from the test used for moisture contents by using wet and dry samples of known volume.

2. The Specific Gravity (G) was performed accoring to ASTM D854.

3. The Liquid Limit (LL) and plastic limit were performed according to ASTM D4318. Samples were prepared according to ASTM D2217, the wet method. The Plastic Index (PI) is the difference between the LL and PL.

4. The Void Ratio (e) was calculated based on the following equation:

$$e = G \frac{\gamma w - 1}{\gamma d}$$

Where γw = Unit Weight of Water

5. The Saturation (S) was calculated based on the following equation.

$$S = \frac{wG}{e}$$

6. The gradation analysis on coarse soils (+ No. 200), such as sand, were performed according to ASTM D422. For predominately fine soils (- No. 200), such as clay and silt, the sand fraction was determined by washing specific gravity test samples through the No. 200 (75-um) sieve. The retained portion is that portion of the sample that was sand.

PROJECT_____ _____ INVIT. NO. _____ SHEET _____ OF _____

****

BID ITEM # 1 G MOB & DEMOB

****

NAME OF DREDGE Sugar Island

	MOB. # DAYS	DEMOB. # DAYS
1. PREPARE DREDGE FOR TRANSFER	2	2
2. TRANSFER ALL PLANT 1000 MILES @ 12 miles/hour =	3.5	
3. TRANSFER ALL PLANT 1000 MILES @ 12 miles/hour =		3.5
4. PREPARE DREDGE AFTER TRANSFER	2	2

5. TOTAL DAYS (MOB. & DEMOB) 15 days

6. DAILY MOB. & DEMOB. RATE x $16,821 per day

7. SUBTOTAL = $252,315

8. SPECIAL COSTS (DESCRIBE)		$0	$0
		$0	$0
9. SUBTOTAL MOBILIZATION & DEMOBILIZATION		=	$252,315
10. OVERHEAD	12.0%	= $30,278	$30,278
	$0		
11. PROFIT	10.0%	= $28,259	$28,259
12.			$0
13. BOND	1.0%	= $3,109	$3,109
14. TOTAL MOBILIZATION & DEMOBILIZATION		=	$313,961

use $314,000

Exhibit 3
1

****

T. TITLE PAGE FOR PLANNING ESTIMATE.

****

Filename: HOP-EST2.WK1

BID ITEM: 1

PROJECT: New Work Dredging York River Entrance

LOCATION: Chesapeake Bay Virginia

INVIT NO: Planing Estimate

ESTIMATOR: John Mazuch

DESCRIPTION OF WORK:

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--> -

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Estimated By: John Mazuch 11 June 1992 Chked By:_____

Exhibit 3

New Work Dredging York River Entrance. Planing Estimate Sheet ____ of ____

****

BID ITEM: #1 A. EXCAVATION QUANTITIES

****

Filename: HOP-EST2.WK1

1. EXCAVATION

A. Required	495,000	c.y.	Dredging Area = 20,040,000 SY
B. Pay Overdepth	505,000	c.y.	
C. Max. Pay Yardage	1,000,000	c.y.	(Yardage Used As Basis For Estimate)
D. O.D. Not Dredged	(80,000)	c.y.	Avg remaining depth of overdepth. = 0.1 ft.
E. Net Pay Yardage	920,000	c.y.	(Yardage Used To Figure Unit Price Per C.Y.)
F. Non-Pay Yardage	200,000	c.y.	Avg depth of Non-Pay excavation. = 0.3 ft.
G. Gross Yardage	1,120,000	c.y.	(Yardage Used To Figure Production Time & Cost)

2. GRAVITY DUMPING

A. Gross Yardage	1,120,000	c.y.

3. SUMMARY OF ADJUSTED DREDGE & PUMPOUT QUANTITIES.

TYPE	% DREDGED	TOTAL DREDGE CYDS	% PUMPOUT	TOTAL PUMPOUT CYDS
Mud:	80%	896,000	0%	0
Sand:	20%	224,000	0%	0
Gravel:	0%	0	0%	0
				0

****

Estimated By: John Mazuch 11 June 1992 Chked By:_____

Exhibit 3
3

New Work Dredging Tork River Entran Planing Estimate Sheet ____ of ____

****

PRODUCTION WORK SHEET

BID ITEM: #1 B.

CYCLE TIME

****

Filename: HOP-EST2.WK1

CYCLE TIME

1. Dredge Used:

A. Name of Dredge. 3600 CYD HOPPER DREDGE

B. Effective Dredge Hopper Cap. 1,900 cy

2. Time Per Average Load Cycle: REMARKS

A. Dredging	60 min	(1,900 cy / 1,900 cy/hr) x 60 min/hr.
B. Turning	12 min	2 turns at 6 minutes per turn.
C. To Disposal Or Mooring	71 min	(12.0 miles / 10.1 mph) x 60 min/hr.
D. Dumping Or Connect To Pipeline	5 min	
E. Pumpout Through Pipeline	0 min	(cy / cy/hr) x 60 min/hr.
F. From Disposal Or Mooring	65 min	(12 miles / 11 mph) x 60 min/hr.

****

3. Subtotal 213 min/load

****

Estimated By: John Mazuch 11 June 1992 Chked By:_____

Exhibit 3
4

****

PRODUCTION WORK SHEET

BID ITEM: #1 C.

DREDGING TIME

****

Filename: NOP-EST2.WK1

DREDGING TIME				REMARKS
1 Available Minutes Per Dredging Day		1,440	min/day	(60 Min/Hr x 24 Hrs/Day)
2 Percent Effective Time	x	85%		
3 Daily Effective Time	=	1,224	min/wday	
4 Total Cycle Time	/	213	min/load	
5 Number Of Loads Per Day	=	5.75	loads/wday	
6 Cubic Yards Per Load	x	1,900	cy/load	
7 Operating Work Days Per Month	x	27	wdays/mo	
8 Gross Cubic Yards Per Month	=	294,975	cy/mo	
9 Gross Cubic Yards		1,120,000	cy (gross)	
10 Gross Cubic Yards Per Month	/	294,975	cy/mo	
11 Dredge Time	=	3.80	months	
12 Clean Up	+	0.00	months	0% Additional Dredging

****

13 Total Dredge Time 3.80 months

Effective + Non-Effective = (3.80 months x 24 hrs/day x 30.42 days/month)

= 2,774 hrs

****

Estimated By: John Mazuch 11 June 1992 Chked By:_____

****

D. MONTHLY PLANT OWNERSHIP & LABOR COST SUMMARY

BID ITEM: #1

EXCAVATION

****

Filename: HOP-EST2.WK1

PLANT OWNERSHIP & OPERATING

1 Equipment 3600 CYD HOPPER DREDGE

2 Plant Ownership & Operating Expense			REMARKS
A. Hopper Dredge....>	$400,000	/mo	See "Dredge Rate" in Backup.
Propulsion Tug...>	self prop.	/mo	
B. Survey Vessel....>	$3,000	/mo	
C. Booster.....>	$0	/mo	
D. Crane Barge.....>	$0	/mo	
E. Tender Tug.....>	$0	/mo	
F. Other Marine.....>	$0	/mo	
G. Shore Equip.....>	$0	/mo	
3 INTEREST ON INVESTMENT on Plant.....>	$61,687	/mo	
4 Labor Expense.....>	$150,082	/mo	See "Labor Rates" Attached
5 Travel Expense.....>	$6,084	/mo	(30.42 dys/mo / 28 dys x $400 rt x 14 ea)

****

6 TOTAL MONTHLY COST $620,853 /mo

****

Estimated By: John Mazuch 11 June 1992 Chked By:_____

New Work Dredging York River Entran Planing Estimate Sheet ___ of ___

****

BID ITEM: #1 E. EXCAVATION COSTS

****

Filename: NOP-EST2.WK1

EXCAVATING COST				REMARKS
1 SubTotal Monthly Cost	=	$620,853	/mo	
Special Monthly Cost	=	$0	/mo	-
Total Monthly Cost	=	$620,853	/mo	
2 Dredge Time	x	3.80	months	
Subtotal.....	=	$2,359,241		
3 Special Lump Sum Costs	+	$0		-
4 Total Direct Costs	=	$2,359,241		
5 Contractors O.H. @ 12.0%		$283,109		
6 Subtotal.....	=	$2,642,350		
7 Profit @ 10.0%	=	$264,235		
8 Subtotal.....	=	$2,906,585		
9 CFC on Plant	=	$0		INTEREST ON INVEST. In Monthly Cost.
10 Subtotal.....	=	$2,906,585		
11 % Bond Cost @ 0.800%	=	$23,253		
12 Net Pay Yardage Cost	=	$2,929,838		
13 Net Pay Yardage	/	920,000	cy	
14 Unit Cost	=	$3.18	/cy	USE $3.15/cy
15 Bid Quantity		1,000,000	cy	
16 Total Dredging Cost	=	$3,180,000		

****

Estimated By: John Mazuch 11 June 1992 Chked By:_____

Exhibit 3

CHECKLIST FOR INPUT DATA.
Planning Est. 11 June 1992

UNIT $. $3.18 /CY
TOTAL.. $3,180,000 JOB COST
TIME... 3.8 MONTHS

PG 1 OF 14: PROJECT TITLES

PROJECT -	New Work Dredging York River Entrance
LOCATION -	Chesapeake Bay Virginia
INVIT # -	Planing Estimate
BID ITEM # -	1
FILENAME -	NOP-EST2.WK1
EST -	John Mazuch
MIDPT DATE -	May-92
DESCRIPTION ENTERED-	YES

PG 13 OF 14: MARKUPS USED

O.H.	12%
PROFIT	10%
BOND	0.800%

PG 2 OF 14: EXCAVATION QTY'S

DREDGING AREA -	20,040,000	sf
REQ'D EXCAVATION -	495,000	cyds
% MUD -	80%	
% SAND -	20%	
% GRAVEL -	0%	
PAY OVERDEPTH -	505,000	cyds
O.D. NOT DREDGED -	80,000	cyds
OVERDIG FOOTAGE -	0.27	ft
NONPAY YARDAGE -	200,000	cyds
GROSS YARDAGE -	1,120,000	cyds

PG 3 OF 14: LOCAL AREA FACTORS

FUEL COST -	$0.65	/gal
CFC RATE -	6.875%	
USE MONTHS / YEAR -	9	mo/yr
MARINE INSUR -	1.5%	
TAXES -	1.0%	
PROVISIONS & SUPP -	$15	/man

PG 4 OF 14: DREDGE SELECTION (ALT-D)

DREDGE: SUGAR ISLAND

LOADS PER DAY -	5.75	
CYCLE TIME -	213	min/load

PG'S 5-7 OF 14: PRODUCTION WORKSHEET

HOPPER CAPACITY -	3,600	cyds	DUMP/CONNECT TIME -	5	min
EFF. HOPPER CAP. -	1,900	cyds	JET PUMP AVAIL? -	YES	
AVAIL DREDGING RATE -	2,100	cy/hr	TYPE OF DISPOSAL -	GRAVITY DUMP	
AVAIL. DRAGHEADS -	2	ea	PUMPING RATE -		cy/hr
ACT. DRAGHDS USED -	2	ea	TRVL SPD TO DREDG -	11.0	mph
DRDGE RATE USED -	1,900	cy/hr	MAX TRVL SPD LIGHT -	13.8	mph
TURNS/CYCLE -	2	ea	EFFECTIVE TIME -	85.0%	
MIN. PER TURN -	6	min	OPER WORK DAYS/MO -	27	days
DISPOSAL DIST -	12	mi	ADD. CLEANUP TIME -	0%	
TRVL SPD TO DISP -	10.1	mph	SPECIAL COST -	$0	/mo
MAX TRVL SPD LOADED -	12.7	mph	SPECIAL COST -	$0	/job

PG'S 8-9 OF 14: PLANT OWN. & OPER.

DREDGE	$400,000
PROPULSION TUG	self prop
SURVEY VESSEL	$3,000
BOOSTER	$0
CRANE BARGE	$0
TENDER TUG	$0
SHORE EQUIP	$0

PG 14 OF 14: DREDGE OPER. ADJ. FAC.

PUMP LOAD FACTOR	50%
RPR & MAINT. ADJ	1.00
JET PUMP % USAGE	100%

PG'S 10-12 OF 14: LABOR, 11 June 1992

OVERTIME % -	28.00%	
VACATION/HOLIDAY % -	8.64%	
TAX & INSUR % -	30.61%	
FRINGE BENEFITS -	$4.35	/hr
DREDGE CREW:		
SUGG. CREW SIZE -	14	ea
USED CREW SIZE -	14	ea
SHORE CREW:		
USED CREW SIZE -	0	ea
GOVERNMENT PERSON -	3	ea
FRE. PD TRAVEL -	28	days
RT TRAVEL COST -	$400	

Estimated By: John Mazuch 11 June 1992 Chked By:_____

A CLAMSHELL DREDGE ESTIMATE BID ITEM # 2

1 PROJECT York River Entrance Channel Study Cost Est.

2 LOCATION Virginia INVIT. NO. PRELIMINARY

3 BID ITEM NO. 2 ESTIMATOR D. MAZUCH CHKED BY [redacted]

4 DESCRIPTION OF WORK 37 Foot Project

Clamshell Operations.

5 EXCAVATION

			REMARKS
A. REQUIRED		495,000 C.Y.	20,040,000 Square Feet
B. PAY OVERDEPTH	+	505,000 C.Y.	
C. MAX. PAY YARDAGE	=	1,000,000 C.Y.	(Yardage used on Bid Form)
D. O.D. NOT DREDGED	-	10,000 C.Y.	
E. NET PAY YARDAGE	=	990,000 C.Y.	(Yardage used to figure Unit Price per c.y.)
F. NON-PAY YARDAGE	+	259,800 C.Y.	0 Feet Average Overdigging
G. GROSS YARDAGE	=	1,249,800 C.Y.	(Yardage used to figure Production Time & Cost)

MOB & DE MOB $ 279,657.00

DREDGING 2,650,000.00

TOTAL $ 2,929,657.00

ABOVE COST INCLUDES PROFIT. (1992 COST)

PRODUCTION WORK SHEET

B

BID ITEM # 2

DREDGE PRODUCTION

1 SIZE OF DREDGE		18 C. Y. Clamshell	
2 SIZE OF BUCKET		18 C.Y.	
A. BUCKET FILL FACTOR	x	90% SOLIDS	Bank, Material, Compaction, & Swell
B. WORKING CAPACITY.....>		16.2 C.Y./BUCKET	
3 AVERAGE OPERATING CYCLE		70 SECONDS	
A. CYCLES PER MINUTE		0.86	(60 Secs per min / 70 Secs per cycle)
B. CYCLE ADJUSTMENT FACTOR	x	0.9	Water Resistance & Bucket Washout
C. BUCKETS PER MINUTE		0.771428571 BUCKETS/MIN	
D. WORKING CAPACITY	x	16.2 C.Y./BUCKET	
E. PRODUCTION		12.5 C.Y./MINUTE	
4 DREDGE EFFICIENCY FACTOR	x	0.75	50 Min work hour, Management, Advance delays, Refueling, Scow positioning, & Crew efficiency
5 OPERATING TIME FACTOR	x	0.8	Unexpected Down Time, Weather, & Repair
6 NET PRODUCTION RATE		7.5 C.Y./MINUTE	
OR		328,500 C.Y./MONTH	(7.50 c.y. per min x 60 Min per hr x 730 hrs per mo)
7 GROSS CUBIC YARDS		1,249,800 CY (GROSS)	
8 CUBIC YARDS PER MONTH	/	328,500 CY/MO	
9 DREDGE TIME	=	3.80 MONTHS	
10 CLEAN UP 5.0%	+	0.19 MONTHS	
11 TOTAL DREDGE TIME	=	3.99 MONTHS	

Exhibit 4
2

PRODUCTION WORK SHEET

C

BID ITEM # 2

TOWING CYCLE TIME

1 SIZE OF TUG 1100

2 TIME PER AVERAGE LOAD CYCLE:

			REMARKS
A. PREPARE FOR SCOW TOW		15 MIN	[Prepare towing lines and maneuver away from dredge safely]
B. TO DISPOSAL AREA	+	144 MIN	12 miles / 5 miles per hr x 60 min
C. DUMPING OR PUMPOUT	+	10 MIN	
D. FROM DISPOSAL AREA	+	120 MIN	12 miles / 6 miles per hr x 60 min
E. DISENGAGE TOW RIGGING AND TIE UP SCOW	+	15 MIN	[Prepare towing lines and maneuver away from dredge safely]

3 TOTAL DISPOSAL CYCLE TIME = 304 MIN/LOAD

PRODUCTION WORK SHEET

D

DISPOSAL TIME

BID ITEM # 2

			REMARKS
1 SIZE OF SCOW		3,000 C.Y.	
A. USEABLE VOLUME	x	90% CAPACITY	
SUBTOTAL.....>		2,700 C.Y.	
B. PER CENT MATERIAL	x	75% SOLIDS	
2 AVERAGE LOAD		2,025 C.Y.	
3 LOAD RATE	/	7.5 C.Y./MINUTE	
4 AVE. LOADING TIME PER SCOW	=	270 MINUTES/LOAD	
5 CALENDAR MINUTES PER DAY		1440 MIN/DAY	(60 MIN/HR x 24 HRS/DAY)
6 PERCENT EFFECTIVE TIME	x	95%	Towing Operation
7 DAILY EFFECTIVE TIME	=	1368 MIN/WDAY	
8 TOWING CYCLE TIME	/	304 MIN/LOAD	
9 NUMBER OF LOADS PER DAY PER TOWING VESSEL	=	4.5	
0 NUMBER OF TOWING VESSELS	x	1	
1 NUMBER OF LOADS PER DAY	=	4.5	
2 CUBIC YARDS PER LOAD	x	2,025	
3 OPERATING DAYS PER MONTH	x	30.42	(365 DAYS/YR DIVIDED BY 12 MO/YR = 30.42 DAYS PER MONTH)
4 MONTHLY RATE	=	277,202 CY/MO	
5 GROSS CUBIC YARDS		1,249,800 CY (GROSS)	
6 CUBIC YARDS PER MONTH	/	277,202 CY/MO	
7 DISPOSAL TIME	=	4.51 MONTHS	

Exhibit 4

G	MOB & DEMOB	BID ITEM #	1

			REMARKS
1 TOTAL MONTHLY COST		$470,425 /MO	
	/	30.42 DAYS/MO	
2 DAILY MOB & DEMOB RATE	=	$15,464 /DAY	
3 PREPARATION FOR TRANSFER OF PLANT		2 DAYS	MOBILIZATION FROM NEW YORK HARBOR
4 TRANSFER TO SITE OF WORK	+	4.2 DAYS	500 MILES @ 5 MPH / 24 HRS/DAY
5 PREPARING PLANT FOR WORK	+	1.5 DAYS	
6 DEMOB PREPARATION	+	2 DAYS	
7 DEMOBILIZATION	+	4.2 DAYS	500 MILES @ 5 MPH / 24 HRS/DAY
8 TOTAL DAYS	=	13.9 DAYS	
	x	$15,464 /DAY	DAILY MOB & DEMOB RATE
9 TOTAL FIELD COST	=	$214,950	
10 SPECIAL FEES	+	$10,000	TOWING INSURANCE
SUBTOTAL.....	=	$224,950	
11 OVERHEAD 12.0%	+	$26,994	$251,944 <--Subtotal
12 PROFIT 10.0%	+	$25,194	$277,138 <--Subtotal
13 BOND COST 1.0%	+	$2,519	
14 TOTAL MOB & DEMOB COSTS	=	$279,657	

CLAMSHELL ESTIMATE

18 C. Y. Clamshell

BID ITEM # 1 MOBILIZATION

BID ITEM # 2 EXCAVATION

ESTIMATED DREDGING QUANTITY:

DREDGING AREA: 20,040,000 SQ. FT.

REQUIRED		495,000 C.Y.		
PAY O.D.	+	505,000 C.Y.		
BID QUANT.	=	1,000,000 C.Y.		
NOT DUG	-	10,000 C.Y.	AVE. BANK HEIGHT:	
NET PAY	=	990,000 C.Y.	@	1.3 FT PAY
NON-PAY	+	259,800 C.Y.	@	0.4 FT OVERDIG.
GROSS	=	1,249,800 C.Y.		1.7 FT TOTAL

DREDGE PRODUCTION WORKSHEET

	Override	Database	Used
Dredge Efficiency Factor	0.75	0.75	0.75
Operating Time Factor	0.8	0.8	0.8
Buckets per min. Reduction Factor	0.9	0.9	0.9
Fill Factor	0.9	0.7	0.9

Bucket Capacity Adjustment Factor.....> 29.16

Bucket Size.....> 18 C.Y.

Bucket Cycle Time.....> 70 Seconds or 0.9 Buckets p

Ave. Bucket Production.....> 7.50 c.y. per min

(29.16 x 18 / 70)

DISPOSAL PRODUCTION WORKSHEET

Scow Size	3000 c.y.
Useable Volume	90 Percent
Percent Solids	75 Percent

Exhibit 4

Prepare for Scow Tow	15 Minutes
Haul Distance	12 Miles
Haul Speed	
to Disposal Area	5 Miles per hour
from Disposal Area	6 Miles per hour
Dumping or Pumpout	10 Minutes
Disengage Scow Tow	15 Minutes
Towing Efficiency	95 Percent
Number of Towing Vessels	1 Tug(s)

CLEANUP DREDGING	5 PERCENT ADDITIONAL TIME
SPECIAL EXCAVATION COSTS	$0 PER MONTH
ADDITIONAL EXCAV. COSTS	$0 LUMP SUM
CONTRACTOR'S OVERHEAD	12 PERCENT OF CONTRACT
CONTRACTOR'S PROFIT	10 PERCENT OF CONTRACT
CONTRACTOR'S BOND	1 PERCENT OF CONTRACT

ABSTRACT OF OFFERS – CONSTRUCTION

1. SOLICITATION NUM: DACW65-89-B-0025

2. DATE ISSUED: 3 April 1988

3. DATE OPENED: 3 May 1989

PAGE 1 OF 1

4. ISSUING OFFICE

District Engineer
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

I CERTIFY that I have opened, read, and recorded on this abstract all offers received in response to this solicitation.

SIGNATURE: CHERYL [illegible] DRUM
Small Business Specialist

DATE SIGNED: 6-16-89

5. PROJECT TITLE

Maintenance Dredging
Thimble Shoal Channel
Chesapeake Bay, VA

6. NUMBER OF ADDENDA ISSUED: one

8. GOVERNMENT ESTIMATE (Check A, B or C and complete D, E and F.)

A. HIRED LABOR

B. REASONABLE CONTRACT (Without Profit)

C. REASONABLE CONTRACT (Including Profit)

9. OFFERS

NO. 1		NO. 2	
A. OFFEROR: American Dredging Co. Camden, NJ		A. OFFEROR: Gulf Coast Trailing Co. Kenner, LA	
B. BID SECURITY (Type and amount): 20%		B. BID SECURITY (Type and Amount): 20%	
C. ADDENDA ACKNOWLEDGED: one		C. ADDENDA ACKNOWLEDGED: one	

7A. ITEM NO.	7B. DESCRIPTION OF OFFERED ITEM	7C. EST. QUANTITY	D. UNIT	E. UNIT PRICE	F. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT
1.	Mobilization and Demobilization	1	JOB	LS	$307,092.00	LS	$ 600,000.00	LS	$ 27,000.00
2.	Dredging Thimble Shoal Channel to a depth of 46 feet below MLW (NOS) within the inbound element and to 51 feet below MLW (NOS) within the outbound element, both with 1-foot allowable overdepth. Quantity includes 26,100 cubic yards estimated accretion from survey date to July 1989.	300,000	CY	$3.45	$1,035,000.00	$1.83	$ 549,000.00	$5.49	$1,647,000.0
	TOTAL ESTIMATED AMOUNT BID				$1,342,092.00		$1,149,000.00		$1,674,000.0
3.	Adjustment in bid price if Contractor-furnished disposal areas are utilized Deduct	1	Job	LS	----------	LS	NO BID	LS	----------
	TOTAL ADJUSTED BID PRICE				$1,342,092.00		$1,149,000.00		$1,674,000.0

Exhibit 5

1-150-0881

1419-101

STANDARD FORM 1419 (10-83)
Prescribed by GSA
FAR (48 CFR) 53.236-1(c)

Exhibit 5

9. O RS *(Continued)*

NO. 3		NO. 4		NO. 5		NO. 6		NO. 7	
FEROR io Limited Part. Brook, IL		A. OFFEROR		A. OFFEROR		A. OFFEROR		A. OFFEROR	
D SECURITY *(Type and Amount)* 20%		B. BID SECURITY *(Type and Amount)*		B. BID SECURITY *(Type and Amount)*		B. BID SECURITY *(Type and Amount)*		B. BID SECURITY *(Type and Am*	
DENDA ACKNOWLEDGED one		C. ADDENDA ACKNOWLEDGED		C. ADDENDA ACKNOWLEDGED		C. ADDENDA ACKNOWLEDGED		C. ADDENDA ACKNOWLEDGED	
D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATI AMOUNT
LS	$300,000.00								
$4.49	$1,347,000.00								
	$1,647,000.00								
LS	----------								
	$1,647,000.00								

BASIS OF AWARD: Award for the entire work will be made to the lowest responsible bidder on the basis of the total price bid using the disposal areas stipulated in the specifications or the total adjusted price bid using Contractor-furnished disposal areas, whichever is lower. Award of the contract on the basis of using Contractor-furnished disposal areas will be subject to the acceptance of the proposed Contractor-furnished disposal areas by the Contracting Officer. Written approval from the applicable agencies as described in paragraph "Contractor-furnished Disposal Area" of the specifications shall be submitted with the bid. Failure by the bidder, who elects to bid on Item No. 3, to furnish the above data with the bid at the time of the bid opening will result in that portion of the bid for the use of the Contractor-furnished disposal area to be considered non-responsive. Prior to making an award, a pre-award survey will be made and the low bidder will be required to show that he has the necessary capital, experience, and owns or can procure the necessary plant to commence the work at the time prescribed in the specifications and thereafter to prosecute and complete the work safely and satisfactorily within the time specified.

ABSTRACT OF OFFERS – CONSTRUCTION

1. SOLICITATION NUMBER: DACW65-92-B-0011
2. DATE ISSUED: 12/06/91
3. DATE OPENED: 01/07/92
PAGE OF: 1 | 2

4. ISSUING OFFICE

U.S. Army Engineer District, Norfolk
803 Front Street
Norfolk, Virginia 23510-1096

I CERTIFY that I have opened, read, and recorded on this abstr offers received in response to this solicitation.

SIGNATURE: Jack Beecher
JACK BEECHER

DATE SIGNE: 1-7

5. PROJECT TITLE

Maintenance Dredging Cape Henry Channel, Baltimore Harbor and Channels, Chesapeake Bay, Virginia

6. NUMBER OF ADDENDA ISSUED: One

8. GOVERNMENT ESTIMATE (Check A, B or C and complete D, E and F.)

A. HIRED LABOR
B. REASONABLE CONTRACT (Without Profit)
C. REASONABLE CONTRACT (Including Profit)

9. OFFERS

NO. 1 (2nd)
A. OFFEROR: Bean Dredging Corporation, Belle Chasse, LA
B. BID SECURITY (Type and amount): 20%
C. ADDENDA ACKNOWLEDGED: One

NO. 2 (3r
A. OFFEROR: Gulf Coast Traili, Kenner, LA
B. BID SECURITY (Type and A: 20%
C. ADDENDA ACKNOWLEDG: One

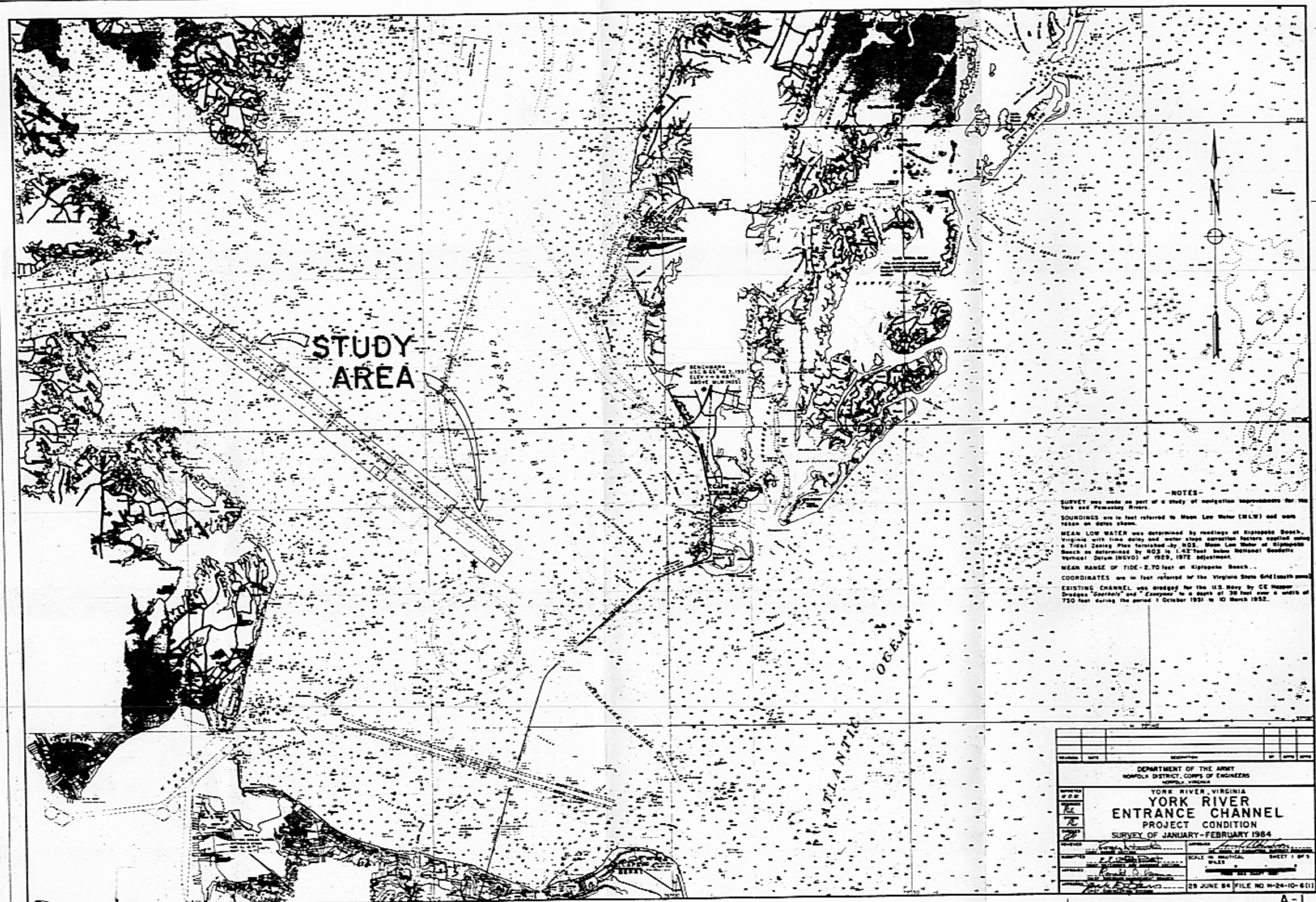
7A. ITEM NO.	7B. DESCRIPTION OF OFFERED ITEM	7C. EST. QUANTITY	D. UNIT	E. UNIT PRICE	F. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	F. ESTIM AMO
0001	Mobilization and Demobilization	1	JO	LS	357,224.00	LS	130,000.00	LS	
0002	Dredging the Cape Henry Channel to a depth of 51 feet below MLW(NOOS) with 1-foot of allowable overdepth and placing the material in the Dam Neck Placement Site.	408200	CY	3.00	1,224,600.00	2.95	1,204,190.00	3.67	1,498,094
	TOTAL				1,581,824.00		1,334,190.00		1,498,094

Exhibit 5
3

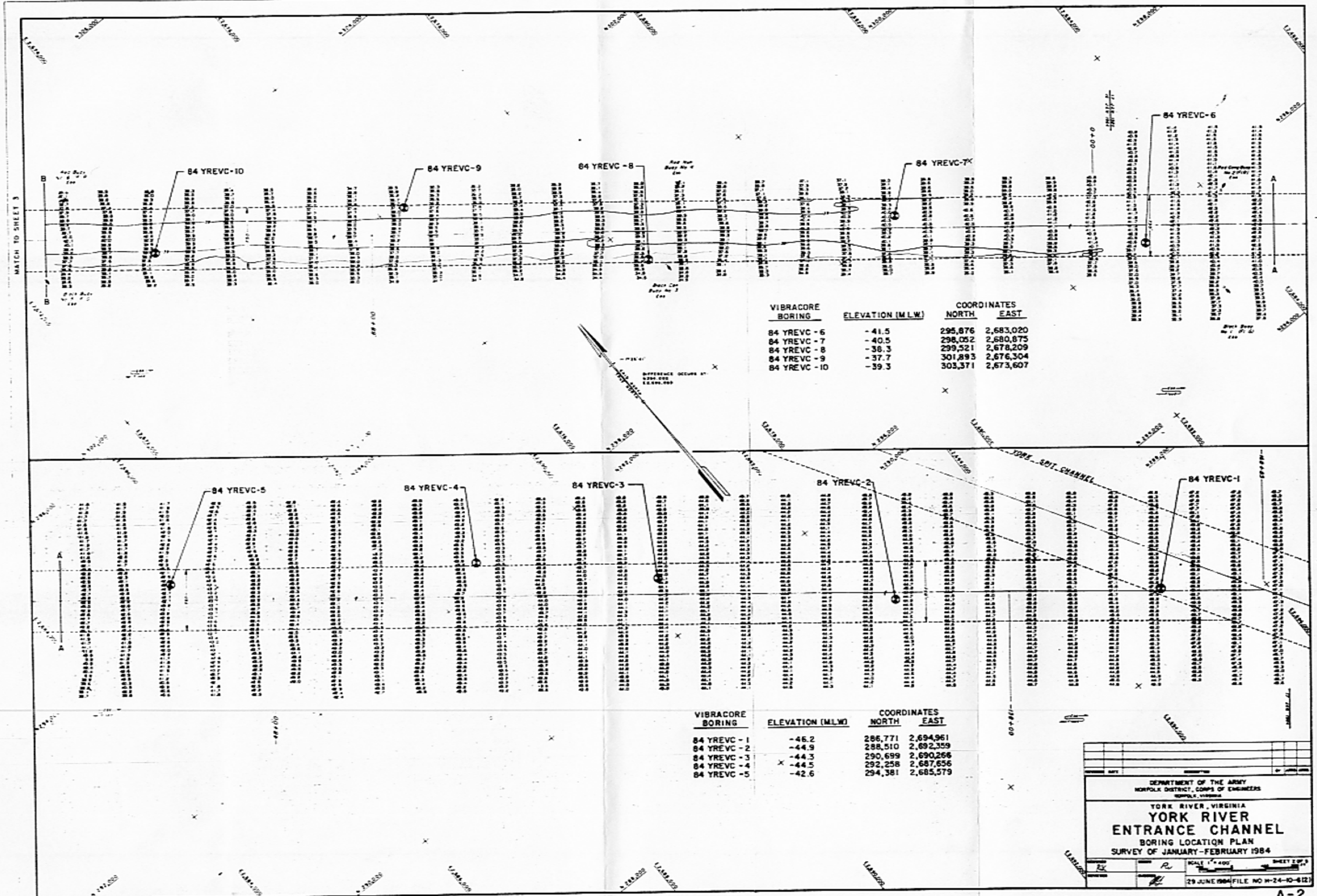
Exhibit 5

9. OFFERS (Continued)

NO. 3 (low)		NO. 4		NO. 5		NO. 6		NO. 7	
A. OFFEROR: ED PARTNERSHIP II		A. OFFEROR		A. OFFEROR		A. OFFEROR		A. OFFEROR	
B. BID SECURITY (Type and Amount): 0%		B. BID SECURITY (Type and Amount)		B. BID SECURITY (Type and Amount)		B. BID SECURITY (Type and Amount)		B. BID SECURITY (Type and Amount)	
C. ADDENDA ACKNOWLEDGED: nic		C. ADDENDA ACKNOWLEDGED		C. ADDENDA ACKNOWLEDGED		C. ADDENDA ACKNOWLEDGED		C. ADDENDA ACKNOWLEDGED	
D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT	D. UNIT PRICE	E. ESTIMATED AMOUNT
LS	59,200.00								
2.25	918,450.00								
TOTAL	977,450.00								


STUDY AREA
CHESAPEAKE CHANNEL
ATLANTIC OCEAN
-NOTES-
SURVEY was made as part of a study of navigation improvements for the York and Pamunkey Rivers.
SOUNDINGS are in feet referred to Mean Low Water (MLW) and were taken on datum shown.
MEAN LOW WATER was determined by readings at Kiptopeke Beach, Virginia with time delay and water slope correction factors applied using a Tidal Zoning Plan furnished by NOS. Mean Low Water at Kiptopeke Beach as determined by NOS is 1.42 feet below National Geodetic Vertical Datum (NGVD) of 1929, 1972 adjustment.
MEAN RANGE OF TIDE - 2.70 feet at Kiptopeke Beach.
COORDINATES are in feet referred to the Virginia State Grid (south zone).
EXISTING CHANNEL was dredged for the U.S. Navy by CE Hopper Dredges "Goethals" and "Essayons" to a depth of 38 feet over a width of 750 feet during the period 1 October 1951 to 10 March 1952.
REVISIONS
DATE
DESCRIPTION
BY
APPD
APPD
DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
NORFOLK, VIRGINIA
YORK RIVER, VIRGINIA
YORK RIVER
ENTRANCE CHANNEL
PROJECT CONDITION
SURVEY OF JANUARY-FEBRUARY 1984
REVIEWED
SUBMITTED
APPROVED
APPROVED
SCALE IN NAUTICAL MILES
SHEET 1 OF 5
29 JUNE 84
FILE NO. H-24-10-6(1)

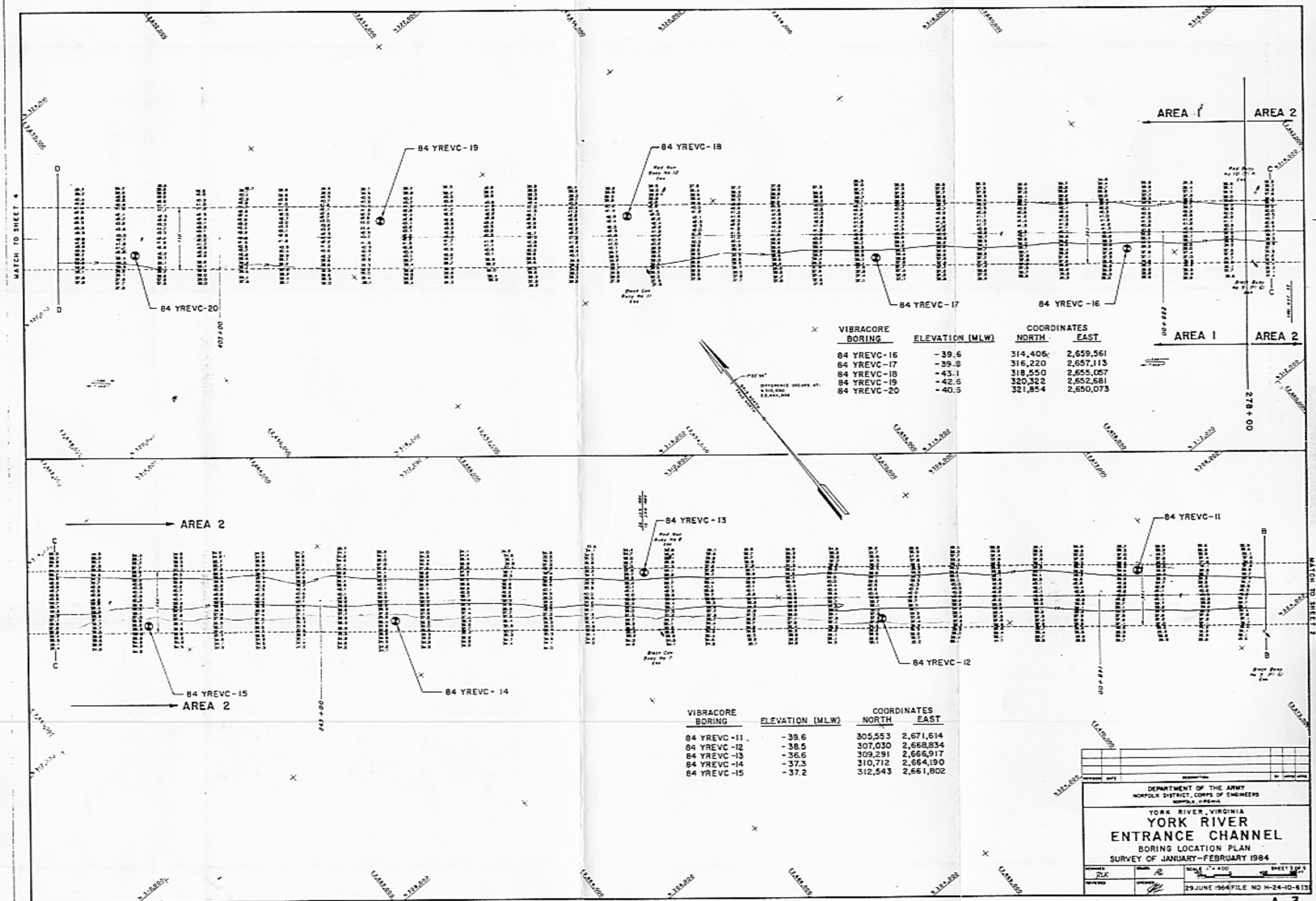
A-1



VIBRACORE BORING	ELEVATION (M.L.W.)	COORDINATES NORTH	COORDINATES EAST
84 YREVC - 6	-41.5	295,876	2,683,020
84 YREVC - 7	-40.5	298,052	2,680,875
84 YREVC - 8	-38.3	299,521	2,678,209
84 YREVC - 9	-37.7	301,893	2,676,304
84 YREVC - 10	-39.3	303,371	2,673,607

VIBRACORE BORING	ELEVATION (M.L.W.)	COORDINATES NORTH	COORDINATES EAST
84 YREVC - 1	-46.2	286,771	2,694,961
84 YREVC - 2	-44.9	288,510	2,692,359
84 YREVC - 3	-44.3	290,699	2,690,266
84 YREVC - 4	-44.5	292,258	2,687,656
84 YREVC - 5	-42.6	294,381	2,685,579

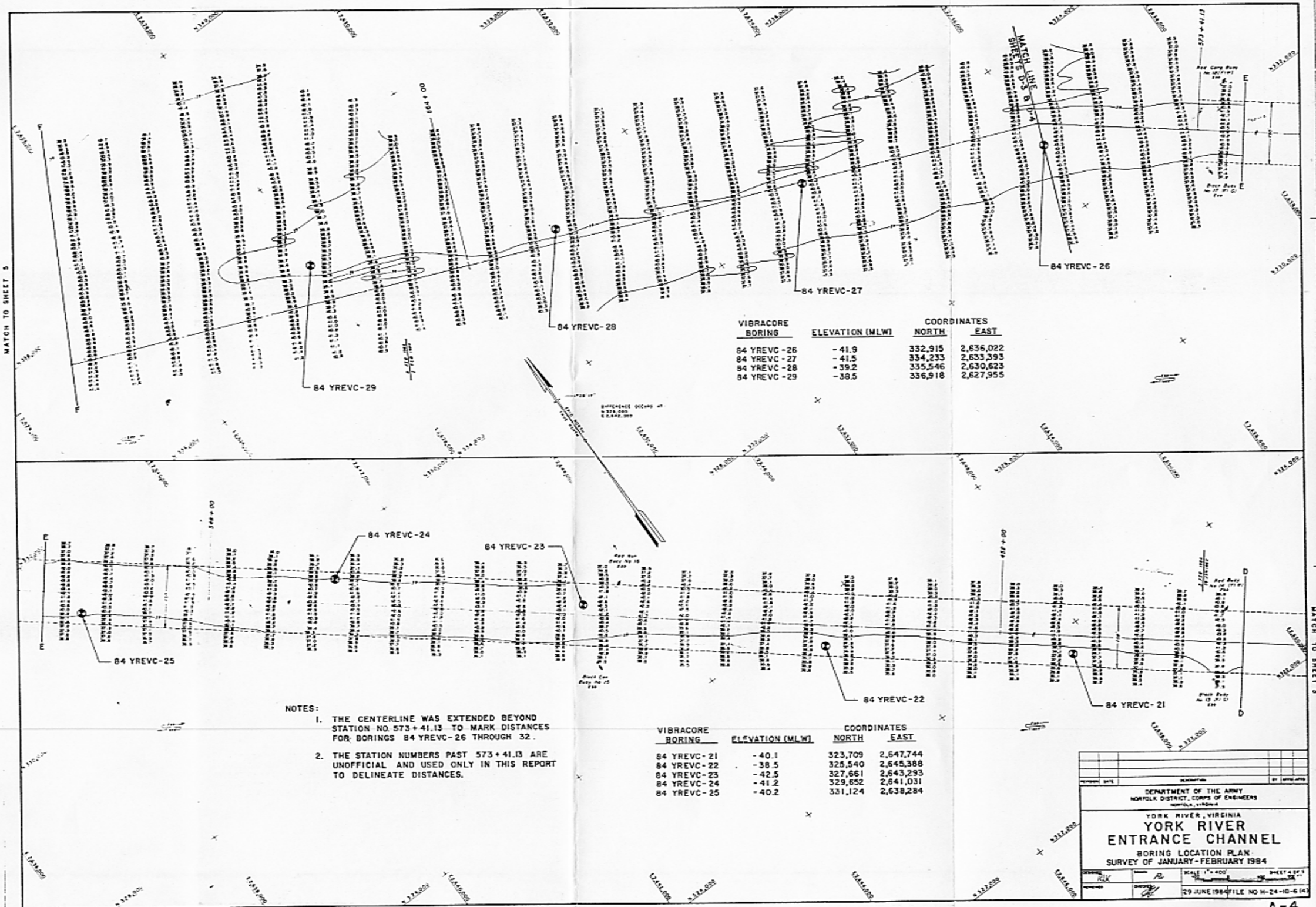
A-2



VIBRACORE BORING	ELEVATION (MLW)	COORDINATES NORTH	COORDINATES EAST
84 YREVC-16	-39.6	314,406	2,659,561
84 YREVC-17	-39.8	316,220	2,657,113
84 YREVC-18	-43.1	318,550	2,655,057
84 YREVC-19	-42.6	320,322	2,652,681
84 YREVC-20	-40.5	321,854	2,650,073

VIBRACORE BORING	ELEVATION (MLW)	COORDINATES NORTH	COORDINATES EAST
84 YREVC-11	-39.6	305,553	2,671,614
84 YREVC-12	-38.5	307,030	2,668,834
84 YREVC-13	-36.6	309,291	2,666,917
84 YREVC-14	-37.3	310,712	2,664,190
84 YREVC-15	-37.2	312,543	2,661,802

A-3



VIBRACORE BORING	ELEVATION (MLW)	COORDINATES NORTH	COORDINATES EAST
84 YREVC-26	-41.9	332,915	2,636,022
84 YREVC-27	-41.5	334,233	2,633,393
84 YREVC-28	-39.2	335,546	2,630,623
84 YREVC-29	-38.5	336,918	2,627,955

NOTES:

1. THE CENTERLINE WAS EXTENDED BEYOND STATION NO. 573+41.13 TO MARK DISTANCES FOR BORINGS 84 YREVC-26 THROUGH 32.
2. THE STATION NUMBERS PAST 573+41.13 ARE UNOFFICIAL AND USED ONLY IN THIS REPORT TO DELINEATE DISTANCES.

VIBRACORE BORING	ELEVATION (MLW)	COORDINATES NORTH	COORDINATES EAST
84 YREVC-21	-40.1	323,709	2,647,744
84 YREVC-22	-38.5	325,540	2,645,388
84 YREVC-23	-42.5	327,661	2,643,293
84 YREVC-24	-41.2	329,652	2,641,031
84 YREVC-25	-40.2	331,124	2,638,284

DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
NORFOLK, VIRGINIA

YORK RIVER, VIRGINIA

YORK RIVER ENTRANCE CHANNEL

BORING LOCATION PLAN
SURVEY OF JANUARY-FEBRUARY 1984

29 JUNE 1984 FILE NO H-24-10-6 (4)

APPENDIX B

NAVIGATION BENEFITS
TRANSPORTATION COST SAVINGS

APPENDIX B

NAVIGATION BENEFITS

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APPENDIX B

BENEFIT EVALUATION FOR DEEP-DRAFT NAVIGATION PROJECT ON THE LOWER YORK RIVER

INTRODUCTION

1. This appendix presents basic data, procedures, and results of analysis used to evaluate navigation benefits attributable to the considered alternatives to address the navigation problems in the lower York River. Note that the appendix presents current navigation operating conditions and procedures and, where appropriate, compares them to the findings in the earlier navigation study, "Detailed Project Report and Environmental Assessment, York and Pamunkey River, Virginia, Navigation Study of lower York River," October 1986.

COMMERCIAL ACTIVITY, COMPOSITION, AND TRENDS

HISTORICAL COMMERCE

2. Most of the waterborne commerce on the York River moves from two locations--West Point at the head of the river and the Amoco docks at Yorktown on the lower York River. This report deals only with the navigational needs of the lower York River to Yorktown.

3. Table B-1 is a summary of waterborne commerce on the lower York River from 1970 to 1990. All commerce on the lower York River is centered around the oil refinery and power station at Yorktown. Additional deep-draft vessel traffic traverses the York River to the Naval Weapons Station and the Naval Supply Center carrying naval stores and munitions.

Table B-1. WATERBORNE COMMERCE, LOWER YORK RIVER
(Short Tons)

	Principal Commodities			Distribution			
				Foreign		Domestic (a)	
Year	Crude oil	Fuel oil	Other fuels	Imports	Exports	Receipts	Shipments
1970	1,688,522	753,720	753,338	1,380,895	0	646,860	1,167,825
1971	1,743,355	809,005	831,629	1,766,062	0	402,606	1,201,467
1972	2,536,610	841,573	1,236,414	2,570,704	0	357,637	1,669,412
1973	2,487,880	721,638	1,072,614	2,619,993	0	325,497	1,327,613
1974	2,359,665	849,820	943,608	2,317,834	0	530,267	1,283,461
1975	2,025,526	1,886,750	868,018	2,738,684	0	565,492	1,431,548
1976	2,386,146	2,809,231	1,048,345	4,442,418	0	277,766	1,514,313
1977	2,286,860	3,491,885	1,101,470	5,130,898	0	459,757	1,276,409
1978	2,465,641	3,348,649	1,124,911	4,776,246	0	863,118	1,299,837
1979	1,768,120	2,615,026	601,146	3,437,884	0	844,275	692,463
1980	2,326,481	3,603,694	918,560	3,279,815	0	922,498	618,830
1981	1,789,222	1,108,156	867,919	2,156,037	0	174,053	1,435,207
1982	2,137,135	1,145,738	1,050,147	2,330,706	0	403,967	1,598,347
1983	2,127,773	618,287	1,013,871	2,072,977	0	468,332	1,218,622
1984	2,375,409	1,065,499	1,030,936	2,422,324	0	358,643	1,690,877
1985	2,825,847	524,297	1,098,688	2,721,389	0	316,730	1,410,713
1986	2,475,364	1,070,998	811,023	3,520,895	0	642,435	1,194,055
1987	2,198,006	1,976,704	459,897	2,297,311	0	653,810	1,683,486
1988	2,857,194	1,962,860	1,451,916	3,025,380	0	567,793	2,688,797
1989	2,899,215	2,272,220	1,441,356	3,069,915	0	650,592	2,892,284
1990 (b)	2,550,035	1,399,012	1,206,830	2,850,107	0	78,770	2,227,000

Source: "Waterborne Commerce Statistics," Corps of Engineers.
(a) Includes all coastwise, inbound, outbound, upbound, downbound, and through traffic.
(b) Preliminary data reported by Amoco Oil Company and Virginia Power Company. Tonnages do not include domestic and/or foreign movements to and from military facilities on the Lower York River.

PROSPECTIVE COMMERCE

4. Amoco opened a refinery in Yorktown in 1956. By the time the refinery became fully operational in 1958, crude and refined petroleum movements peaked at 5,000,000 tons. Movements remained fairly constant at 4,000,000 tons until 1988 when they once again exceeded 5,000,000 tons. Refining capacity at the facility since 1958 has increased from 40,000 to about 53,000 barrels per day depending on the grade.

5. The company's projected crude charge rate capacity is the current 53,000 barrels per day or about 2,700,000 tons. East Coast markets are anticipated to remain the primary receivers of commerce. East Coast shipments are not likely to change since the York River refinery has a location advantage in receiving foreign crude for supplying these markets.

6. In 1965, the Yorktown refinery constructed 450,000 barrels of tankage to increase its total crude tankage capacity to 1,360,000 barrels or about 200,000 tons. In order to handle larger tankers, numerous improvements to the pier were made to permit safer and more efficient handling of the larger ships. A second pier has since been constructed to handle 150,000 deadweight ton (DWT) tankers. The depth across the face of the pier is 40 feet. At the present time, no firm plans exist for further expansion of the refinery. Officials of the company have stated that whether the Yorktown refinery will continue at its present level or be expanded will depend upon several factors, including depth of water in the York River entrance channel.

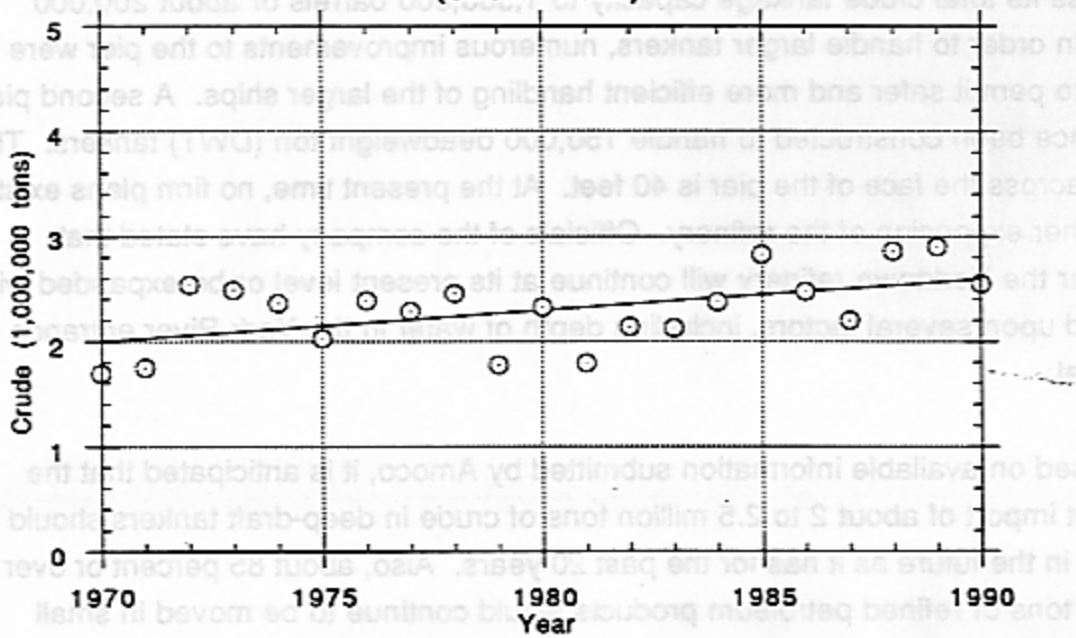
7. Based on available information submitted by Amoco, it is anticipated that the present import of about 2 to 2.5 million tons of crude in deep-draft tankers should prevail in the future as it has for the past 20 years. Also, about 85 percent or over 2 million tons of refined petroleum products would continue to be moved in small tankers and barges along the Atlantic Coast. The remainder is moved by truck and rail.

8. In addition to crude and refined petroleum moving to and from the Amoco docks, fuel oil moves to Virginia Power Company's Yorktown power station. The Virginia Power Company plant has three power units--two 150-megawatt units and an 870-megawatt unit. The 870-megawatt unit burns No. 6 fuel oil. The two smaller units

burn coal. Total fuel oil requirements are estimated at 400,000 tons annually of which historically about one-half was received in deep-draft tankers.

9. Figure B-1 is a plot of crude oil imports from column one, table B-1. A simple linear regression analysis (regression line) shows a gradual upward trend in the import of foreign crude from 1970-1990. Management indicated, however, that this trend will not continue. Plant throughput capacity will limit future imports to about the current level of 2,700,000 net tons per year. Thus, the refinery has been producing at or near capacity for the past several years. The average crude imports over the past 20 years, 1970-1990, are 2,300,000 tons.

Figure B-1. TREND IN CRUDE OIL IMPORTS 1970-1990
LOWER YORK RIVER
(Short Tons)



10. The prospective deep-draft commerce for 1995 (for which base year navigation benefits will be computed) and for the 50-year project life is presented in table B-2. The total annual volume of crude imports is projected to remain at the historical average annual level experienced over the past 20 years of 2,300,000 net tons.

Table B-2. PROSPECTIVE COMMERCE FOR THE UPPER YORK RIVER - PETROLEUM
(Thousands of Net Tons)

Commodity	1990	1995 (base year)	2000	2045
Petroleum				
Crude	2,300	2,300	2,300	2,300
Refined	2,300	2,300	2,300	2,300
Fuel Oil	400	400	400	400
Total	5,000	5,000	5,000	5,000

EXISTING FLEET COMPOSITION

11. A breakdown of trips and drafts of commercial vessels arriving and departing from the York River for the period 1970 to 1990 is given in table B-3. Data do not include naval vessel traffic, but include commercial vessel trips to naval facilities.

Table B-3. TRIPS AND DRAFTS OF VESSELS ON YORK RIVER, 1970-1990, INBOUND AND OUTBOUND

Year	Draft in feet				
	35-39	30-34	25-29	20-24	19 & under
1970	-	119	28	88	22,183
1971	-	115	50	68	23,911
1972	-	193	58	84	23,794
1973	-	171	56	72	23,792
1974	52	99	29	46	20,946
1975	53	112	52	89	31,512
1976	109	100	62	114	19,415
1977	93	118	81	83	15,702
1978	105	49	92	98	17,496
1979	79	45	68	119	19,965
1980	75	43	56	131	13,710
1981	46	21	64	149	9,615
1982	35	34	63	90	11,567
1983	36	24	37	105	20,989
1984	36	30	75	159	3,110
1985	39	29	86	127	2,787
1986	51	25	39	54	3,383
1987	45	26	35	147	4,937
1988	39	26	34	102	8,504
1989 (a)	26	12	43	NA	NA (b)
1990 (a)	28	20	35	NA	NA (b)

Source: "Waterborne Commerce Statistics," Corps of Engineers.
(a) Virginia Pilots Association, tanker class vessel trips only, inbound and outbound, lower York River. Does not include commerce to military facilities on the York River.
(b) Not available.

12. The crude oil tankers moving on the lower York River over the past 20 years have ranged in size from 36,000 deadweight tons (DWT) to 150,000 DWT. The smaller tankers have maximum loaded drafts between 36 and 40 feet. The largest tankers can load to 50 feet. These crude oil carriers call at Yorktown 35 to 50 times a year. Table B-4 shows the distribution of crude oil deliveries for 1983 (reported in the 1986 report) and 1990. As shown, the distribution changed significantly. In 1990, 73 percent of the crude was delivered in tankers 70,000 DWT and greater compared to 47 percent in 1983. This is due mainly because of the source of the crude and to some degree because of the phasing out of smaller tankers. Approximately 46 percent of the crude in 1983 was imported from Venezuela which has deep-draft restriction in many ports limiting tankers to about 40,000 DWT.

Table B-4. 1983 and 1990 CRUDE OIL IMPORTS BY DWT, YORK RIVER

DWT			1983				1990			
Minimum	Maximum	Draft (a)	Tonnage	Percent of tonnage	Number of port calls	Percent of port calls	Tonnage	Percent of tonnage	Number of port calls	Percent of port calls
30,000	39,999	37	792,496	43	27	57	0	0	-	-
40,000	49,999	39	88,425	5	3	6	0	0	-	-
50,000	59,999	41	42,615	2	1	2	0	0	-	-
60,000	69,999	43	0	0	-	-	0	0	-	-
70,000	79,999	45	598,305	33	10	21	445,095	17	7	19
80,000	89,999	46	124,465	7	3	6	1,246,281	49	18	49
90,000	99,999	48	57,778	3	1	2	641,153	25	9	24
100,000	109,999	50	122,002	7	2	4	217,506	9	3	8
110,000	119,999	52	0	0	-	-	0	0	-	-
120,000	129,999	53	0	0	-	-	0	0	-	-
130,000	139,999	54	0	0	-	-	0	0	-	-
140,000	149,999	55	0	0	-	-	0	0	-	-
150,000	159,999	55	0	0	-	-	0	0	-	-
Total			1,826,086	100	47	98	2,550,035	100	37	100

Sources: Virginia Pilots Association; Amoco Oil Company, Yorktown Refinery, Yorktown, Virginia; "Fiscal Year 1991, Deep Draft Vessel Cost Estimates," U. S. Army Corps of Engineers.

(a) Maximum design draft for DWT range.

13. Thus, the source of the crude has considerable impact on the size of tanker used and the manner in which the crude is imported. Primarily, crude is shipped directly from the exporting port in 70,000 to 150,000 DWT tankers to the York River refinery. However, in the past, crude oil from places such as north and west Africa, northern Europe, and Arabian Gulf have been shipped in Ultra Large Crude Carriers (ULCC) and Very Large Crude Carriers (VLCC) and unloaded and stored at one of six transshipment terminals in the Caribbean. From these terminals, the crude is transferred to smaller tankers (around 70,000-80,000 DWT) to complete its journey to the ports of destination--for the most part, the U.S. East Coast. The transshipment terminals allow the crude oil to be moved cheaply on large tankers (with lower unit transportation costs) for most of the journey.

14. Table B-5 presents crude oil imports by origin for 1983 and 1990. The table shows that the Yorktown refinery receives crude oil from several foreign ports. In 1983, about 74 percent of the crude came from ports in Venezuela and Trinidad (Caribbean). In 1990, just over 80 percent was exported from Norway and Mexico. The list of exporting countries or regions is a representative list of the countries the Yorktown refinery has engaged in trade. The countries cover the primary geographical zones of crude exports to East Coast ports. Thus, it provides a very representative example of the trade routes for crude oil imports.

15. About 40 percent of the imported fuel oil is received in deep-draft tankers. In 1983, all imported fuel oil was delivered in the 60,000 DWT tanker range originating from the Caribbean. In 1990, tanker sizes ranged from 52,000 DWT to 92,000 DWT.

16. Between 50 and 60 percent of the fuel oil delivered to the Amoco docks is purchased domestically. This fuel oil is usually shipped in tankers (29,000 DWT) or barges. The maximum draft of the barges is 15-20 feet. The small tankers have loaded drafts of 34 feet. Table B-6 summarizes the 1983 and 1990 residual fuel oil receipts and imports by DWT and draft to the Virginia Power Company station at Yorktown. Table B-7 shows 1983 and 1990 residual fuel oil domestic receipts and imports by origin.

17. As indicated above, over 2 million tons of refined petroleum products are shipped from the Yorktown refinery for consumption domestically. Shipments, however, are normally in small tankers or barges. Very rarely are they limited by channel depths in the lower York River.

Table B-5. CRUDE OIL IMPORTS BY ORIGIN, 1983 AND 1990, YORK RIVER

Origin	1983		1990	
	Metric tons	Percent	Metric tons	Percent
Alaska	42,615	2		
Algeria	180,155	10		
Gabon			67,540	3
Mexico			762,356	30
North Sea (U.K.)	192,595	11		
Norway			1,280,186	50
Trinidad (Caribbean)	471,786	26	439,953	17
United Arab Emirates	58,014			
Venezuela	880,921	48		
Total	1,826,086	100	2,550,035	100

Source: "The Journal of Commerce," Port Import Export Reporting Service; Amoco Oil Company, Yorktown Refinery, Yorktown, Virginia.

Table B-6. 1983 and 1990 RESIDUAL FUEL OIL DOMESTIC RECEIPTS BY DWT, YORK RIVER

DWT			1983				1990			
Minimum	Maximum	Draft (a)	Tonnage	Percent of tonnage	Number of port calls	Percent of port calls	Tonnage	Percent of tonnage	Number of port calls	Percent of port calls
Barge		20	36,000	12	5	36	78,770	11	9	53
20,000	29,999	35	119,200	39	5	36	0	-	-	-
30,000	39,999	37	33,200	11	1	7	48,978	14	2	12
40,000	49,999	39	0	-	-	-	0	-	-	-
50,000	59,999	41	0	-	-	-	38,118	11	2	12
60,000	69,999	43	117,500	38	3	21	93,331	28	2	12
70,000	79,999	45	0	-	-	-	66,846	20	1	6
80,000	89,999	46	0	-	-	-	0	-	-	-
90,000	99,999	48	0	-	-	-	52,799	16	1	6
Total			305,700	100	14	100	378,842	100	17	101

Sources: Virginia Pilots Association; Amoco Oil Company, Yorktown Refinery, Yorktown, Virginia; "Fiscal Year 1991, Deep Draft Vessel Cost Estimates," U. S. Army Corps of Engineers.
(a) Maximum design draft for DWT range.

Table B-7. RESIDUAL FUEL DOMESTIC RECEIPTS AND IMPORTS BY ORIGIN, 1983 AND 1990, YORK RIVER

Origin	1983 Metric tons	1983 Percent	1990 Metric tons	1990 Percent
Domestic				
Baltimore, MD	15,300	5		
Bayonne, NJ	94,300	31		
Norfolk, VA	20,700	7		
U.S. Gulf Coast	57,400	19	195,827	52
Imports				
Canada			6,100	2
Caribbean			70,750	19
Northern Europe (North Sea)			106,165	28
St. Croix, Virgin Island	117,500	38		
Total	305,200	100	378,842	101

Sources: "The Journal of Commerce," Port Import Export Reporting Service; Amoco Oil Company, Yorktown Refinery, Yorktown, Virginia.

CONSTRUCTION TRENDS IN TANKERS

18. The growth of the tanker has been most traumatic over the last 30 years. At the close of World War II, there were only a handful of tankers throughout the world whose size exceeded 20,000 DWT. The bulk of the world fleet consisted mostly of United States flag T-2 class vessels of 16,000 DWT. The T-2 tanker drew only 30.2 feet of water and was accommodated adequately by channels 35 feet deep. By 1955, less than 6 percent of the total world tanker tonnage exceeded 40,000 DWT in size, and the largest vessel was only 46,000 DWT. A rapid increase in size took place from 1955 to 1968 so that over 39 percent of the tanker tonnage in 1968 exceeded 60,000 DWT and, of vessels under construction at the end of 1968, more than 87 percent exceeded 100,000 DWT in size. In 1980, over 75 percent of the world tanker tonnage was carried in tankers exceeding 90,000 DWT. During the 1980's, total tanker tonnage decreased from a high of 350 million DWT in 1981 to under 250 million DWT in 1987. Since 1987, total tanker tonnage has steadily

increased to its current level of 274 million DWT (1990). The decrease in total tonnage is the result of the gradual scaling down in the number of 175,000 DWT and over (ULCC and VLCC) class tankers. The size breakdown of the world tanker fleet from 1970 to 1990 is shown in table B-8.

Table B-8. WORLD TANKER FLEET, 1970-1990
(Million DWT)

DWT	1970	%	1980	%	1990	%
10,000 - 39,999	43.8	31.9	29.7	9.2	39.1	14.2
40,000 - 89,999	48.1	35.1	48.7	15.0	57.0	20.8
90,000 - 124,999	16.9	12.3	23.3	7.2	123.5	8.6
125,000 - 174,999	4.9	3.6	29.0	8.9	31.9	11.6
175,000 - and over	23.4	17.1	194.0	59.7	122.9	44.8
Total	137.1	100.1	324.7	100.0	274.4	100.0

Sources: "Tanker Industry 1981: Market Trends," H. P. Drewry, Ltd; "World Tanker Fleet 1990," Institute for Water Resources.

FUTURE FLEET COMPOSITION

19. The navigation benefits of the channel deepening alternative depend upon the future composition of the tanker traffic in the York River. On the whole, it is anticipated that the large tankers (ULCCs and VLCCs, 175,000 DWT and above) will continue to predominate on the long-haul routes such as the Arabian Gulf to the Caribbean. Medium-sized tankers (100-174,999 DWT) will account for a large proportion of movements on medium-haul routes such as North Africa to the U.S. Gulf Coast or West Africa to the U. S. Gulf Coast. Short-haul routes such as Caribbean to U.S. East Coast ports will continue to be mostly restricted to small tankers (70,000-90,000 DWT). Port draft limitations in U.S. East Coast ports will continue to favor small tankers. Medium-size tankers operate on these routes, however, often with partial cargoes. Similar draft restrictions for loading in Venezuela are also prime limiting factors on the anticipated size of ships that will continue trade at U.S. East Coast ports.

COMMERCIAL BENEFITS

GENERAL

20. Commercial users on the lower York River include Amoco Oil Company and Virginia Power Company. Commercial benefits are based on vessel traffic and cargo volumes beginning in 1995, the base year, and projected over the 50-year project life. Benefits are measured as the difference in transportation costs under existing and projected navigational conditions with and without the proposed project. The applicable discount rate is 8-1/4 percent and price levels are October 1992.

21. National Economic Development (NED) benefits will be derived from 1990 trade routes and average annual cargo volumes. An average vessel class will be computed for each trade route and vessel characteristics and cost data for the average vessel will be interpolated from "Deep Draft Vessel Cost, 27 March 1992," Institute for Water Resources. After review of several different approaches this approach was determined to provide a consistent analysis for comparison of incremental transportation costs per foot of draft for the range of tankers that call at the refinery each year. The incremental transportation cost savings for the average class vessels will be applied to the average annual tonnages and 1990 trade routes to determine NED benefits. As noted above and pointed out in tables B-5 and B-7, the vessels used for commerce on the York River and the origin of commodities change each year. Consequently, an additional analysis is provided at the end of this section to evaluate several of these variables sensitive to project benefits. They include alternative vessel DWT groups and trade routes. The result will be to provide a range of potential annual transportation cost savings for the alternative project depths.

22. In 1985, the controlling depth in the lower York River was 37 feet. At that time, it was estimated that over a 10-year period (or by 1995) the river would shoal to a controlling depth of 35.5 feet. Currently, the existing controlling depth in the lower York River is 35 feet. Revised shoaling rates indicate that the channel will shoal to a controlling depth of 33 feet over the next 50 years or approximately 1/2 foot every 12.5 years.

23. The Plan Formulation section of the report discusses several alternatives to alleviate the navigational problems in the York River. The most practical alternatives are lightering which has been used in the past as a last resort and a deeper channel. The following is an evaluation of each alternative.

LIGHTERING OPERATIONS

24. The Plan Formulation section of the report points out that lightering (fully offloading) or lightening (partially offloading) has been practiced in the past by Amoco and could be resumed in the future if conditions change that make it economically attractive. Given the restrictions on tanker size imposed by draft limitations in the York River, lightering and lightening operations could provide a means for large tankers to be used on medium- and long-haul routes. Considerable economies of scale could be realized by using large tankers over much of the route. These large tankers could be partially or totally offloaded in the Chesapeake Bay close to the York River. The tanker lightened and the crude oil offloaded into smaller tankers or barges could complete the journey to the refinery. In the case of lightering, once the tanker has been totally offloaded, it could resume its voyage to other ports or back to the exporting area.

25. Lightering and lightening would cost substantially more than conventional docking. Additional expense would be incurred for rehandling the crude and for the use of smaller tankers to transport the crude to the refinery. Also, discharging at sea increases the risk of spills and takes much longer than discharging at a shore terminal, thus, increasing in-port costs. On the average, VLCC's and ULCC's take 16 days to offload when lightering compared to only 2 to 4 days at a shore facility. Inclement weather could further delay the operation.

26. The additional costs associated with lightering and lightening are usually more than outweighed by the economies of scale experienced over the bulk of the journey. Although in recent years a surplus of tanker tonnage has depressed charter rates to where medium-size tankers can operate partially loaded competitively with smaller tankers as well as the VLCC's and ULCC's. Assuming these medium-size tankers are partially loaded, they could enter the port facility to offload. However, given the restrictions on the York River, even a lightered vessel still might require sufficient draft to prevent it from docking. Thus, there is a limit to the size of tanker that could call at the refinery even in a lightened condition. This

size limitation restricts the potential economies of scale experienced over the first part of the journey. With lightering, the large tanker does not generally need to dock, so this problem does not arise.

27. The limited size of the plant's operation is another reason why lightering and lightening are not routinely practiced by Amoco. The storage tank capacity is 1,360,000 barrels. A small ULCC or VLCC of 175,00 DWT could haul approximately 1,000,000 barrels of crude. It is questionable whether the refinery would ever let reserves become depleted to the point where this quantity of crude needs to be brought in over a short period of time.

28. Lightering or lightening is not a feasible operation under existing conditions or as an alternative to the shoaling problem in the York River Channel . As stated above, the risks and costs are greater than current operational procedures. Eliminating the shoaling problem and providing a deeper channel, however, has the greatest potential for maximizing NED benefits through incremental transportation costs savings.

CHANNEL DEEPENING

29. Only the deep-draft tankers delivering crude oil and fuel oil have loaded drafts that exceed the existing controlling depth in the lower York River. Crude and some fuel oil imports originate primarily from ports located in the geographical regions of the Atlantic (north and south), Gulf of Mexico, and Indian Oceans, including the North Sea, and Arabian Sea and connecting waters. Occasionally, crude is shipped to the East Coast from Alaska. Specifically, some of the port locations are Venezuela, Trinidad, St. Croix, Algeria, United Arab Emirates, Netherland Antilles, Norway, Mexico, and Gabon. The greatest portion of residual fuel oil is purchased domestically.

30. The existing controlling depth in the York River Channel is 35 feet. All of the tankers that called at Yorktown in 1990 had maximum drafts that exceeded 35 feet. Based on Corps of Engineers criteria for safe navigation and channel design, vessels should not navigate the York River with a draft greater than 30 feet (35 feet less 5-foot underkeel clearance, appendix A). The tankers, however, routinely exceed this design draft and sail up the York River with drafts of up to 36 feet. (The Virginia Pilot's Association indicated it will bring in a vessel at 34.5 feet under most

conditions. If the vessel can arrange for high-water transit, they would allow 36 feet through the channel to the refinery in Yorktown.) By tankers exceeding the Corps of Engineers channel design draft of 30 feet and by effectively using the tide, the industry has maximized efficiency and reduced transportation cost per ton of cargo delivered.

31. Table B-9 summarizes by origin the average tanker characteristics, cargo, and loaded draft sailing up the York River for 1983 and 1990. The table clearly shows that tankers take full advantage of channel depths and are light loaded because of the channel limitations in the York River. The only exception is crude oil imports from Venezuela in 1983. Channel and port restrictions in that country restrict tanker sizes to under 40,000 DWT. Thus, vessels arrived with full cargos. Imports from Venezuela today, however, would be restricted by channel limitations in the York River Channel and would be required to light load.

32. Table B-10 summarizes by origin the average fuel oil tanker characteristics, cargo, and loaded draft sailing up the York River for 1983 and 1990. The deep-draft tankers operate similarly to the crude carriers, maximizing draft and cargo.

33. The benefit evaluation (transportation cost savings) of different channel designs is based on the average DWT tanker computed for each importing region (origin) in table B-9 and B-10.

34. Table B-11 lists the pertinent operating costs and characteristics for various tanker classes. The data shown are prepared by the Corps of Engineers, Institute of Water Resources and are intended to be "representative" of the costs and characteristics for a vessel of given type and size. Variations can exist in actual costs and characteristics of vessels with similar DWT limits. Vessel characteristics and operating costs for the representative average DWT vessels in tables B-9 and B-10 for 1990 were interpolated from these data and displayed in tables B-12 through B-17.

35. The DWT per incremental draft in tables B-12 through B-17 represents the weight in tons of cargo, stores, fuel, passengers, and crew carried by the tanker when loaded to her maximum summer loadline. Tankers calling at Yorktown will not consistently carry the same cargo tonnage per designated draft each trip. A

portion of the tonnage will be taken up by ballast. However, ballast is generally a constant variable (as are stores, fuel, passengers, and crew). Thus, an increase in channel depth will be taken up by increased cargo tons.

Table B-9. AVERAGE INBOUND CRUDE OIL TANKER CHARACTERISTICS BY DWT AND DRAFT USING THE YORK RIVER, 1983 AND 1990

Origin	No. trips	Average DWT	Average design draft (ft.)	Average cargo (metric tons)	Average loaded draft (ft.)	Channel depth (ft.)
			1983			
Venezuela	30	38,000	37.0	35,000	37.0	37.0
(Std dev)		(1,554)	(1.2)	(4,700)	(3.7)	
Caribbean	9	78,900	44.0	60,000	38.0	37.0
(Std dev)		(5,290)	(1.5)	(5,661)	(0.9)	
North Sea	4	78,500	45.0	64,000	38.0	37.0
(Std dev)		(10,200)	(3.0)	(3,279)	(0.9)	
Algeria	3	78,700	44.0	64,000	36.6	37.0
(Std dev)		(11,500)	(3.7)	(3,516)	(0.5)	
United Arab Emirates	1	70,600	44.4	58,000	37.5	37.0
			1990			
Norway	18	89,892	43.7	71,121	35.1	35.0
(Std dev)		(7,120)	(1.8)	(2,758)	(0.6)	
Mexico	11	86,880	40.4	69,305	34.7	35.0
(Std dev)		(9,136)	(1.9)	(3,773)	(1.2)	
Trinidad	7	82,921	42.7	62,850	34.6	35.0
(Std dev)		(8,992)	(2.2)	(6,645)	(2.9)	
Gabon	1	81,274	40.0	67,540	35.0	35.0

Table B-10. AVERAGE INBOUND TANKER CHARACTERISTICS FOR RESIDUAL FUEL RECEIPTS BY DWT AND DRAFT USING THE YORK RIVER, 1983 AND 1990

Origin	No. trips	Average DWT	Average design draft (ft.)	Average cargo (metric tons)	Average loaded draft (ft.)	Channel depth (ft.)
			1983			
Barges and small tankers						
Bayonne, NJ	4	29,000	33.5	24,000	33.5	37.0
Baytown TX	2	33,800	35.8	33,200	34.2	37.0
Norfolk, VA	4	6,000	15.0	5,200	15.0	37.0
Baltimore, MD	1	16,000	20.0	15,200	20.0	37.0
Deep-draft tankers						
St. Croix	3	89,892	42.0	47,800	36.7	
(Std dev)		(840)	(0.7)	(2,616)	(1.4)	37.0
			1990			
Barges and small tankers						
U. S. Gulf Coast	4	NA	15.0	12,427	15.0	35.0
Canada	1	NA	15.0	6,100	15.0	35.0
Caribbean	2	NA	15.0	5,213	15.0	35.0
North Sea	2	NA	15.0	6,680	15.0	35.0
Deep-draft tankers						
U. S. Gulf Coast	3	73,600	42.7	48,710	34.7	35.0
(Std dev)		(16,497)	(3.0)	(3,554)	(0.5)	
Caribbean	3	48,000	38.7	20,100	31.3	35.0
(Std dev)		(8,642)	(2.5)	(1,897)	(1.5)	
North Sea	2	51,489	40.5	46,800	34.5	35.0
(Std dev)		(27,482)	(4.9)	(28,328)	(0.7)	

Table B-11. ESTIMATED FOREIGN FLAG TANKER COSTS (1992 PRICE LEVELS)

Item	Deadweight tons (DWT)								
	25,000	35,000	50,000	60,000	70,000	80,000	90,000	120,000	150,000
Total annual fixed cost ($)	5,535,033	5,782,786	6,150,835	6,394,936	6,638,562	6,884,934	7,125,187	7,854,988	8,585,635
Total daily fixed costs ($)	15,814	16,523	17,574	18,271	18,967	19,663	20,358	22,443	24,630
Daily fuel cost ($)									
At sea	2,999	3,305	3,822	4,072	4,308	4,641	4,856	5,461	6,124
In port	432	432	540	540	540	648	648	648	756
Daily total cost ($)									
At sea	18,814	19,828	21,396	22,343	23,275	24,303	25,214	27,903	30,654
In port	16,249	16,955	18,144	18,811	19,507	20,311	21,006	23,091	25,286
Hourly total cost ($)									
At sea	784	826	891	931	970	1,013	1,051	1,163	1,277
In port	677	706	755	784	813	846	875	962	1,054
Ship characteristics									
Length (ft)	560	615	700	740	770	790	800	865	920
Beam (ft)	70	80	87	90	97	103	106	120	128
Draft (ft)	33	36	40	41	43	45	47	52	56
Imersion rate (tons/in)	88	103	120	155	173	185	210	237	284
Speed (knots)	14	14	14	14	14	14	14	14	14
Fuel consumpton									
At sea (tons/day)	29	33	38	41	45	47	50	58	66
In port (tons/day)	2	2	3	3	3	3	3	3	4

Source: "Fiscal Year 1992, Deep Draft Vessel Cost Estimates," U. S. Army Corps of Engineers.

Table B-12. 89,890 DWT TANKER OPERATING COST BETWEEN NORWAY AND YORK RIVER, VIRGINIA (a)

	Draft in feet											
	26	28	30	32	34	36	38	40	42	44	46	46.7
DWT (b)	38,200	43,200	48,200	53,200	58,200	63,200	68,200	73,200	78,200	83,200	88,200	89,892
Total annual fixed cost ($000)	7,123	7,123	7,123	7,123	7,123	7,123	7,123	7,123	7,123	7,123	7,123	7,123
Travel time												
At sea (hrs)	268	268	268	268	268	268	268	268	268	268	268	268
In port (hrs) (c)	16	18	21	23	25	27	29	31	33	35	38	38
Fixed operating cost ($)												
At sea	227,243	227,243	227,243	227,243	227,243	227,243	227,243	227,243	227,243	227,243	227,243	227,243
In port (d)	13,783	15,587	17,391	19,196	21,000	22,804	24,608	26,412	28,216	30,020	31,824	32,434
Fuel cost ($)												
At sea	54,101	54,101	54,101	54,101	54,101	54,101	54,101	54,101	54,101	54,101	54,101	54,101
In port (e)	439	496	554	611	669	726	784	841	898	956	1,013	1,033
Total operating cost ($)	295,566	297,427	299,289	301,151	303,013	304,874	306,736	308,597	310,458	312,320	314,181	314,811
Cost/DWT ($)	7.74	6.88	6.21	5.66	5.21	4.82	4.50	4.22	3.97	3.75	3.56	3.50

(a) Last column interpolated from cost and characteristic data in table B-11 for above DWT class vessel and the following trade routes and distances: Norway, 4,313 miles; Mexico (Gulf Coast only), 2001 miles; Trinidad (Caribbean), 2000 miles; U. S. Gulf Coast, 2,200 miles; North Sea, 5,200 miles.
(b) DWT per foot of draft based on interpolated immersion rate (tons/inch), table B-11.
(c) Based on a discharge rate of 2,350 DWT per hour.
(d) Based on 350-day year, 24-hour day, and in-port hours indicated.
(e) Based on interpolated daily fuel cost for above DWT class vessel, 24-hour day, and in-port hours indicated.

Table B-13. 86,880 DWT TANKER OPERATING COST BETWEEN MEXICO AND YORK RIVER, VIRGINIA (a)

	Draft in feet											
	25	27	29	31	33	35	37	39	41	43	45	46.2
DWT (b)	35,000	39,900	44,800	49,700	54,600	59,500	64,400	69,300	74,200	79,100	84,000	86,880
Total annual fixed cost ($000)	7,050	7,050	7,050	7,050	7,050	7,050	7,050	7,050	7,050	7,050	7,050	7,050
Travel time												
At sea (hrs)	124	124	124	124	124	124	124	124	124	124	124	124
In port (hrs) (c)	15	17	19	21	23	25	27	29	32	34	36	37
Fixed operating cost ($)												
At sea	224,936	224,936	224,936	224,936	224,936	224,936	224,936	224,936	224,936	224,936	224,936	224,936
In port (d)	12,500	14,250	16,001	17,751	19,501	21,251	23,001	24,751	26,501	28,251	30,001	31,030
Fuel cost ($)												
At sea	24,765	24,765	24,765	24,765	24,765	24,765	24,765	24,765	24,765	24,765	24,765	24,765
In port (e)	402	458	515	571	627	684	740	796	853	909	965	998
Total operating cost ($)	262,603	264,409	266,217	268,023	269,829	271,636	273,442	275,248	277,055	278,861	280,667	281,729
Cost/DWT ($)	7.50	6.63	5.94	5.39	4.94	4.57	4.25	3.97	3.73	3.53	3.34	3.24

(a) Last column interpolated from cost and characteristic data in table B-11 for above DWT class vessel and the following trade routes and distances: Norway, 4,313 miles; Mexico (Gulf Coast only), 2001 miles; Trinidad (Caribbean), 2000 miles; U. S. Gulf Coast, 2,200 miles; North Sea, 5,200 miles.
(b) DWT per foot of draft based on interpolated immersion rate (tons/inch), table B-11.
(c) Based on a discharge rate of 2,350 DWT per hour.
(d) Based on 350-day year, 24-hour day, and in-port hours indicated.
(e) Based on interpolated daily fuel cost for above DWT class vessel, 24-hour day, and in-port hours indicated.

Table B-14. 82,921 DWT TANKER OPERATING COST BETWEEN TRINIDAD AND YORK RIVER, VIRGINIA (a)

	Draft in feet											
	24	26	28	30	32	34	36	38	40	42	44	45.5
DWT (b)	33,500	38,100	42,700	47,300	51,900	56,500	61,100	65,700	70,300	74,900	79,500	82,921
Total annual fixed cost ($000)	6,955	6,955	6,955	6,955	6,955	6,955	6,955	6,955	6,655	6,955	6,955	6,955
Travel time												
At sea (hrs)	124	124	124	124	124	124	124	124	124	124	124	124
In port (hrs) (c)	14	16	18	20	22	24	26	28	30	32	34	35
Fixed operating cost ($)												
At sea	221,901	221,901	221,901	221,901	221,901	221,901	221,901	221,901	221,901	221,901	221,901	221,901
In port (d)	11,803	13,424	15,045	16,665	18,286	19,907	21,528	23,148	24,769	26,390	28,011	29,216
Fuel cost ($)												
At sea	24,313	24,313	24,313	24,313	24,313	24,313	24,313	24,313	24,313	24,313	24,313	24,313
In port (e)	385	438	491	543	596	649	702	755	808	861	913	953
Total operating cost ($)	258,402	260,076	261,750	263,422	265,096	266,770	268,444	270,117	271,791	273,465	275,138	276,363
Cost/DWT ($)	7.71	6.83	6.13	5.57	5.11	4.72	4.39	4.11	3.87	3.65	3.46	3.33

(a) Last column interpolated from cost and characteristic data in table B-11 for above DWT class vessel and the following trade routes and distances: Norway, 4,313 miles; Mexico (Gulf Coast only), 2001 miles; Trinidad (Caribbean), 2000 miles; U. S. Gulf Coast, 2,200 miles; North Sea, 5,200 miles.
(b) DWT per foot of draft based on interpolated immersion rate (tons/inch), table B-11.
(c) Based on a discharge rate of 2,350 DWT per hour.
(d) Based on 350-day year, 24-hour day, and in-port hours indicated.
(e) Based on interpolated daily fuel cost for above DWT class vessel, 24-hour day, and in-port hours indicated.

Table B-15. 60,000 DWT TANKER OPERATING COST BETWEEN U. S. GULF COAST AND YORK RIVER, VIRGINIA (a)

	Draft in feet											
	20	22	24	26	28	30	32	34	36	38	40	41.1
DWT (b)	21,000	24,700	28,400	32,100	35,800	39,500	43,200	46,900	50,600	24,300	58,000	60,000
Total annual fixed cost ($000)	16,734	16,734	16,734	16,734	16,734	16,734	16,734	16,734	16,734	16,734	16,734	16,734
Travel time												
At sea (hrs)	136	136	136	136	136	136	136	136	136	136	136	136
In port (hrs) (c)	9	11	12	14	15	17	18	20	22	23	25	26
Fixed operating cost ($)												
At sea	533,894	533,894	533,894	533,894	533,894	533,894	533,894	533,894	533,894	533,894	533,894	533,894
In port (d)	17,802	20,939	24,075	27,212	30,348	33,485	36,621	39,758	42,895	46,031	49,168	50,863
Fuel cost ($)												
At sea	23,152	23,152	23,152	23,152	23,152	23,152	23,152	23,152	23,152	23,152	23,152	23,152
In port (e)	201	236	272	307	343	378	414	449	484	520	555	574
Total operating cost ($)	575,049	578,221	581,393	584,565	587,737	590,908	594,081	597,253	505,985	603,597	606,769	608,483
Cost/DWT ($)	27.38	23.41	20.47	18.21	16.42	14.96	13.75	12.73	11.87	11.12	10.46	10.14

(a) Last column interpolated from "Fiscal Year 1992, Deep Draft Vessel Cost Estimates," U. S. flag tanker costs (1992 price levels), U. S. Army Corps of Engineers, 27 March 1992, for above DWT class vessel and the following trade route and distance: U. S. Gulf Coast, 2,200 miles.
(b) DWT per foot of draft based on interpolated immersion rate (tons/inch) from above referenced source.
(c) Based on a discharge rate of 2,350 DWT per hour.
(d) Based on 350-day year, 24-hour day, and in-port hours indicated.
(e) Based on interpolated daily fuel cost for above DWT class vessel, 24-hour day, and in-port hours indicated.

Table B-16. 60,000 DWT TANKER OPERATING COST BETWEEN CARIBBEAN AND YORK RIVER, VIRGINIA (a)

	Draft in feet											
	20	22	24	26	28	30	32	34	36	38	40	41.1
DWT (b)	21,000	24,700	28,400	32,100	35,800	39,500	43,200	46,900	50,600	24,300	58,000	60,000
Total annual fixed cost ($000)	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395
Travel time												
At sea (hrs)	124	124	124	124	124	124	124	124	124	124	124	124
In port (hrs) (c)	9	11	12	14	15	17	18	20	22	23	25	26
Fixed operating cost ($)												
At sea	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029
In port (d)	6,803	8,002	9,200	10,399	11,598	12,796	13,995	15,194	16,392	17,591	18,790	19,437
Fuel cost ($)												
At sea	21,047	21,047	21,047	21,047	21,047	21,047	21,047	21,047	21,047	21,047	21,047	21,047
In port (e)	201	236	272	307	343	378	414	449	484	520	555	574
Total operating cost ($)	232,080	233,314	234,548	235,782	237,017	238,250	239,485	240,719	241,952	243,187	244,421	245,087
Cost/DWT ($)	11.05	9.45	8.26	7.35	6.62	6.03	5.54	5.13	4.78	4.48	4.21	4.08

(a) Last column interpolated from cost and characteristic data in table B-11 for above DWT class vessel and the following trade routes and distances: Norway, 4,313 miles; Mexico (Gulf Coast only), 2001 miles; Trinidad (Caribbean), 2000 miles; U. S. Gulf Coast, 2,200 miles; North Sea, 5,200 miles.
(b) DWT per foot of draft based on interpolated immersion rate (tons/inch), table B-11.
(c) Based on a discharge rate of 2,350 DWT per hour.
(d) Based on 350-day year, 24-hour day, and in-port hours indicated.
(e) Based on interpolated daily fuel cost for above DWT class vessel, 24-hour day, and in-port hours indicated.

Table B-17. 60,000 DWT TANKER OPERATING COST BETWEEN NORTH SEA AND YORK RIVER, VIRGINIA (a)

	Draft in feet											
	20	22	24	26	28	30	32	34	36	38	40	41.1
DWT (b)	21,000	24,700	28,400	32,100	35,800	39,500	43,200	46,900	50,600	24,300	58,000	60,000
Total annual fixed cost ($000)	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395	6,395
Travel time												
At sea (hrs)	323	323	323	323	323	323	323	323	323	323	323	323
In port (hrs) (c)	9	11	12	14	15	17	18	20	22	23	25	26
Fixed operating cost ($)												
At sea	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029	204,029
In port (d)	6,803	8,002	9,200	10,399	11,598	12,796	13,995	15,194	16,392	17,591	18,790	19,437
Fuel cost ($)												
At sea	54,723	54,723	54,723	54,723	54,723	54,723	54,723	54,723	54,723	54,723	54,723	54,723
In port (e)	201	236	272	307	343	378	414	449	484	520	555	574
Total operating cost ($)	265,756	266,990	268,224	269,458	270,693	271,926	273,161	274,395	275,628	276,863	278,097	278,763
Cost/DWT ($)	12.66	10.81	9.44	8.39	7.56	6.88	6.32	5.85	5.45	5.10	4.79	4.65

(a) Last column interpolated from cost and characteristic data in table B-11 for above DWT class vessel and the following trade routes and distances: Norway, 4,313 miles; Mexico (Gulf Coast only), 2001 miles; Trinidad (Caribbean), 2000 miles; U. S. Gulf Coast, 2,200 miles; North Sea, 5,200 miles.
(b) DWT per foot of draft based on interpolated immersion rate (tons/inch), table B-11.
(c) Based on a discharge rate of 2,350 DWT per hour.
(d) Based on 350-day year, 24-hour day, and in-port hours indicated.
(e) Based on interpolated daily fuel cost for above DWT class vessel, 24-hour day, and in-port hours indicated.

36. The advantage of traveling fully loaded is evident in the transportation cost per ton of cargo (cost/DWT) estimates shown in tables B-12 through B-17.

37. The navigation benefits of a deeper channel in the York River are the transportation cost savings per ton of cargo realized when tankers draw more than 36 feet. Benefits were computed at channel depths beginning at 36 feet and at 1-foot increments up to a maximum channel depth of 45 feet. Transportation costs were estimated based on 1990 trade routes, the average tanker class used in the trade route, and average annual crude oil imports for the past 20 years. The average annual tonnage was distributed among the 1990 importing countries based on the countries percent share of the market that year (table B-5), except for Gabon. Gabon was excluded from the analysis because its crude share in 1990 was transported by one light-loaded vessel trip. Consequently, no transportation cost savings would be realized with a deeper channel. The tonnage (2.6 percent share) was absorbed by Trinidad. Similar distribution was accomplished for fuel oil receipts. The 1990 trade routes and annual tonnages were assumed throughout the 50-year evaluation period. As indicated above, the origin of crude oil and fuel oil changes from year to year. Thus, the routes used in the analysis are representative of the many possible combinations of import trade routes and vessels classes that have been used in the past and will continue to be used in the future. Additional analysis was accomplished using alternate trade routes and vessel sizes to evaluate the probable minimum and maximum effect on transportation costs and benefits of a channel deepening project. A summary of the analysis in presented in the Sensitivity Analysis section.

38. Underkeel clearance and tidal delays. Actual operating practice for crude carriers and tankers navigating the York River includes a minimum under keel clearance and the use of tides. As table B-9 shows crude carriers and tankers on average in 1983 and 1990 navigated the channel with drafts equal to the existing controlling depth in the channel. Vessel captains routinely adjust the ship's speed so that the vessels will arrive during favorable tidal conditions. As indicated above harbor pilots at or near high water will allow 36 feet through the channel or about 1-foot over the existing controlling depth of 35 feet. Based on a mean tide range of 2.7 feet, harbor pilots are roughly maintaining a minimum under keel clearance of about 1 to 1.5 feet. The harbor pilots operated in this manner in 1983 when the

controlling depth was 37 feet, as well. It is reasonable to assume for benefit evaluation purposes they will again operate in a similar fashion with a project equal to the 1983 controlling depth of 37 feet and for greater incremental depths. (Note this assumption is made for depths up to 45 feet. Geological conditions for the greater depths (say 40 feet and over) could require greater under keel clearances which would reduce the transportation savings for those depths. However, for evaluations purposes maximum navigation drafts were assumed.) Thus, under the with-project condition of assuming a vessel transit depth of 1-foot over the project depth takes into account similar underkeel clearances and tidal delays as under the without-project scenario.

39. Note that only on average vessels navigated the existing channel at the maximum allowable draft, i.e., 37 feet in 1983 and 35 feet in 1990. In actuality, vessels navigated the channel at depths slightly higher or lower than the allowable depth as shown by the standard deviation in average loaded draft by origin in tables B-9 and B-10 . This is because a specific dwt tanker does not always carry the same total tonnage each trip. In addition to crude or fuel oil, a portion of a vessel's total tonnage is taken up by stores, fuel, passengers, crew, and ballast, all of which can effect the draft of the vessel. Thus, there are a number of variables that may effect a vessel's draft including the controlling depth of the channel and tide. Slight variations in these variables result in the draft of the tanker oscillating around the controlling depth of the channel, as shown in tables B-9 and B-10. The oscillating effect of the non-product variables on the draft of the vessel is relatively consistent. Thus, it is assumed for each incremental depth. Therefore, the primary factor explaining the mean increase in tanker draft for each incremental project depth is the additional crude or fuel oil per tanker trip. The increase in additional crude or fuel oil per trip reduces unit transportation costs which is a NED benefit.

40. Crude Oil Imports. Existing tankers are moving on the York River with maximum drafts of between 34.5 and 36 feet compared to about 38 feet less than 10 years ago. A 36-foot controlling depth in the York River Channel would provide minimum project depth. With a 36-foot channel, vessels could navigate the channel at depths of between 36 and 37 feet, depending on tidal conditions. Under these circumstances, tankers would gain an additional transit depth of 1 foot, resulting in substantial transportation cost savings. For example, transportation costs for tankers transporting crude from Norway on an average are $4.82 per ton

(DWT) with a 36-foot draft limitation (table B-12). With a 36-foot deep channel project, these same tankers could load to 37 feet by effectively using the tide, thus reducing unit transportation costs to $4.66 per DWT or a per ton savings (benefit) of $0.16. Based on the assumption that Norway would continue to account for 50.2 percent of the total average annual crude imports of 2,300,000 tons to the York River, transportation cost savings of $188,412 would be realized, as shown in table B-18.

Table B-18. TRANSPORTATION COST SAVINGS FOR CRUDE OIL IMPORTS FROM NORWAY WITH A 36-FOOT CHANNEL PROJECT, YORK RIVER

Item	Without project condition	With project condition
Draft (max)	36 feet	37 feet
Payload (DWT)	63,300	65,700
Total cost	$304,874	$306,213
Cost/DWT	$4.82	$4.66
Annual crude (tons)	1,154,600	1,154,600
Total transportation costs	$5,569,790	$5,381,326
Transportation cost savings		$188,412

Note: Mathmatical relationship between numbers may not compute exactly due to rounding.

41. Similar computations were computed for crude imports from Mexico and Trinidad resulting in total transportation costs savings with a 36-foot channel project of $362,778. Table B-19 summarizes the existing conditions transportation cost savings for crude oil imports for several channel project depths. The savings were computed based on the existing tanker draft limitation of 36 feet and the assumption tankers would continue historical trends and take full advantage of project depth and tidal conditions which would permit access to the refinery at a depth of about 1 foot over the project controlling depth at low water.

Table B-19. TRANSPORTATION COST SAVINGS FOR FOR CRUDE OIL IMPORTS WITH ALTERNATIVE CHANNEL PROJECTS UNDER EXISTING (1991) CONDITIONS

Channel project dept (ft)	Norway	Mexico	Trinidad	Total
		Percent share		
-	50.2	29.9	19.9	100.0
		Average annual imported tons		
-	1,154,623	687,714	457,709	2,300,046
		Transportation cost savings		
36	$188,412	$109,797	$64,569	$362,778
37	376,834	204,068	129,138	710,040
38	539,511	298,338	185,257	1,023,106
39	702,187	380,158	241,376	1,323,721
40	844,062	461,977	290,602	1,596,641
41	985,936	533,660	339,828	1,859,424
42	1,110,758	605,343	383,357	2,099,458
43	1,235,580	668,662	426,886	2,331,128
44	1,346,245	731,982	465,964	2,544,181
45	1,456,919	789,923	465,964	2,712,806

42. Fuel Oil Receipts. Company officials have indicated that future fuel oil receipts will remain at the current annual level of about 400,000 tons. Historically, about 10 percent of the fuel oil is received in barges and 90 percent in deep-draft tankers. This ratio is anticipated to remain the same. Barges have minimal capacity and are unable to keep pace with plant demand. Fuel from Hampton Roads (Norfolk, VA) and the Chesapeake Bay area are generally received in barges, whereas imported fuel oil and oil from the U. S. Gulf Coast are transported in tankers. Thus, the transportation cost savings for future fuel imports will be based on 360,000 tons annually.

43. In 1990, only eight tankers called at Yorktown with fuel oil--two were in the 35,000-DWT range, one was 92,000 DWT and five were between 50,000 - 70,000

DWT. The wide range in tanker sizes and the few number of trips for each exporting area (U.S. Gulf, Caribbean, and North Sea) generates the greatest potential in the variation of the probable transportation cost savings of a channel project. The five tankers between 50,000 - 70,000 DWT, however, accounted for 70 percent of the fuel oil imported. Therefore, an average vessel class of 60,000 DWT will be used to determine transportation cost savings for fuel oil deliveries.

44. The average annual fuel imports of 360,000 tons will be distributed among the exporting areas based on their percent share of the market for 1990 (U. S. Gulf, 48.7%; Caribbean, 20.1%; and North Sea, 31.2 %). These tonnages, trade routes, and percentages will be assumed throughout the 50-year evaluation period. As indicated above, there is a substantial potential in the variation of transportation cost savings for a channel project. Thus, as with the crude sector, additional sensitivity analysis will be accomplished to determine the potential range in transportation cost savings (benefits).

45. Table B-20 estimates transportation cost savings for a 36-foot channel project for fuel oil received from the U. S. Gulf region based on the assumptions indicated above and tanker cost data in table B-15. Table B-21 summarizes transportation cost savings based on existing conditions for several channel project depths for all the exporting regions.

Table B-20. TRANSPORTATION COST SAVINGS FOR FUEL OIL RECEIPTS FROM U. S. GULF WITH A 36-FOOT CHANNEL PROJECT, YORK RIVER

Item	Without project condition	With project condition
Draft (max)	36 feet	37 feet
Payload (DWT)	50,600	52,450
Total cost	$600,425	$602,885
Cost/DWT	$11.87	$11.49
Annual crude (tons)	175,320	175,320
Total transportation costs	$2,080,366	$2,014609
Transportation cost savings		$65,757

Note: Mathmatical relationship between numbers may not compute exactly due to rounding.

Table B-21. TRANSPORTATION COST SAVINGS FOR FUEL OIL RECEIPTS WITH ALTERNATIVE CHANNEL PROJECTS UNDER EXISTING (1991) CONDITIONS

Channel project dept (ft)	U. S. Gulf	Caribbean	North Sea	Total
		Percent share		
-	48.7	20.1	31.2	100.0
		Average annual imported tons		
-	175,320	72,360	112,320	360,000
		Transportation cost savings		
36	$65,757	$10,966	$19,569	$96,292
37	121,515	21,932	39,137	192,584
38	188,882	31,499	56,209	276,590
39	246,250	11,066	76,281	363,597
40	297,274	49,575	88,466	435,315
41	297,274	49,575	88,466	435,315
42	297,274	49,575	88,466	435,315
43	297,274	49,575	88,466	435,315
44	297,274	49,575	88,466	435,315
45	297,271	49,575	88,466	435,315

SUMMARY OF TRANSPORTATION COST SAVINGS (BENEFITS)

46. Deep-draft navigation benefits were computed based on the existing conditions transportation cost savings and project depths in tables B-19 and B-21. Benefits were evaluated over a 50-year period beginning in 1995, the base year. It was assumed that the channel under existing conditions would shoal about 2 feet over the next 50 years or about 1/2-foot every 12.5 years. Thus in 2002, 2015, 2027, and 2040, benefits were recomputed using controlling depths of 34.5, 34.0, 33.5, and 33.0 feet, respectively. For evaluation purposes, it was assumed that for all vessel trips tankers would take full advantage of tidal conditions and navigate the channel at the maximum depth permitted by the harbor pilots of about 1 foot below project depth. Table B-22 presents undiscounted transportation cost savings (benefits) over a 50-year project life for several project depths. Average annual equivalent benefits are shown in table B-23.

Table B-22. SUMMARY OF UNDISCOUNTED TRANSPORTATION COST SAVINGS (BENEFITS) ($)

Project depth	Existing condition 1990(a)	Base year 1995(a)	2002(b)	2015(c)	2027(d)	2040(e)	2045(e)
36	459,075	459,075	717,551	976,229	1,244,658	1,513,091	1,513,091
37	902,624	902,624	1,161,198	1,419,775	1,688,206	1,956,639	1,956,639
38	1,299,696	1,299,696	1,558,269	1,816,847	2,085,278	2,353,709	2,353,709
39	1,687,318	1,687,318	1,942,890	2,201,468	2,469,898	2,738,329	2,738,329
40	2,031,956	2,031,956	2,290,527	2,533,921	2,817,534	3,085,966	3,085,966
41	2,294,739	2,294,739	2,553,309	2,796,701	3,080,317	3,348,748	3,348,748
42	2,534,773	2,534,773	2,793,341	3,036,735	,3320,349	3,590,780	3,590,780
43	2,766,443	2,766,443	3,025,011	3,268,408	3,452,019	3,820,451	3,820,451
44	2,979,506	2,979,506	3,238,078	3,484,470	3,765,086	4,033,517	4,033,517
45	3,148,121	3,148,121	3,406,688	3,650,080	3,966,695	4,202,127	4,202,127

(a) Controlling navigation depth at low water of 35.0 feet (existing condition).
(b) Controlling navigation depth at low water of 34.5 feet.
(c) Controlling navigation depth at low water of 34.0 feet.
(d) Controlling navigation depth at low water of 33.5 feet.
(e) Controlling navigation depth at low water of 33.0 feet.

B-23. AVERAGE ANNUAL EQUIVALENT TRANSPORTATION COST SAVINGS (BENEFITS IN $) CRUDE OIL AND FUEL OIL IMPORTS AND RECEIPTS

	Project depth (feet)									
Item	36	37	38	39	40	41	42	43	44	45
Base Year	459,075	902,624	1,299,696	1,667,316	2,031,956	2,294,739	2,534,773	2,766,443	2,979,506	3,146,121
Future (a)	798,953	1,242,544	1,639,616	2,024,853	2,368,233	2,631,015	2,871,113	3,093,940	3,315,783	3,484,394

(a) Project depth transportation cost savings benefits begin accruing in 1986. Benefits are discounted to 1995 and amortized over the 50-year project life at 8-1/4%.

SENSITIVITY ANALYSIS -COMMERCIAL BENEFITS

47. The transportation cost savings evaluation in this appendix represents one of many possible estimates of benefits for various channel projects. The analysis is a representative estimate of benefits based on historical tonnages, trade routes, and vessel sizes. It represents an average or medium estimate of transportation cost savings. Most likely as trade routes, tonnages, and vessel sizes change from year to year, actual transportation cost savings will be higher or lower than the average or medium. This section will estimate the potential maximum and minimum transportation cost savings based on alternative combinations of these changing variables. The results will provide a wide range or corridor of possible transportation cost savings for which all possible transshipment scenarios will fall.

48. Note that additional variables will impact transportation costs. They are the actual vessel operating cost data provided in table B-11, "Estimated Foreign Flag Tanker Costs (1992 Price Levels)" and similar cost data for U. S. flag vessels referred to in footnote (a), table B-15. These data are "representative" of the costs for a vessel of a given type and size. In actuality, there is variation in actual costs of vessels of a given type and size. In addition, ship characteristics will vary among similar DWT vessels affecting the immersion rate and corresponding cost per DWT per foot of loaded draft. The data are provided annually by the Corps of Engineers, Institute of Water Resources (IWR) to be used by Corps of Engineers planners in studies to determine the potential benefits of harbor improvement projects. In this study, the data will be used as provided by IWR. Any potential variation in these data will apply equally to all the trade routes and vessel classes. Thus, these data should not have a significant impact on the relative differences in transportation cost savings among projects and the selection of the optimal project. The overriding factor that will determine the variation in transportation cost savings over time remains the origin of the crude and fuel oil (trade routes) and the predominant or average vessel DWT used in the transshipment.

49. As indicated earlier, crude and fuel oil are purchased from foreign ports primarily within the geographical regions of the Atlantic Ocean (north and south), Gulf of Mexico, and Indian Ocean, including the North Sea, and Arabian Sea and connecting waters. Crude has also been transshipped from Alaska on rare occasions. The greatest portion of residual fuel oil is purchased domestically, primarily from the Gulf Coast region. In the past, crude and fuel oil imports have

originated from places such as Venezuela, Trinidad, St. Croix, Algeria, United Arab Emirates, Netherland Antilles, Norway, Mexico, Gabon, North Sea, Scotland, West Africa, Libya, and the Bahamas. The list is not conclusive, but it covers all geographical regions used in the transshipment of crude and fuel oil to the Yorktown refinery.

50. To develop a corridor of probable benefits from various channel project alternatives, transportation cost savings were computed based on estimated crude and fuel oil imports from the nearest and farthest foreign and/or domestic ports (trade routes) by various DWT class tankers. The farthest transshipment point used in the analysis is the United Arab Emirates which is 9,700 miles via the Suez Canal. The greatest potential for transportation cost savings would come from this region simply because it cost more to transship commodities longer distances. The shortest trade route evaluated was the Caribbean, approximately 2,000 miles. Potential minimum benefits would be derived from this region. For comparison, estimates for trade routes within these two regions are also presented.

51. Each trade route was evaluated using different DWT class vessels to further develop a maximum corridor of potential benefits. In our analysis above, a representative or average vessel DWT was determined for each trade route base on historical transshipments. In actuality, if all transshipments moved on tankers substantially smaller or larger than the average size vessel, transportation cost savings would vary significantly. The smaller tankers, less than 60,000 DWT, for example, would likely result in minimum net transportation cost savings for the various channel project depths because this size tanker is already operating at near maximum efficiency under existing conditions. Thus, it would have the least to gain from a deeper channel. Larger vessels (70,000 - 100,000+ DWT) have greater maximum loaded drafts and, therefore, are restricted more by existing channel depths. Thus, they would have the most to gain from a deeper channel.

52. The minimum transportation cost savings scenario for crude oil imports was achieved by assuming that all imports originated in Venezuela. Imports from this area are restricted to 38,000 DWT tankers with maximum loaded drafts of about 37 feet. Consequently, a 36-foot channel project would maximize benefits for these tankers. Total transportation cost savings would equal $401,969 annually based on crude imports of 2,300,000 tons. Note that 2,300,000 annual tons of crude

imports will be assumed for all the alternative scenarios. The 2,300,000 annual tons is based on a 20-year history of imports and represents a reasonable average annual projection of future tonnages.

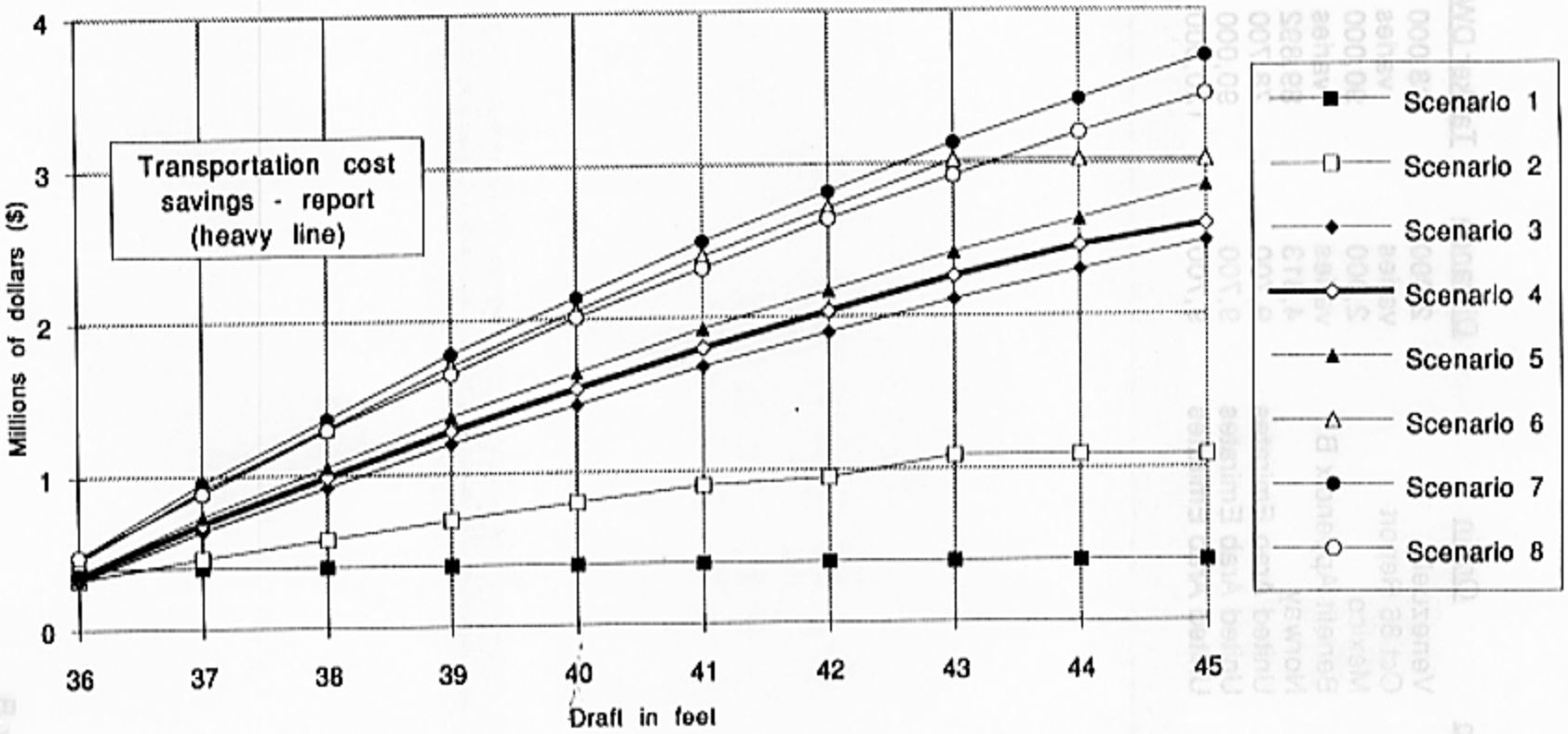
53. The potential maximum transportation cost savings were achieved by assuming that all crude oil is transshipped from the United Arab Emirates in 90,000 DWT tankers. Under this scenario, transportation costs were reduced by $478,741 with a 36-foot channel project to over $3,701,831 with a 45-foot channel project. All other possible combinations of trade routes and tanker DWT's resulted in transportation benefits that fell within these maximun and minimum scenarios. (Note that the 90,000 DWT tankers maximized operating efficiency.) Figure B-2 graphically presents the transportation cost savings for eight scenarios. The assumptions for each scenario follows the graph. Scenario 4 (heavy line) is based on the transportation cost savings presented in the report. Note also that the analysis presents existing condition transportation cost savings (benefits) only. Furture shoaling conditions are not evaluated. Projected shoaling will increase benefits over the life of the channel project.

54. A similar procedure was followed for fuel oil imports and is presented in figure B-3. The heavy line (Scenario B) is based on the transportation cost savings analysis presented in the previous section. A list of the assumptions for each scenario follows the graph.

55. Figure B-4 combines the maximum and minimum crude and fuel oil transportation benefits. The two scenarios represent one trade route (origin) and vessel size (DWT). However, most likey actual crude oil imports and fuel oil receipts will originate from more than one port or country and will be transshipped in many different size tankers. As management indicated, it is always looking for the best price and, therefore, is continuously negotiating new contracts for crude shipments as contracts expire. Management further emphasized that sensitive world economies and political climates make it expedient to diversify commodity sources, particularly crude oil. Thus, actual transportation cost benefits from a deeper channel will occur well inside the benefit corridor shown in figure B-4. As more trade routes and average vessel classes are used, transportation cost savings will more closely favor the middle line (heavy line) -- the transportation cost savings presented in the report.

56. The sensitivity analysis demonstrates that regardless of the trade routes and tankers sizes used in the transshipment of crude and fuel oil to the Yorktown refinery, substantial benefits will accrue to each alternative channel project depth. The analysis supports the "representative" analysis approach for estimating transportation cost reduction benefits for several channel project depths.

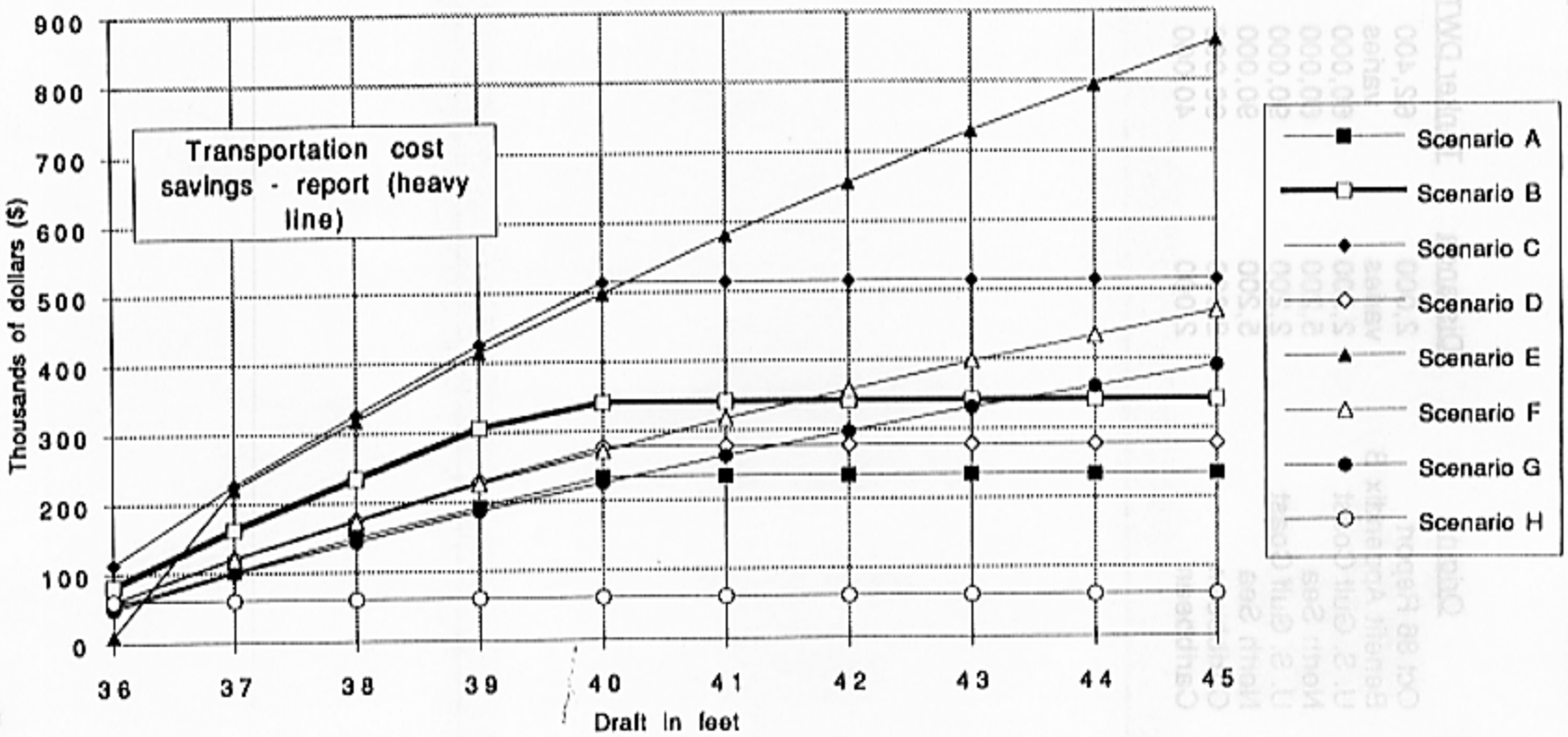
Figure B-2. CRUDE OIL IMPORTS TRANSPORTATION COST SAVINGS - ALTERNATIVE TRANSSHIPMENT SCENARIOS



List of assumptions for transshipment scenarios in figure B-2

Scenario	Origin	Distance	Tanker DWT	Tons
1	Venezuela	2,000	38,000	2,300,000
2	Oct 86 Report	varies	varies	2,047,000
3	Mexico	2,000	90,000	2,300,000
4	Benefit Appendix B	varies	varies	2,300,000
5	Norway	4,313	89,892	2,300,000
6	United Arab Emirates	9,700	78,700	2,300,000
7	United Arab Emirates	9,700	90,000	2,300,000
8	United Arab Emirates	9,700	120,000	2,300,000

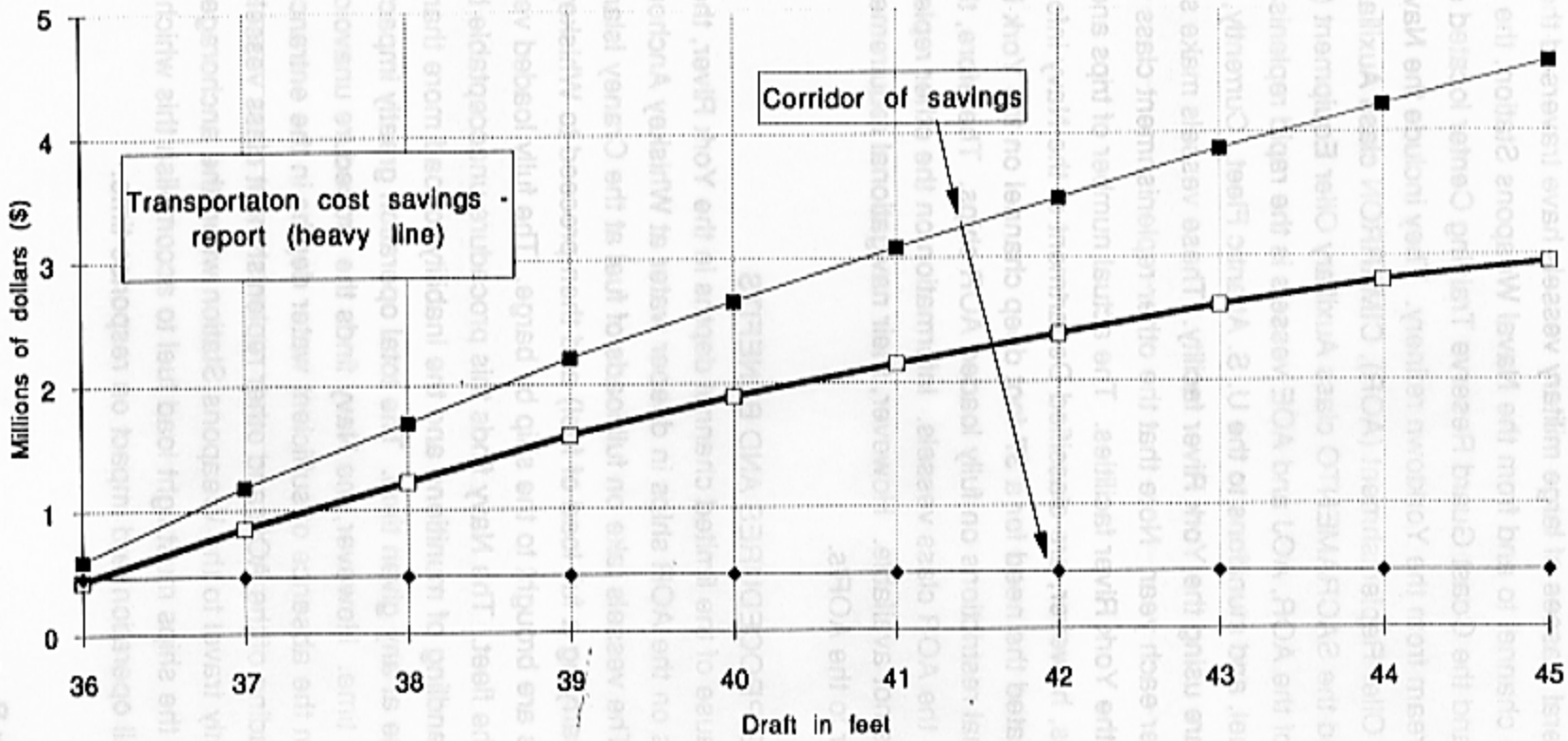
Figure B-3. FUEL OIL RECEIPTS TRANSPORTATION COST SAVINGS - ALTERNATIVE TRANSSHIPMENT SCENARIOS



List of assumptions for transshipment scenarios in figure B-3

Scenario	Origin	Distance	Tanker DWT	Tons
A	Oct 86 Report	2,000	62,400	360,000
B	Benefit Appendix B	varies	varies	360,000
C	U. S. Gulf Coast	2,200	60,000	360,000
D	North Sea	5,200	60,000	360,000
E	U. S. Gulf Coast	2,200	90,000	360,000
F	North Sea	5,200	90,000	360,000
G	Caribbean	2,000	90,000	360,000
H	Caribbean	2,000	40,000	360,000

Figure B-4. YORK RIVER CHANNEL TRANSPORTATION COST SAVINGS - ALTERNATIVE TRANSSHIPMENT SCENARIOS



MILITARY BENEFITS

57. Several classes of large military vessels have traversed the York River entrance channel to and from the Naval Weapons Station, the Naval Supply Center, and the Coast Guard Reserve Training Center located on the York River just upstream from the Yorktown refinery. They include the Navy WICHITA class Auxiliary Oiler Replenishment (AOR), CIMARRON class Auxiliary Oiler Jumboized (AOJ) and the SACRAMENTO class Auxiliary Oiler Equipment (AOE) vessels. The mission of the AOR, AOJ and AOE vessels is the rapid replenishment of naval stores, fuel, and munitions to the U. S. Atlantic Fleet. Currently, the AOR class vessels are using the York River facility. These vessels make several trips to the York River each year. Note that the other replenishment class vessels periodically rotate to the York River facilities. The actual number of trips and rotational schedules, however, are classified Department of the Navy information. The Navy has indicated the need for a 37-foot deep channel on the York River to eliminate operational restrictions on fully loaded AOR ships. Therefore, this analysis is limited to the AOR class vessels. Information on the other replenishment class vessels is not available. However, their navigational requirements are assumed to be similar to the AOR's.

LOADING PROCEDURES AND BENEFITS

58. Because of the limited channel depths in the York River, the Navy is loading munitions on the AOR ships in deeper water at Whiskey Anchorage in Hampton Roads. The vessels take on full loads of fuel at the Craney Island Depot (if not already carrying a full load of fuel) and then proceed to Whiskey Anchorage where munitions are brought to the ship by barge. The fully loaded vessels then deploy to support the fleet. The Navy finds this procedure unacceptable because of the double handling of munitions and the inability to load more than one vessel in anchorage at any given time. The total operation greatly impacts the ship's response time. However, the Navy finds the procedure unavoidable and the most feasible in the absence of sufficient water depths in the entrance channel to allow for full loading of the AOR and other replenishment class vessels. The AOR's infrequently travel to the Weapons Station when the anchorage is unavailable; however, the ships must light load fuel to accomplish this which further complicates the overall operation and impact on response time.

59. The ability of the Navy to load the AOR's rapidly and efficiently at the Weapons Station is significant from a national defense standpoint. However, it is difficult to quantify the many components of national defense in terms of monetary values. The Navy, however, was able to determine the operational savings that would be gained with the construction of a channel project to permit unrestricted access by the AOR's currently navigating the York River. The Navy Department, Atlantic Division, Naval Facilities Engineering Command, has estimated that loading at anchorage results in additional operating costs of $88,000 per year for the AOR class vessels. The AOR's draw approximately 33.5 feet of water fully loaded. Department of Navy personnel have indicated a 3.5-foot below keel clearance is required for deep-draft naval vessels on the York River. They further indicated that for national defense purposes the 3.5-foot clearance must be maintained during all tidal conditions. A minimum channel depth of 37 feet would allow the AOR class vessels to transit the York River to the Yorktown Naval Weapons Station. The Navy reports the cost savings would be $88,000 annually.

OFFLOADING PROCEDURES AND BENEFITS

60. In addition to taking on munitions from the Weapons Station, AOR's must also unload munitions at the Weapons Station. This typically occurs with vessels returning from deployment and is required before vessels are allowed to dock at the Naval Station, Norfolk. Because these vessels are already light on fuel, they can presently proceed to the Weapons Station without first offloading fuel and without being restricted by the channel depth. Navy personnel have projected that AOR vessels could continue to offload munitions at the Weapons Station pier as long as the entrance channel has a limiting depth of about 35 feet m.l.w. Depths less than 35 feet would require the Navy to offload the AOR's at Whiskey Anchorage. The additional operating cost would be similar to that encountered during loading operations, $88,000 per year.

SUMMARY OF MILITARY BENEFITS

61. For the purpose of evaluating the feasibility of the alternatives considered in this report, it is considered appropriate to utilize the Navy benefits computed based on underkeel clearance of 3.5 feet during all tidal conditions. The annual quantifiable Navy benefits, including benefits resulting from the elimination of continued channel shoaling to less than 35 feet, are shown in table B-24.

Table B-24. MILITARY BENEFITS BY PROJECT DEPTH ON THE YORK RIVER

Project depth (feet)	Existing condition 1990 ($)	Base year 1995 ($)	Future 2002-2045 (a) ($)	Average annual Navy benefits (b) ($)
36	0	0	0	0
37	88,000	88,000	176,000	141,000
38	88,000	88,000	176,000	141,000
39	88,000	88,000	176,000	141,000
40	88,000	88,000	176,000	141,000
41	88,000	88,000	176,000	141,000
42	88,000	88,000	176,000	141,000
43	88,000	88,000	176,000	141,000
44	88,000	88,000	176,000	141,000
45	88,000	88,000	176,000	141,000

(a) Channel is projected to shoal about 1/2 foot every 12.5 years. By 2002, the controlling channel depth will be 34.5 feet requiring AOR's to offload at Whiskey Anchorage before proceeding to Weapons Station resulting in an additional $88,000 in operating costs.

(b) Average annual benefits are discounted to 1995 (base year) and amortized over the 50-year project life at 8-1/2 percent.

COMMERCIAL AND MILITARY BENEFITS

62. The following table summarizes commercial and military benefits by project depth on the York River.

Table B-25. AVERAGE ANNUAL EQUIVALENT TRANSPORTATION COST SAVINGS BENEFITS BY PROJECT DEPTH ON THE YORK RIVER

Project depth (feet)	Commercial ($)	Military ($)	Total ($)
36	761,861	0	761,861
37	1,170,568	141,000	1,311,568
38	1,561,245	141,000	1,702,245
39	1,905,305	141,000	2,046,305
40	2,253,303	141,000	2,394,303
41	2,500,048	141,000	2,641,048
42	2,742,118	141,000	2,883,118
43	2,960,090	141,000	3,101,090
44	3,172,257	141,000	3,313,257
45	3,358,609	141,000	3,499,609

FISH AND WILDLIFE SERVICE COORDINATION ACT REPORTS

APPENDIX C

APPENDIX C
FISH AND WILDLIFE COORDINATION
ACT REPORT
YORK AND PAMUNKEY RIVERS, VIRGINIA

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UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

YORK AND PAMUNKEY RIVERS

NAVIGATION STUDY

LITERATURE REVIEW OF FISH AND WILDLIFE RESOURCES WITHIN THE POTENTIAL PROJECT IMPACT AREA

Planning Aid Report

April 1984

Prepared by: Albert J. Spells
Gary D. Frazer
Division of Ecological Services
Gloucester Point, Virginia

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INTRODUCTION

The Norfolk District of the Corps of Engineers is conducting a feasibility study of a proposal to deepen the existing Federal navigation channel for the York River and has requested assistance from the U.S. Fish and Wildlife Service in identifying fish and wildlife related resources in the vicinity of the proposed project. The following Planning Aid Report summarizes the relevant information available in existing sources and points out areas where there is a need for additional baseline information.

DESCRIPTION OF PROPOSED PROJECT

The existing authorized navigation project for the York River provides for a channel 22 feet deep at mean low water (mlw) and 400 feet wide terminating in a turning basin just downstream of Eltham Bridge at West Point. An 18 mile long entrance channel into the York River from Chesapeake Bay was dredged for the U.S. Navy in 1951-52. This entrance channel has not been maintained and had an effective depth in 1973 of approximately 37 feet.

In response to Congressional direction, the Norfolk District completed a feasibility study in 1972 of the navigational needs for the York and Pamunkey Rivers. The report recommended that the Federal government construct and maintain a 2-lane, 2-depth entrance channel into the York River. It recommended that the inbound lane be 50 feet deep and 250 feet wide, and that the channel extend from the 50 foot depth contour in Chesapeake Bay to the marine terminal of the American Oil Company refinery in the lower York River (Figure 1). The report did not recommend any modification of the existing 22 foot deep channel in the upper York River.

Ocean dumping was suggested as the most suitable method for dredged material disposal, although upland disposal on sites at Guinea Neck and Cape Charles (Figure 1), as well as at the Craney Island Disposal Area in Hampton Roads, was also considered.

The recommendations on the York River navigation project have been held in abeyance since 1973, at the request of the Office of Management and Budget, pending completion of studies on deep-draft navigation and dredged material disposal for the Hampton Roads and Baltimore Harbor areas. These reports have now been completed. Because a considerable amount of new information pertinent to the York River navigation project has become available since the 1972 feasibility study, the Corps is preparing another feasibility study that will examine present day project considerations.

DESCRIPTION OF PROJECT AREA

Location

The proposed project has the potential to directly impact an area encompassing the Pamunkey River from just above West Point to its confluence with the York River, the entire York River and surrounding uplands, the lower portion of Chesapeake Bay, and the area around Cape Charles on the Eastern Shore of Virginia (Figure 1). This area includes portions of Gloucester, King and Queen, King William, New Kent, James City, York, and Northampton counties. The towns of West Point, Gloucester Point, Yorktown, and Cape Charles lie within the project area. Also included within the project area are portions of the Colonial National Historical Park, the Yorktown Naval Weapons Station, the Cheatham Annex Naval Supply Depot,

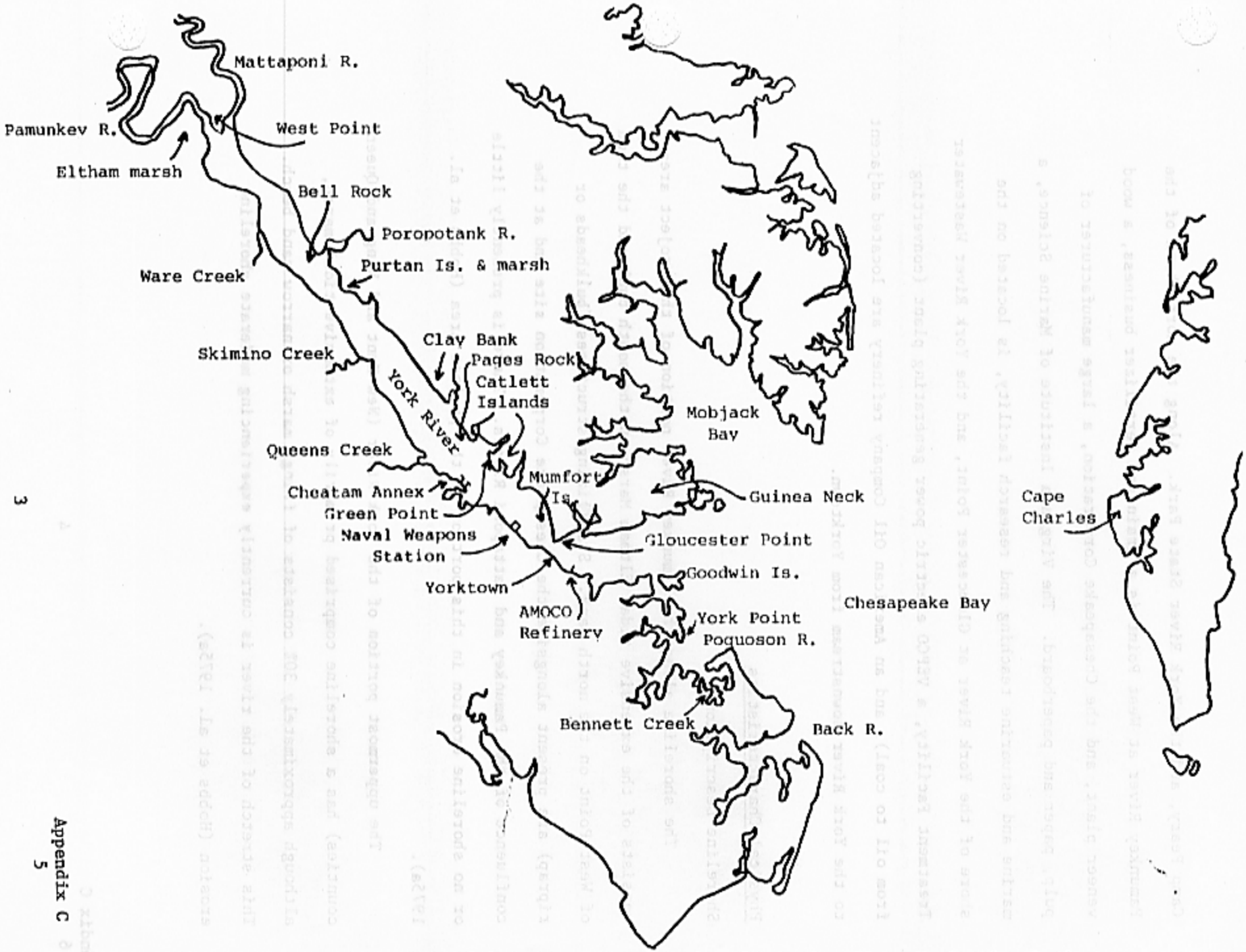

Figure 1. Landmarks within potential impact area of York and Pamunkey River Navigation Project.

Camp Peary, and the York River State Park. Along the north bank of the Pamunkey River at West Point is a grain and fertilizer business, a wood veneer plant, and the Chesapeake Corporation, a large manufacturer of pulp, paper and paperboard. The Virginia Institute of Marine Science, a marine and estuarine teaching and research facility, is located on the shore of the York River at Gloucester Point, and the York River Wastewater Treatment Facility, a VEPCO electric power generating plant (converting from oil to coal), and an American Oil Company refinery are located adjacent to the York River downstream from Yorktown.

Physical Characteristics

Shoreline Description

The shoreline along the Pamunkey River portion of the project area consists of the extensive tidal Eltham Marsh on the south bank and the town of West Point on the north bank. Stabilizing structures (bulkheads or riprap) are present alongside the Chesapeake Corporation site and at the confluence of the Pamunkey and Mattaponi Rivers. There is presently little or no shoreline erosion in this portion of the project area (Hobbs et al. 1975a).

The uppermost portion of the York River (New Kent and King and Queen counties) has a shoreline comprised primarily of extensive tidal marsh, although approximately 30% consists of fringe marsh or narrow sand beach. This stretch of the river is currently experiencing moderate shoreline erosion (Hobbs et al. 1975a).

The north bank of the York River, from the Poropotank River to the mouth of the Bay, lies within Gloucester County. Consisting either of stretches of extensive tidal marsh or of low bluffs with fringe marshes or narrow sand beaches at their toes, this portion of the shoreline is experiencing slight to moderate erosion (Anderson et al. 1976). At the mouth of the York River in Gloucester County lie the Guinea Marshes, a large area of extensive tidal marsh that experiences moderate, with isolated severe, shoreline erosion due to waves generated in Mobjack Bay and Chesapeake Bay (Anderson et al. 1976).

The York County portion of the York River shoreline, which is essentially the south bank of the river from its midpoint to its mouth, is characterized by high bluffs with fringe marsh, narrow beach, or artificial stabilizing structures at the base (Anderson et al. 1975). The upriver portion of the shoreline is primarily fringe marsh, the stretch between Cheatham Annex Naval Supply Depot and Yorktown is extensively riprapped, and the shoreline downstream of Yorktown alternates between artificial stabilizing structures and sand beach. Most of this stretch of the York River shoreline is presently experiencing little or no shoreline erosion, primarily due to the successful placement of riprap, although portions near the mouth of the river experience moderate to severe erosion (Anderson et al. 1975).

The eastern portion of York County contains areas of extensive tidal marsh and fringe marsh. This area is subject to wave action from the lower Chesapeake Bay, and thus is presently experiencing moderate, to isolated severe, shoreline erosion (Anderson et al. 1975).

Hydrologic Parameters

The York River basin drains an area of approximately 2663 square miles (6924 square kilometers). Average annual precipitation in this portion of the coastal plain is approximately 45 inches (114 centimeters), with the rate of precipitation highest during July and August and lowest from September through January (Sturm and Neilson 1977).

The York River system is tidal and brackish within the potential project area. Mean tidal range varies from 2.2 feet at the mouth of the river to 3.0 feet at West Point. The tidal prism for the York River is calculated at 4 billion cubic feet (113 million cubic meters) at the mouth and 1 billion cubic feet (28 million cubic meters) at West Point (Sturm and Neilson 1977).

Stroup and Lynn (1963) found average salinities (1949-61) at a depth of 10 feet of 22 parts per thousand (ppt) in the fall and 16 ppt in the spring at the mouth of the York, and 18 ppt in the fall and 12 ppt in the spring at Clay Bank near the river's midpoint. During 1970-81, salinities in the York River just upstream of the mouth of the Poropotank River averaged 14 ppt in October and 8.2 ppt in May/June (Haven et al. 1981).

Table 1 presents water temperature data collected via a temperature probe set at a depth of 5 feet mlw offshore of the Virginia Institute of Marine Science at Gloucester Point.

Table 1. York River water temperature (C°), 1958-71 (Jordan et al. 1972).

Month	Mean*	Min.**	Max.**
Jan.	3.53	-1.4	8.3
Feb.	3.83	-1.4	9.7
Mar.	7.15	0.8	13.9
Apr.	12.60	5.4	6.4
May	18.64	10.6	24.7
June	23.30	16.1	29.7
July	26.06	21.7	30.6
Aug.	26.18	21.3	31.1
Sept.	23.84	17.5	30.0
Oct.	18.90	11.9	25.8
Nov.	12.66	6.7	19.2
Dec.	6.67	-0.3	12.8

* Monthly mean calculated from daily means.

** Monthly maximum and minimum derived from lists of daily maximums and minimums.

Water Quality

The water quality of the York River can probably best be categorized as fair, although it is generally in better condition that the other major western shore tidal rivers.

There are relatively few point source discharges into the York River system within or near the potential project area. The largest of these include the Chesapeake Corporation at West Point and the York River Wastewater Treatment Facility, the VEPCO power plant, and the American Oil Company refinery, all downstream from Yorktown. Toxic substances do not presently pose any known water quality problems in the York River system

(EPA 1983a), although unusually high concentrations of certain metals of unknown source have been found in the sediments downstream of West Point (EPA 1983b).

Nutrient enrichment was considered by Sturm and Neilson (1977) to be "not a problem" in the York River. They found that phytoplankton concentrations, as measured by chlorophyll a levels, and nutrient concentrations (nitrogen and phosphorus) were well within recommended limits for other portions of the Bay. Other researchers (EPA 1983b) characterized the York upstream of approximately the AMOCO refinery as being moderately enriched. Nutrient levels are low in the mouth of the river and into the lower Chesapeake Bay. The enrichment profile in the river may change, however, since the 15 million gallon per day (maximum) York River Wastewater Treatment Facility went on line in the fall of 1983.

The York River system has sufficiently high levels of fecal coliform bacteria to force condemnation of shellfish beds from West Point to the mouth of the Poropotank and in many of the river's small tributaries (Virginia SWCB 1980).

Dissolved oxygen levels in the York River range from good to extremely poor (Sturm and Neilson 1977, based on July samples). An area of particular concern is the channel between the mouth of the river and the Coleman Bridge at Gloucester Point, where near bottom dissolved oxygen levels are often below the 4 milligram per liter (mg/l) water quality standard. The low biochemical oxygen demand in this stretch of the river (due to tidal flushing) indicates that external pollutant loadings are not the primary cause of the low dissolved oxygen levels. It is believed that a combination of thermal and salinity stratification in this stretch of the river, which limits the mixing and transport of dissolved materials in the water column, is the main contributor to the low dissolved oxygen levels (Hyer et al. 1975, Sturm and Neilson 1977).

Biological Characteristics

Tidal Wetlands

The potential project area has an abundance of tidal wetlands (see Figure 2). The tidal wetland communities along the York River and the adjacent Chesapeake Bay shoreline are principally high-value wetlands that contribute significantly to the functioning of the Bay ecosystem (Silberhorn 1974, Moore 1976, 1977 and 1980, and Doumlele 1979).

The vegetated tidal wetland communities within the project area generally have saltmarsh cordgrass (*Spartina alterniflora*), sea lavender (*Limonium nashii*), and saltmarsh aster (*Aster tenuifolius*) growing along the creekbanks and low areas that receive daily inundation by the tides. Just above this zone, one finds saltgrass (*Distichlis spicata*), saltmeadow hay (*Spartina patens*), black needlerush (*Juncus roemerianus*), saltmarsh bulrush (*Scirpus robustus*), and, if the salinity is very low, big cordgrass (*Spartina cynosuroides*). At the highest elevations, one is likely to find groundsel tree (*Baccharis halimifolia*) and marsh elder (*Iva frutescens*), commonly referred to collectively as "saltbushes", as well as species such as sea oxeye (*Borrichia frutescens*), saltmarsh fimbristylis (*Fimbristylis spadicea*), and switchgrass (*Panicum virgatum*).

These vegetated tidal wetland communities serve as a major source of primary productivity for the estuarine ecosystem, and they produce large quantities of detritus (decayed plant material), the basis for a major marine and estuarine food web. They directly provide food and essential habitat to an abundance of fish and wildlife, including such economically significant species as muskrats (*Ondatra zibethicus*), black ducks (*Anas rubripes*), juveniles and adults of finfish such as spot (*Leiostomus xanthurus*), menhaden (*Brevoortia*

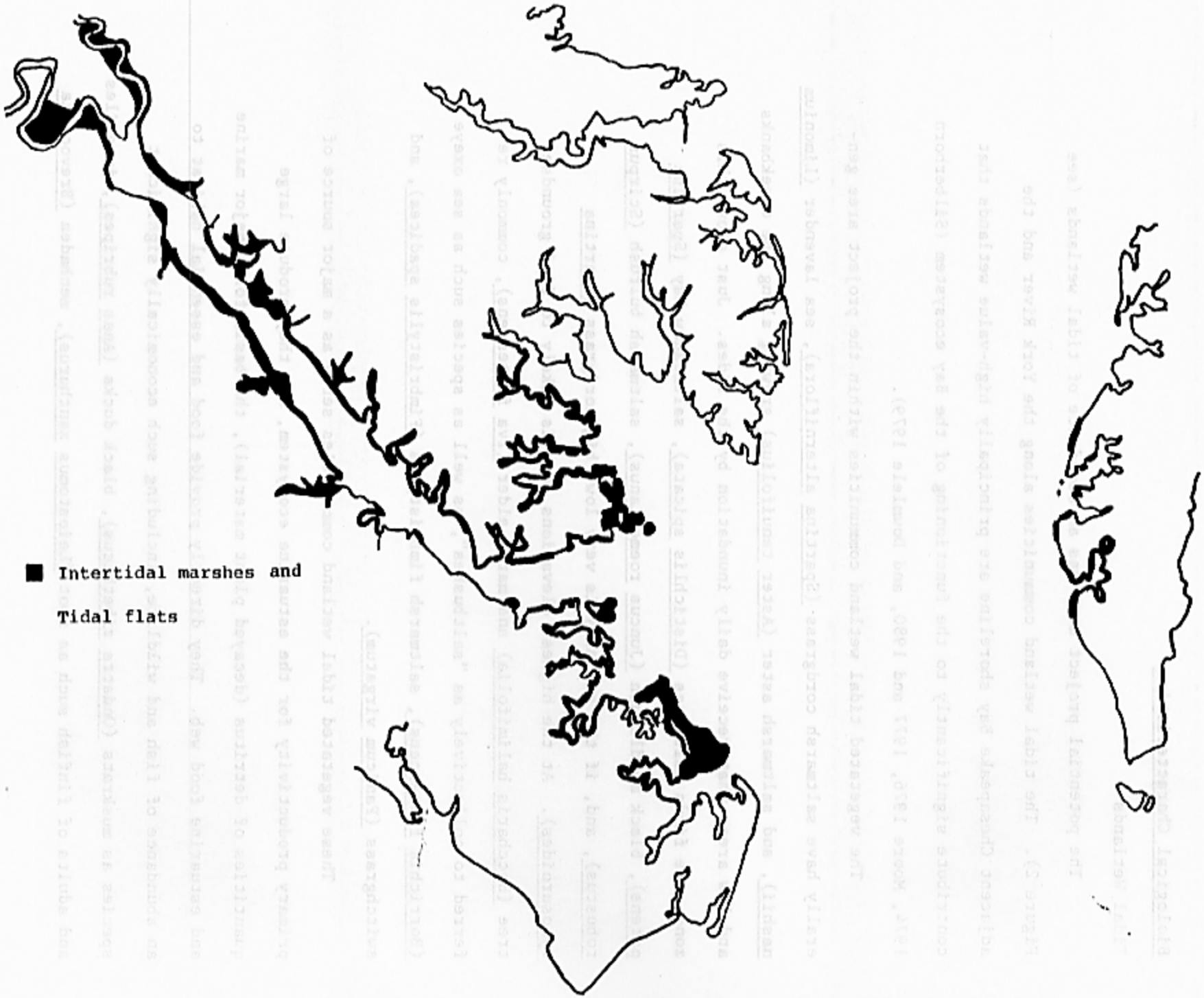

Figure 2. Distribution of intertidal marshes and tidal flats within potential impact area (VIMS undated).

tyrannus), alewife (Alosa pseudoharengus), striped bass (Morone saxatilis), and grey trout (Cynoscion regalis), and blue crabs (Callinectes sapidus). Vegetated tidal wetlands also absorb flood waters, buffer shoreline erosion, trap sediments, and improve water quality by assimilating nutrients.

Tidal flats (mud flats) are those areas that are regularly exposed at low tide and are not vegetated with vascular plants. They, too, are extremely productive biological communities, with the productivity centered in the algal mats and diatoms. They provide habitat for a variety of shellfish and other invertebrates, and they are also important nursery, spawning, or foraging habitats for many fish, birds, and other animals.

Within the potential project area, extensive vegetated tidal marshes are concentrated at the lower reaches of the Pamunkey River and the many tributaries flowing into the York (Figure 2). Extensive tidal marshes are also found in the undeveloped low-lying areas adjacent to the Chesapeake Bay. Fringe marsh and tidal flats are present along a significant portion of the project area's shoreline.

Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) is an important component of the Chesapeake Bay ecosystem. Carter et al. (1983: 50-53) succinctly describe the fundamental values of SAV as follows:

> "...the plants create a habitat that provides food and cover for large numbers of invertebrate species--insect larvae, mollusks, crustaceans and others--which are eaten by fish, waterfowl, and larger invertebrates. The plants themselves (seeds, leaves, stems, tubers, and attached epiphyte populations) are consumed by such diverse herbivores as ducks, muskrats, snails, turtles, and fish. The vegetation provides valuable spawning sites for some fish and refuge for fish fry, many invertebrate species, and juvenile and

molting crabs. Plant beds also improve water quality by absorbing nutrients from the water column, by providing a source of oxygen as a byproduct of photosynthesis, and by settling particulate matter. The stems and leaves retard current flow, and the roots stabilize the bottom, thus slowing erosion and encouraging the accumulation of sediment. In turn, plants provide a valuable source of detritus that serves as food for numerous organisms in the detritus based food chain of the estuary and coastal zone."

Unfortunately, the distribution and abundance of SAVs in Chesapeake Bay has declined precipitously since the early 1960's, and current levels are the lowest in the Bay's recorded history (EPA 1983a). A variety of factors have been implicated in the decline, including nutrient enrichment resulting in light reduction due to increased phytoplankton concentrations and periphyton growth on the leaf surface (Kemp et al. 1982a from EPA 1983b, van Montfrans et al. 1982, Orth and Moore 1983) and shading due to increased sediment loads (Kemp et al. 1982b from EPA 1983b).

Two species of SAV are presently found within the potential project area - eelgrass (Zostera marina) and widgeon grass (Ruppia maritima). Eelgrass is the dominant SAV in portions of the Bay where salinities remain greater than 10 ppt. Widgeon grass is also found in these areas, often in mixed stands with eelgrass but sometimes in dense monotypic stands. In the Chesapeake Bay, eelgrass has historically occurred from just below mlw to approximately 2 meters mlw (Orth 1976). Widgeon grass is usually restricted to the shallower portions of this range.

Although the SAV beds in the York River experienced severe declines in the early 1970's (Orth et al. 1982), the potential project area still contains the most extensive SAV beds on the western shore of Virginia. Figure 3 shows the historical and 1980 distributions of SAV beds within the potential project

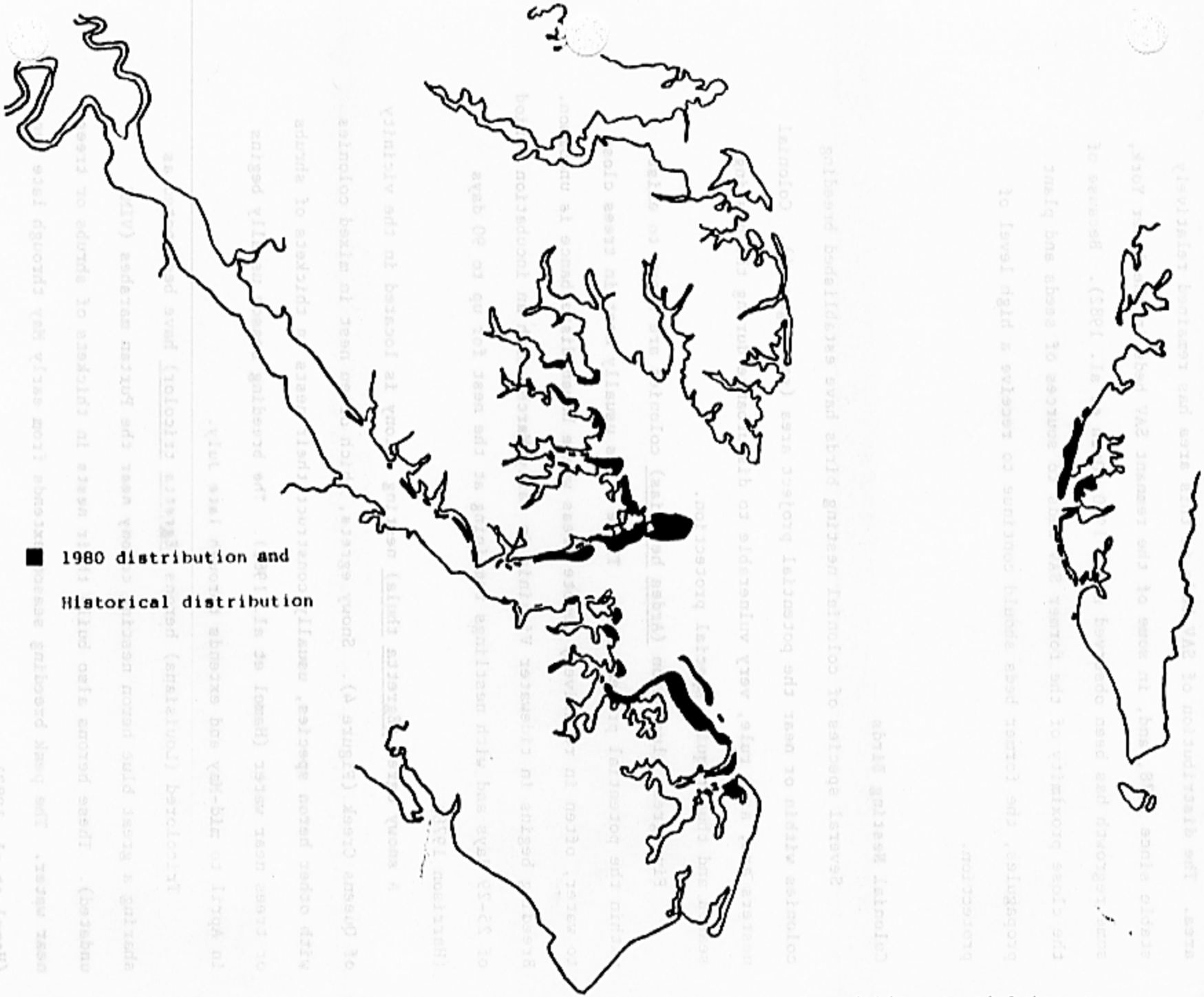

Figure 3. Historical and 1980 distribution of submerged aquatic vegetation within potential impact area (Orth and Gordon 1975, Orth et al. 1982, Stevenson and Confer 1978, VIMS undated).

area. The distribution of SAV beds in this area has remained relatively stable since 1978, and, in some of the remnant SAV beds in the lower York, some regrowth has been observed since 1980 (Orth et al. 1982). Because of the close proximity of the former SAV beds to sources of seeds and plant propagules, the former beds should continue to receive a high level of protection.

Colonial Nesting Birds

Several species of colonial nesting birds have established breeding colonies within or near the potential project area (see Figure 4). Colonial nesters are, as a rule, very vulnerable to disturbance during the nesting season and thus require special protection.

Five great blue heron (*Ardea herodias*) colonies are known to exist within the potential project area. These birds usually nest in trees close to water, often in relatively remote areas where human disturbance is uncommon. Breeding begins in tidewater Virginia in early March, with an incubation period of 25-29 days and with nestlings remaining at the nest for up to 90 days (Harrison 1978).

A snowy egret (*Egretta thula*) nesting colony is located in the vicinity of Queens Creek (Figure 4). Snowy egrets, which often nest in mixed colonies with other heron species, usually construct their nests in thickets of shrubs or trees near water (Hamel et al. 1982). The breeding season usually begins in April to mid-May and extends through late July.

Tricolored (Louisiana) herons (*Egretta tricolor*) have been noted as sharing a great blue heron nesting colony near the Purtan marshes (VIMS undated). These herons also build their nests in thickets of shrubs or trees near water. The peak breeding season extends from early May through late June (Hamel et al. 1982).

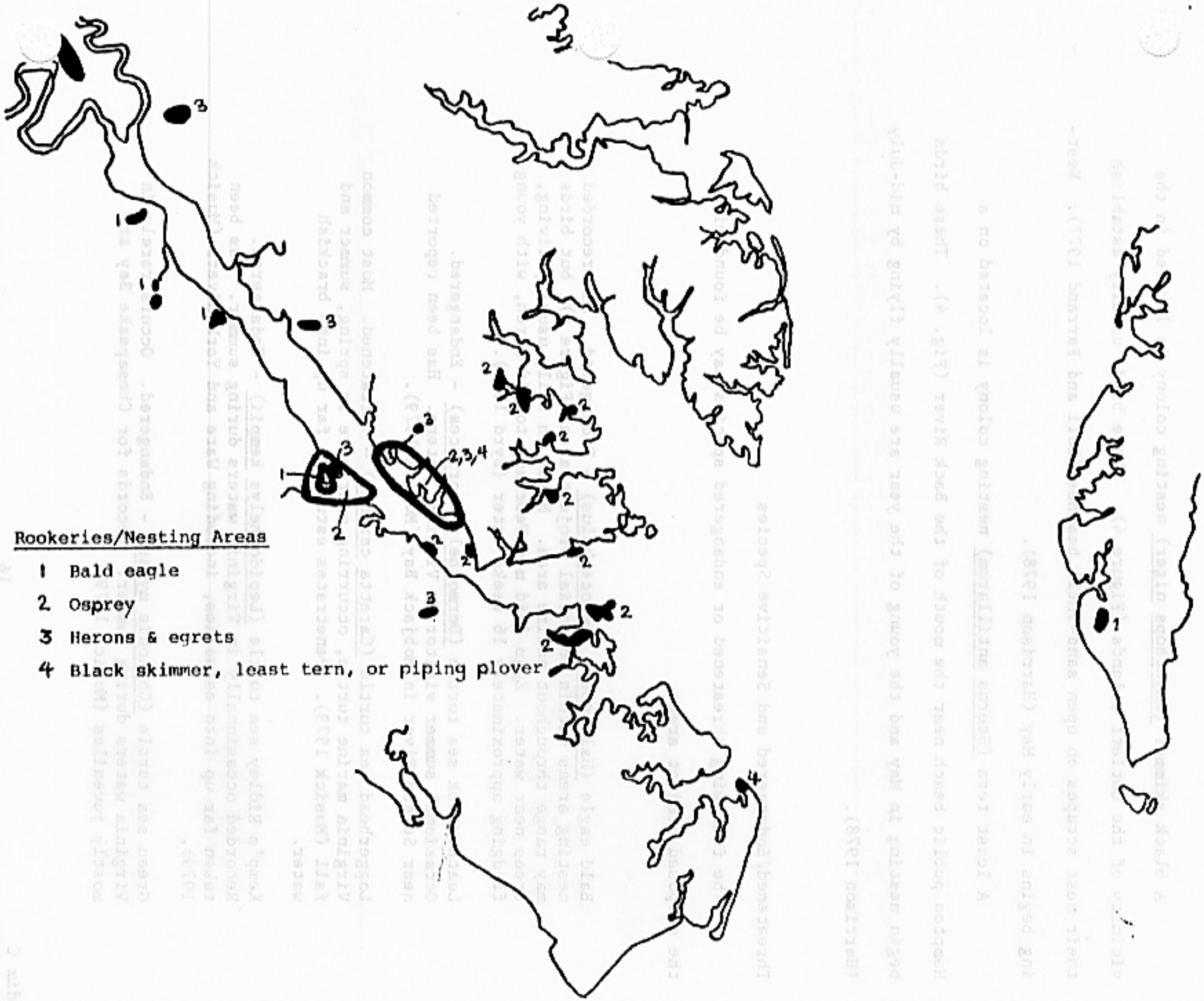

Figure 4. Nesting areas of threatened, endangered, or sensitive birds within potential impact area (Via 1979, VIMS undated).

A black skimmer (Rhynchops niger) nesting colony is located in the vicinity of the Catlett Islands (Figure 4). These birds usually establish their nest scrapes on open sand-shell beaches (Bull and Farrand 1977). Nesting begins in early May (Harrison 1978).

A least tern (Sterna antillarum) nesting colony is located on a Hampton public beach near the mouth of the Back River (Fig. 4). These birds begin nesting in May and the young of the year are usually flying by mid-July (Harrison 1978).

Threatened/Endangered and Sensitive Species

The following threatened or endangered species may be found within the proposed project area:

Bald eagle (Haliaeetus leucocephalus) - Endangered. Six recorded nesting areas within potential project area (Figure 4), but birds may range throughout entire area. Nests in tall, usually living, trees near water. Eggs laid mid-February to mid-March, with young fledging approximately 16 weeks later (Byrd 1979).

Leatherback sea turtle (Dermochelys coriacea) - Endangered. Occasional summer visitor to Virginia waters. Has been reported near Severn River in Mobjack Bay (Musick 1979).

Loggerhead sea turtle (Caretta caretta) - Threatened. Most common Virginia marine turtle, occurring nearshore in spring, summer and fall (Musick 1979). Penetrates estuaries far up into brackish water.

Kemp's Ridley sea turtle (Lepidochelys kempii) - Endangered. Recorded occasionally in Virginia waters during summer. Has been taken far up into estuaries, including Ware and York Rivers (Musick 1979).

Green sea turtle (Chelonia mydas) - Endangered. Occurs rarely in Virginia waters during summer. Records for Chesapeake Bay are mostly juveniles (Musick 1979).

speculated that the increase in species diversity during the winter was due partly to the capture of incidental species which sought the relatively warmer water of the deep holes during the cold months. Jordan et al. (1972) reported a similar species dominance for 1967 to 1971. He reported that twelve species composed over 92 percent of the individuals captured from the mouth of the Bay to rivermile 50 in the Pamunkey River. Other species that have been classified as ecologically important at some life stage in the York River are Atlantic menhaden (Brevoortia tyrannus), silver perch (Bairdiella chrysoura), black drum (Pogonias cromis), summer flounder (Paralichthys dentatus), spotted hake (Urophycis regia), naked goby (Gobiosoma bosci), Atlantic silverside (Menidia menidia), northern searobin (Prionotus carolinus), mummichog (Fundulus heteroclitus), and winter flounder (Pseudopleuronectes americanus). Other important species that migrate through the York River to spawn upstream, but are rarely captured in trawls, are the anadromous Alosids--blueback herring (Alosa aestivalis), alewife (Alosa pseudoharengus), hickory shad (Alosa mediocris) and American shad (Alosa sapidissima). A list of fish species likely to be found in the York River appears in Table 3.

Most available data on fish distributon, abundance and seasonality in the York River were obtained from channel trawls and did not take into account the distribution in shallow water areas. However, Bender (1974) did report that from 1967 to 1972 a beach seine survey was conducted monthly in the lower York from July to October. The survey selected shallow open beach zones at about 10 stations, and demonstrated high use of the beach zone by fish, and the distinct differences in species and age groups compared to deep water catches. Bender stated that this survey indicated that the shallow zone was by far the most important area for the young of many species. The data from this survey were documented in summary tables in files at the Virginia Institute of Marine Science (VIMS).

Table 3. A list of fish species reported from the York River, Virginia, with reference to resident species (R) and those species of recreational and/or commercial value (C) (from Jordan 1972).

R	Dorosoma petenense	Threadfin Shad
R	Dorosoma cepedianum	Gizzard Shad
R	Anchoa hepsetus	Striped Anchovy
R	Anchoa mitchilli	Bay Anchovy
R	Opsanus tau	Oyster Toadfish
R	Gobiesox strumosus	Skillet Fish
R	Hyporhamphus unifasciatus	Halfbeak
R	Strongylura marina	Atlantic Needlefish
R	Cyprinodon variegatus	Sheepshead Minnow
R	Fundulus diaphanus	Banded Killifish
R	Fundulus heteroclitus	Mummichog
R	Fundulus majalis	Striped Killifish
R	Lucania parva	Rainbow Killifish
R	Gambusia affinis	Mosquitofish
R	Membras martinica	Rough Silverside
R	Menidia beryllina	Tidewater Silverside
R	Menidia menidia	Atlantic Silverside
R	Syngnathus floridae	Dusky Pipefish
R	Syngnathus fuscus	Northern Pipefish
R	Chasmodes bosquianus	Striped Blenny
R	Hypsoblennius hentzi	Feather Blenny
R	Gobiosoma bosci	Naked Goby
R	Microgobius thalassinus	Green Goby
R,C	Paralichthys dentatus	Summer Flounder
R,C	Pseudopleuronectes americanus	Winter Flounder
R	Trinectes maculatus	Hogchoaker
R,C	Morone americanus	White Perch
R,C	Ictalurus catus	White Catfish
R,C	Ictalurus punctatus	Channel Catfish
	Petromyzon marinas	Sea Lamprey
C	Alosa aestivalis	Blueback Herring
C	Alosa mediocris	Hickory Shad
C	Alosa pseudoharengus	Alewife
C	Alosa sapidissima	American Shad
C	Morone saxatilis	Striped Bass
C	Anguilla rostrata	American Eel
C	Brevoortia tyrannus	Atlantic Menhaden
	Urophycis regia	Spotted Hake
C	Centropristis striatus	Black Seabass
	Bairdiella chrysoura	Silver Perch
C	Cynoscion nebulosus	Spotted Seatrout
C	Cynoscion regalis	Weakfish
C	Leiostomus xanthurus	Spot

Table 3, Cont'd.

C	Micropogonias undulatus	Atlantic Croaker
C	Menticirrhus americanus	Southern Kingfish
C	Menticirrhus saxatilis	Northern Kingfish
	Prionotus carolinus	Northern Searobin
C	Sphoeroides maculatus	Northern Puffer
C	Pomatomus saltatrix	Bluefish
C	Pogonias cromis	Black Drum

Incidental fish species reported from the York

	Carcharhinus plumbeus	Sandbar Shark
	Mustelus canis	Smooth Dogfish
	Squalus acanthias	Spiny Dogfish
	Raja eglanteria	Clearnose Skate
	Dasyatis centroura	Roughtail Stingray
	Dasyatis sayi	Bluntnose Stingray
	Rhinoptera bonasus	Cownose Ray
	Conger oceanicus	Conger Eel
	Clupea harengus	Atlantic Herring
	Opisthonema oglinum	Atlantic Thread Herring
	Synodus foetens	Inshore Lizardfish
	Merluccius bilinearis	Silver Hake
	Urophycis chuss	Red Hake
	Ophidion marginatum	Striped Cusk-eel
	Ablennes hians	Flat Needlefish
	Hippocampus erectus	Lined Seahorse
	Mycteroperca microlepsis	Gag
	Remora australis	Whale Sucker
	Caranx crysos	Blue Runner
	Caranx hippos	Crevalle Jack
	Trachurus lathami	Rough Scad
	Selene setapinnis	Atlantic Moonfish
C	Coryphaena hippurus	Dolphin
	Orthopristis chrysoptera	Pigfish
	Lagodon rhomboides	Pinfish
C	Stenotomus chrysops	Scup
C	Sciaenops ocellatus	Red Drum
	Chaetodipterus faber	Atlantic Spadefish
	Chaetodon ocellatus	Spotfin Butterflyfish
C	Tautoga onitis	Tautog

Table 3, Cont'd.

	Mugil cephalus	Striped Mullet
	Mugil curema	White Mullet
	Astroscopus guttatus	Northern Stargazer
	Gobiosoma ginsburgi	Seaboard Goby
	Trichiurus lepturus	Atlantic Cutlassfish
C	Euthynnus alletteratus	Little Tuna
C	Scomberomorus maculatus	Spanish Mackerel
	Peprilus alepidotus	Harvestfish
C	Peprilus triacanthus	Butterfish
	Prionotus evolan	Striped Searobin
	Etropus microstomus	Smallmouth Flounder
	Scophthalmus aquosus	Windowpane
	Symphurus plagiusa	Blackcheek Tongfish
	Chilomycterus schoepfi	Striped Burrfish

Table 4b. Pounds of croaker, spot, striped bass and weakfish landed in the York River, Virginia from 1972 through 1981. Numbers in parenthesis indicate the percentage of the total finfish catch for the given year (Virginia Marine Resources Commission and National Marine Fisheries Service Data)

	Croaker	Spot	Striped Bass	Weakfish	Total %	Total Finfish
1972	46200 (4.37)	270400 (25.59)	80300 (7.59)	120800 (11.42)	48.95	1057500
1973	224700 (7.72)	105600 (3.63)	106000 (3.64)	630800 (21.68)	36.67	1852600
1974	64800 (10.03)	68200 (10.56)	32900 (5.09)	77200 (11.19)	36.87	646100
1975	252200 (18.17)	80500 (5.80)	37900 (2.73)	251900 (18.15)	44.85	1387700
1976	400300 (18.16)	97500 (4.42)	37000 (1.68)	252000 (11.43)	35.69	2204100
1977	1891600 (3.47)	431000 (7.90)	22600 (0.41)	916200 (16.79)	28.57	5456500
1978	1923000 (36.81)	680700 (13.03)	10500 (0.20)	449500 (8.60)	58.64	5224200
1979	387700 (7.81)	551100 (11.10)	19100 (0.38)	790900 (15.93)	35.22	4963300
1980	53900 (2.57)	194600 (9.27)	6300 (0.30)	760100 (36.21)	48.35	2099300
1981	50500 (2.58)	226500 (11.56)	6500 (0.33)	358500 (18.29)	32.76	1959900
	4945900 (18.42)	2706100 (10.08)	359100 (1.34)	4607900 (17.16)		26851200

been attributed to large mortalities of juveniles in the winters of 1979 and 1980 (Frank Wojcik, VIMS, personal communication).

Blue Crab

The blue crab (Callinectes sapidus) must be considered one of the most important species in the York River. Commercial landings of this species at times exceed the total catch of all other fish and shellfish combined (Table 5). From 1972 through 1981 blue crabs accounted for 36 percent of the total harvestable fisheries resources from the York River. Van Engel (1968) stated that the importance of the blue crab was not reflected in biomass estimates from trawl data, primarily since trawl tows are always made in deeper channels, while commercial crab catches are made in shallow waters either over inshore flats or on mid-river bars.

Van Engel further stated that some members of the blue crab population spend their entire life in the Chesapeake Bay estuary, and thus this species can be classified as a resident. Some individuals, very small juveniles of both sexes and a few large males, are often found upriver in fresh water while adult females may be found outside the mouth of the Bay in oceanic waters. Adult males do not usually leave the brackish portions of the river.

Stocks of blue crab in the York system are derived from small juveniles migrating from the lower Chesapeake Bay. Adult females that overwinter in the deeper waters of the lower Bay spawn in the same area during late May

Table 5. Commercial landings in pounds and dollar value of the blue crab, Callinectes sapidus, from the York River system in comparison with total commercial harvest of all fishes and shellfish for 1972 through 1981.

	Total Pounds All Landings	Pounds Crabs	% of Total Landings
1972	5581500	4091900	73.3
1973	2237200	68200	3.0
1974	1426900	73600	5.2
1975	1814500	42200	2.3
1976	3710800	1209400	32.6
1977	7330200	1690100	23.1
1978	8213300	2679700	32.6
1979	7694700	1932800	25.1
1980	5426200	2930400	54.0
1981	5303400	2839500	53.5
TOTAL	18738700	17557800	36.0

	Total Dollars All Landings	Dollars Crabs	% Dollars Crabs of Total Landings
1972	777947	290079	38.1
1973	511676	13454	2.6
1974	736032	14756	2.0
1975	531097	10762	2.0
1976	795141	260555	32.7
1977	1143646	312287	27.3
1978	1825297	615228	33.7
1979	1875009	335516	17.9
1980	1659610	556339	33.5
1981	1654076	517691	31.3
TOTAL	11509531	2926667	25.4

and early June. Larvae are produced within two weeks of spawning and after a succession of 7 molts over the next month they reach the megalopa stage and then the first post-larval juvenile stage by September, at which time they migrate into the York River.

Crab catches in experimental trawls were most numerous and had the most biomass between river mile 10 on the York and river mile 35 on the Pamunkey River with the center of abundance and peak of weight at river mile 10 on the York (Van Engel 1968). Chittenden and Van Engel (1972) found a similar distribution of abundance for 1958, 1959 and 1965 through 1970. They reported the most abundance from the mouth of the York to river mile 30 on the Pamunkey with the maximum average abundance at river mile 25. The month with the maximum average abundance was July. Van Engel reported the distribution found during his study coincided with the concentration distribution of commercial crab pots.

Plankton

Available information on phytoplankton distribution, abundance and seasonality in the York River indicates that phytoplankton community structure is very dynamic with diatoms and flagellates being the dominant groups. Jordan et al. (1972) indicated from surveys taken between January 1960 and January 1961 that the phytoplankton is dominated by diatoms in the winter and early spring and by flagellates in the summer. Population levels of both groups were generally low in the fall. On an annual basis, Jordan et al. concluded that diatoms and flagellates are of comparable significance in the surface waters of the lower Chesapeake Bay. Species lists and figures showing seasonality, abundance and distribution of phytoplankton in the York River are available but have not been included in this report.

Van Engel (1968) in their discussion of zooplankton taken in samples from York River mile 10 to mile 50 on the Pamunkey River stated that zooplankton numbers increased gradually from a fall low in October to a maximum in May. They concluded that grazing pressure by fish did not significantly reduce the population of zooplankton as the numbers of zooplankton remained relatively large when young plankton-feeding fish were most abundant. It was theorized that the wetlands in the nursery area may have served as a reservoir for zooplankton. It was speculated that tidal currents would carry enough zooplankters into the river channel to maintain a stable population. A noted reduction in the zooplankton population did occur when the tentaculate ctenophore comb jelly (*Mnemiopsis leidyi*) was present. Burrell (1968) found that numbers of small plankton, such as copepods and the larvae of annelids, mollusks and barnacles varied inversely with the numbers of the comb jelly. *Mnemiopsis leidyi* was preyed upon by another comb jelly, *Beroe ovata*, in the summer and fall to such an extent that *Mnemiopsis* was restricted to areas outside the range of the beriod. Burrell concluded that *Mnemiopsis* had little impact on the survival of larval fishes.

During their study Van Engel (1968) found the copepods *Acartia tonsa* and *Eurytemora affinis* were the most numerous zooplankters throughout the year. The mysid shrimp, *Neomysis americana*, and the gammarid amphipods, *Monoculodes edwardii* and *Gammarus* sp., made up much of the biomass of the study area, particularly in late spring and summer. Small zooplankters such as copepods and cladocerans were abundant at the time when larval fishes were dependent on the plankton for food. Mysids and gammarids, however, made up a greater portion of the biomass of the crustacean zooplankton and were more important to the food

chain, providing the link between the highly productive wetlands and the young fish. The mysid, Neoysis americana, and the amphipid Gammarus sp. were the two most important zooplankters in the diets of ten fish species ranging from over 30 percent to over 60 percent in frequency of occurrence in fish stomachs.

Benthos and Shellfish

Species diversity of macrobenthos in the York River exhibits the classical pattern of reduced levels in the upstream direction (Bender 1974). This is because many species are primarily marine and cannot tolerate salinities much reduced from that of seawater (31 to 38 ppt (stenohaline species)) or can tolerate low polyhaline salinities (18 to 30 ppt), but not meso- and oligohaline salinities (5 to 18 ppt and 0.5 to 5 ppt, respectively). Only a few species live in the zone of lowest diversity. Bender states that the attenuation of species upestuary is not continuous but is rather abrupt at or near the transition from polyhaline to mesohaline regimes.

Boesch (1971) studied the benthic populations of the lower Chesapeake Bay and the York and Pamunkey Rivers. In his study he prepared a table listing the known distribution of 360 macrobenthic species from the region as a function of distance up the estuary. Analyses of station similarity and faunal affinity showed that communities were virtually continuous along the estuarine gradient and that species were generally distributed independently. In Boesch's community structure analyses he concluded that community complexity was constant throughout the polyhaline zone but decreased continuously into the mesohaline and oligohaline zone. He found that the dominant species in the lower York were the polychaetes, Tharyx setigera, Heteromastus filiformis, Nephtys incisa,

Harmothoe sp., Pseudeurythoe paucibranchiata and Cirratulus grandis, and the echinoderm, Amphioda atra.

Haven et al. (1966) studied benthic animal-sediment relationships in the lower York River. They established stations at four water depths and evaluated the number of individuals and population at each station monthly. They concluded that species diversity did not differ among the four depths but the number of individuals found at the various stations tended to show a trend toward increasing abundance in shallow water.

Macrobenthic invertebrates of commercial importance in the York are the American oyster, Crassostrea virginica, and the hard clam, Mercenaria mercenaria. Oysters occur naturally over the length of the York River system but are extremely scarce in the lower half of the river due to the virus MSX and drills which are abundant in the lower third of the river and extend upriver as far as Greens and Pages Rock. For this reason few spat setting on natural cultch survive in the zone from Gloucester Point to the mouth of the river (Bender 1974). Boesch (1971) indicated that the oyster was found in the York River system to approximately river mile 55 in the Pamunkey River. Haven et al. (1981) and the Virginia State Water Control Board (1980) illustrated the distribution of public and leased oyster and clam beds in the York River (Figure 5).

Unlike other river systems in Virginia, the distribution of Baylor grounds (naturally productive state owned oyster grounds) in the York are discontinuous with wide areas between the blocks (Haven et al. 1981). Baylor ground distribution in the York and Poquoson Rivers and Mobjack Bay is detailed in Table 6. Bottoms largely composed of exposed shell and oysters were rated

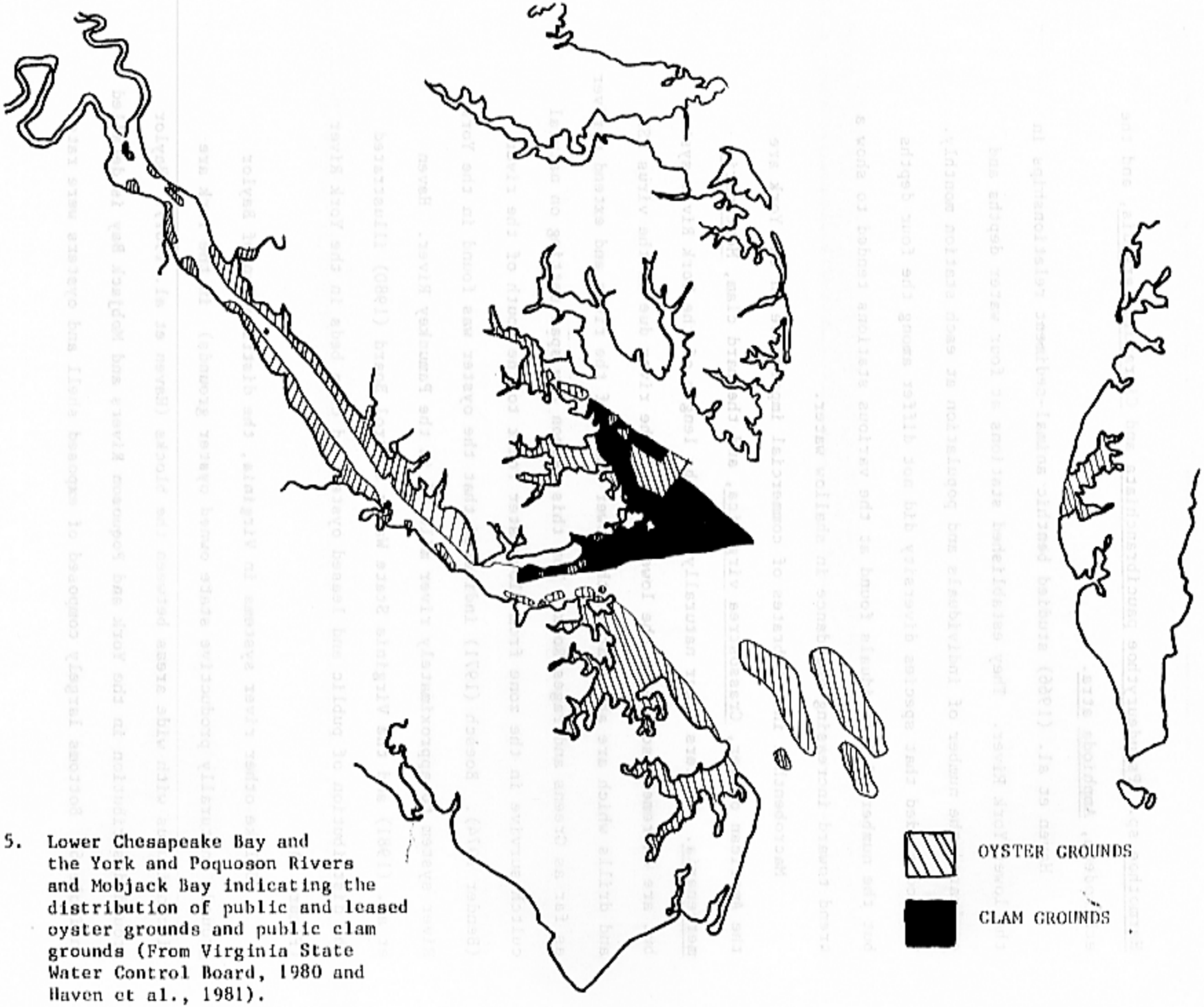

Figure 5. Lower Chesapeake Bay and the York and Poquoson Rivers and Mobjack Bay indicating the distribution of public and leased oyster grounds and public clam grounds (From Virginia State Water Control Board, 1980 and Haven et al., 1981).

Table 6. Baylor grounds in the York and Poquoson Rivers, and in Mobjack Bay (proper), Virginia

Area	Acres of Baylor Grounds	Acres of Baylor Grounds High to Moderate Production Potential	Depth (ft.)
York River			
Bell Rock	170.1	8.5	<18
Below Bell Rock to Coleman Bridge	1753.3	857.7	6 to 18 (91% <18)
Below Coleman Bridge	525.3	223.2	6 to 18 (83%<18)
TOTAL	2448.7	1089.4	
Poquoson River	8931.1	813.6	91.3%<18
Mobjack Bay (proper)	5609.1	411.9	most <18

by Haven et al. as having the highest value for oyster culture. Those composed of sand and shell, or mud and shell were next. Bottoms lacking shell were considered to have a low potential for growing oysters. In the upper York River there were two areas of shell bottom in the vicinity of Bell Rock Light. In the mid-section of the York from just above Clay Bank to Gloucester Point, there were extensive areas of oyster rock and shelly bottom which were continuous. Public bottoms on the south side of the York above Gloucester Point were not extensive. However, there were areas on the south side that could not be surveyed due to restrictions associated with military installations. In the lower York, below Gloucester Point on the north side, blocks of Baylor bottom contain extensive areas of mud-shell. In Mobjack Bay most of the Baylor bottoms were classed as having a low potential. They consisted of mud or sand devoid of any significant quantity of shell. On the western side of Mobjack Bay, there were a few irregularly-shaped areas of oyster rock. On the eastern side were a few areas of sand shell. In the Poquoson River extensive eelgrass beds existed in the area where depth was less than about 6 feet mean low water in a strip from Goodwin Island to York Point, and from the mouth of Bennett Creek to Marsh Point. There were also extensive beds inshore of Drum Island Flats. Areas covered with eelgrass were not satisfactory for oyster culture. Only 9.1 percent of the Baylor bottom in the Poquoson River was rated as having a high or moderate potential for oyster culture.

The hard clam in the York, from 2 miles above Coleman Bridge to the river entrance, was moderately to highly productive in 1972 (Haven et al. 1973). Other moderately to highly productive areas of hard clams were the Tue Marsh-Back Creek area and the Poquoson Flats. Haven et al. (1973) classified these

areas as being among the six major areas of hard clam density in the lower Chesapeake Bay. In the York River they found hard clams up to the Camp Peary-Clay Bank region, and at all stations sampled in the Poquoson River and Mobjack Bay (Figure 6). On the lower south side of the York River clams were scarce. Between the Yorktown and Goodwin Island areas, hard clam density decreased dramatically at two sample stations immediately below the AMOCO oil refinery. Distribution was spotty and abundance sparse at sample sites above the Coleman Bridge with one notable exception. At Green Point an abundance of clams suitable for commercial harvest was found (12.5 bushels in 3 hours using an escalator dredge). No hard clams were found above Camp Peary. In Mobjack Bay moderate abundance was encountered for the three most intensely sampled stations.

While the lower York River is not used for oyster culture, many areas of bottom are highly productive of hard clam, and from 10 to 20 "patent tong" boats daily work in the area extending from the mouth of the York River to two miles above Coleman Bridge. The value of the oyster harvest from the lower York is very low and has been since 1960 because of MSX (Haven and Kendall 1974). Haven and Kendall stated that there is a potential for culturing oysters in the lower York by short-term holding of large oysters and growing MSX resistant oysters.

Even though the studies referred to state that the natural production of oysters is low in the York, from 1972 through 1981 the oyster constituted 5.06 percent of the total poundage of all fish and shellfish landed, and 19.64 percent of the total dollar value (Table 7). This seemingly contradiction to the references no doubt occurs because there are many privately leased oyster grounds in the York. Most leased oyster grounds in the York are not naturally productive; they must be planted with shell or seed oysters to be productive (Haven et al. 1978). Information on leased oyster grounds in the York can be

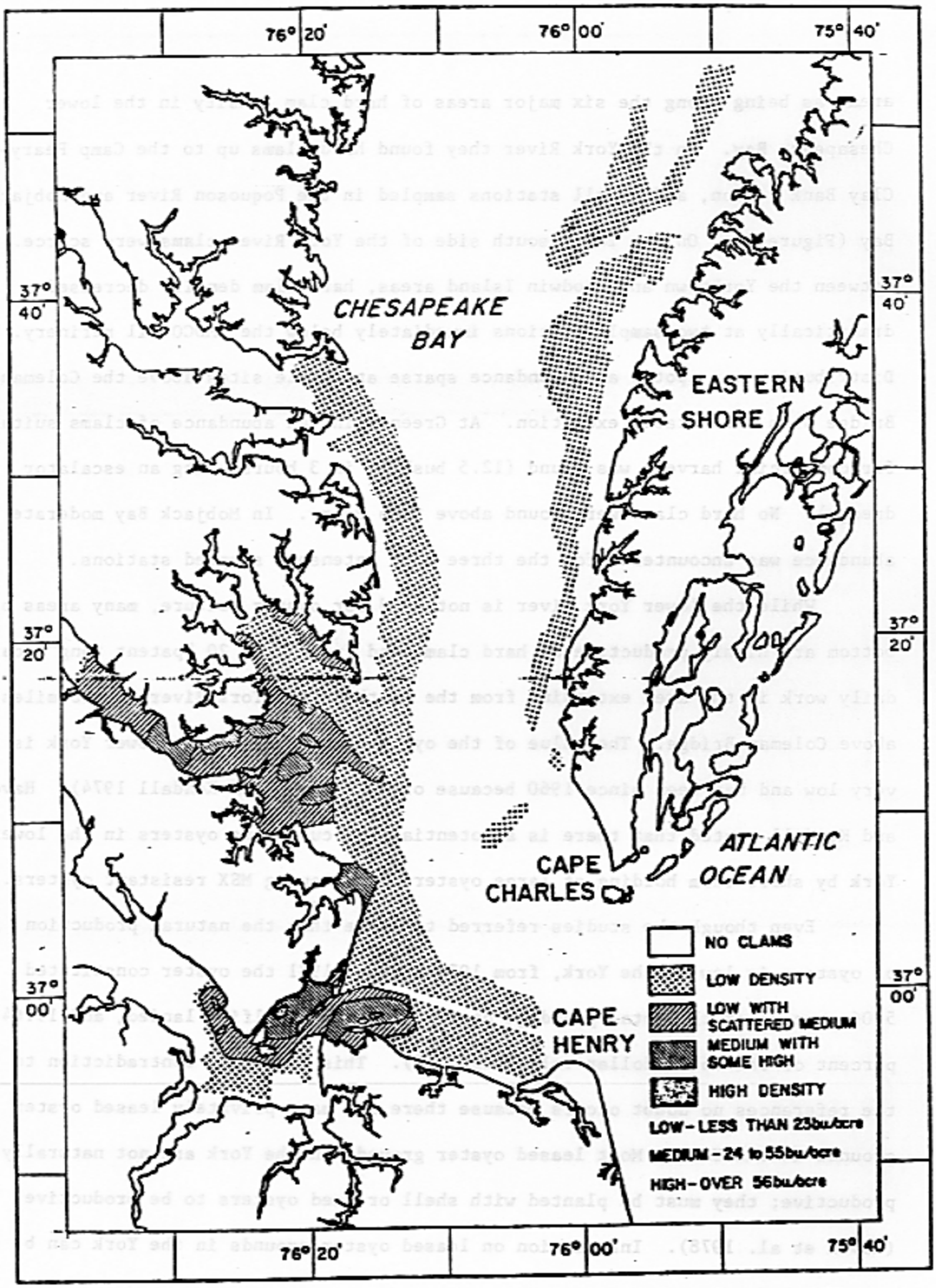

Figure 6. Distribution of Hard Clams in Chesapeake Bay (from Haven et al. 1973).

Table 7. Commercial landings of oysters and hard clams from the York River, Virginia, for 1972 through 1981. Parenthesized numbers are the percentages of the total commercial landing from the York for all fish and shellfish. (Virginia Marine Resources Commission and National Marine Fisheries Service Catch Data)

	Clams		Oysters		Oysters and Clams	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
1972	282200 (5.06)	252939 (32.51)	148500 (2.66)	110207 (14.17)	430700 (7.72)	363146 (46.68)
1973	250500 (11.20)	235788 (46.08)	65900 (2.95)	45331 (8.86)	316400 (14.14)	281119 (54.94)
1974	617300 (43.26)	579372 (78.72)	74200 (5.20)	60517 (8.22)	691500 (48.46)	639889 (86.94)
1975	283100 (15.60)	265648 (50.02)	101500 (5.59)	79293 (14.93)	384600 (21.20)	344941 (64.95)
1976	119800 (3.23)	112513 (14.15)	177000 (4.77)	165355 (20.80)	296800 (8.00)	277868 (34.95)
1977	66000 (0.90)	80748 (7.06)	117600 (1.60)	140732 (12.31)	183600 (2.35)	221480 (19.37)
1978	9900 (0.12)	25123 (1.38)	299500 (3.65)	345763 (18.94)	309400 (3.77)	370886 (20.32)
1979	15600 (0.20)	47586 (2.53)	783000 (10.18)	608512 (32.45)	798600 (10.38)	656098 (34.99)
1980	8800 (0.16)	76540 (4.61)	387700 (7.14)	463027 (27.90)	617312 (11.38)	539567 (32.51)
1981	194800 (3.67)	294192 (17.79)	309200 (5.83)	242047 (14.63)	504000 (9.50)	536239 (32.42)
	1848000 (3.79)	1970449 (17.12)	2464100 (5.06)	2260784 (19.64)	4312100 (8.85)	4231233 (36.76)

obtained from the Virginia Marine Resources Commission. The hard clam in the York constituted 3.79 percent of the total poundage from 1972 through 1981, and 17.12 percent of the total dollar value.

PRELIMINARY IMPACT ANALYSIS

Potential significant adverse environmental impact to the York River and lower Chesapeake Bay may occur as a result of the project alternatives. These impacts would appear directly and secondarily as results of dredging, dredge material disposal, lightering or the construction of an oil pipeline.

Dredging Impacts

The most obvious impact from dredging would be the direct destruction and displacement of benthic macroinvertebrates, including oysters and hard clams, in the path of the dredge. There are clams in the area of the entrance channel of suitable concentration to be of commercial value. Past studies have shown that recolonization of a deepened channel by benthic organisms may occur within two weeks to two years. Even though the original biomass may be attained in that period, recolonization is usually by opportunistic species which are less valuable to the food chain. Original species diversity is seldom achieved and the number of demersal (bottom feeding) fish consequently seldom attains pre-dredging proportion and species diversity. Species diversity in the deepened channel may be influenced by the substrate type in the original channel. Decreased oxygen supply in and above the substrate may also influence species diversity.

During the dredging operation bottom sediments would be disturbed and suspended. Turbidity created during dredging can reduce the penetration

of light necessary for photosynthesis by phytoplankton and macrophytes, thus reducing the oxygen supply in the water column. Suspended sediment could cause adverse impacts on filter feeding organisms, e.g. oysters and clams. In filter feeders heavy suspended sediment loads could cause abrasion of gill filaments, clogging of gills, impaired respiration, impaired feeding, reduced pumping rates, retarded egg development and reduced growth and survival of larvae. Similar impacts could occur to zooplankton, larval fish and larval blue crabs. These impacts would not readily affect adult fish because of their mobility. However, filter feeding fish could be affected more than non-filter feeding fish. If the dredging operation would not extend for a long period, and was scheduled to avoid critical spawning and nursery periods, these impacts from suspended sediments should not be significant.

Dredging could result in chemical changes in the water column such as decreased dissolved oxygen levels due to increased oxygen demand resulting from resuspension of nutrients and pollutants. Low oxygen levels in the water column could have a synergistic effect because the York River has experienced periods of low oxygen levels during summer due to the "red tide" effect caused by high concentrations of dinoflagellates. Oxygen demand may also be associated with suspension of the deeper sediment layers, which in estuarine systems typically exhibits increasingly reduced (deoxidized) sediment deposits. Heavy metals and potential increased oxygen demand due to oxidation of deep sediments when suspended, along with the potential suspension of other pollutants, can have significant adverse impacts on aquatic organisms. Sediments, especially in areas of known high levels of pollutants, should be sampled to determine their potential for adversely impacting aquatic resources.

Deepening the access channel to the York, and deepening the channel in the York, may disrupt the existing hydrological regime. Water transport

patterns and the salinity regime may be changed. These modifications may have significant impacts on the aquatic resources in the York River estuary and should be thoroughly studied before this project is initiated.

Secondary Impacts From Dredging

This project would induce larger commercial vessels to use the York River. As a result the probability of increased vehicular accidents would increase, thus increasing the potential for large oil spills. Increased traffic by larger vessels could cause more frequent turbidity periods due to resuspension of sediments by propellers. More frequent turbidity periods could cause adverse impacts to present and historical submerged aquatic vegetation (SAV) beds, and shellfish grounds. Larval forms and other benthic organisms may also be adversely impacted.

Dredged Material Disposal Impact

Disposal alternatives for this project have been determined to be open water, upland, and possibly beach nourishment. Following are discussions of potential impacts from each alternative.

Open Water Disposal - The impacts associated with overboard disposal would be similar to those resulting from dredging, except the impacts would be more severe and widespread. The most obvious and most significant impact from overboard disposal would be the direct burial and suffocation of benthic organisms. Adverse impacts to the aquatic system could be reduced by employing such measures as controlled placement and configuration of the

disposal area; silt barriers or silt screens; avoiding work during periods which are critical for the survival of larval forms; avoiding direct disposal in areas of high concentrations of ecologically and commercially important resources, i.e. submerged aquatic vegetation (SAV) beds (historical and present), oysters, clams and blue crabs; and placing dredged material in such a manner as to preclude siltation in critical habitats, i.e. shellfish grounds and SAVs. Dredged material should not raise bottom elevations to the extent that they would no longer be within their existing aquatic habitats, i.e. intertidal or subtidal. The same considerations should be given to ocean disposal. Also it should be determined if the dredged material is suitable for open water disposal. EPA guidelines should be used to make that determination.

Beach Disposal - The direct impacts of beach disposal are based on the abundance and kinds of organisms present, the quantity and quality of the dredged material, and the time of year it is placed on the beach. The major impacts to a beach community are the direct mortality of benthic infauna and their larvae covered by dredged material; avoidance of the area by these species due to high turbidity levels; reduction in predators in the area such as crabs, finfish and shorebirds due to loss of food species; and loss of suitable habitat due to changes in grain size and beach face slope. These impacts can be minimized by avoiding disposal during the period of larval recruitment of beach infauna, which is primarily between April and July.

Upland Disposal - Disposal of dredged material on an upland site would have minimal to no impacts on the aquatic environment if the disposal area were

properly constructed. However, this alternative would impact whatever habitat existed at the site. Potential upland sites include previously used sites, i.e. the disposal site on the York near West Point, areas on the three military installations along the York, woodland and abandoned agricultural fields. Until definite sites are proposed, impacts of this alternative cannot be quantified.

Environmental Impacts of Lightering

The major potential impact of lightering would be increased potential for oil spills during lightering and during transport of oil to the terminal. Another impact would be the potential for increased vessel accidents due to increased large vessel traffic in the lower Chesapeake Bay, Hampton Roads, and the lower York River.

Pipeline Impacts

Impacts from a pipeline construction would occur from wetlands destruction, and the crossing of waterways. Both these impacts can be minimized by routing a pipeline along an inland route which would avoid areas of substantial wetlands and aquatic habitat. A long-term potential impact associated with a pipeline could be leakages which could have major adverse impacts on aquatic and wetlands habitats. This potential impact could also be reduced by placing the pipeline route inland.

INFORMATION NEEDS

Our literature survey has highlighted several areas where additional information is needed before the full impact of the various project alternatives can be understood.

Deepening the channel at the mouth of the York River has the potential to affect the salinity regime and current patterns of the York. Because the lower York contains sensitive and very valuable SAV beds, experiences dissolved oxygen problems, and assimilates up to 15 million gallons per day of treated sewage, even slight changes in salinity regime or current pattern may have significant effects that should be examined in detail. In addition, recent modeling of the effects of deep draft channel construction for the Baltimore and Norfolk Harbors indicates that alterations of the salinity regime may extend far upriver. The faculty of the Virginia Institue of Marine Science (VIMS) has developed mathematical models for several characteristics of the York River (e.g. Hyer et al. 1975). We suggest that the Corps consider using VIMS' expertise to model the physical effects of a deep draft channel to the York River.

The potential for increased turbidity in the vicinity of historical or existing SAV beds due to an increase in deep draft vessel traffic should be studied. The Fish and Wildlife Service considers the SAV beds within the project area to be a unique and irreplaceable habitat; any potential impact on them should be thoroughly understood.

There is a dearth of published information on finfish community structure in shallow water areas of the York River. More information is needed before the impacts of overboard disposal can be described. We expect that a search for unpublished information on the shallow water fish community, such as what might be available in the VIMS computer data banks, or a survey of fishery scientists or watermen who are familiar with this resource will provide enough information for the Corps to be able to intelligently assess the potential impacts on the shallow water community of alternatives involving overboard disposal.

Our literature survey uncovered a very general description of unusually high concentrations of certain metals in the sediments downstream of West Point (EPA 1983b). Before these sediments are disturbed, further research is needed to pinpoint the types, concentrations, and sources of these metals and to examine the potential impacts on fish and wildlife of resuspending these sediments at the dredge and disposal sites.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

DIVISION OF ECOLOGICAL SERVICES
1825B Virginia Street
Annapolis, Maryland 21401

JUN 4 1985

Colonel Claude D. Boyd III
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Mr. Robert Pretlow, Planning Division

Dear Colonel Boyd:

Since March of 1982, our office has been assisting your Planning Division in the preparation of the York and Pamunkey Rivers Navigation Study by identifying the potential environmental impacts associated with the various options under consideration for improving navigation into the York River system. Our April 1982 Planning Aid Report presented preliminary recommendations on items to be addressed within the Feasibility Study. A second Planning Aid Report that we submitted in April 1984 (USFWS 1984) presented the results of a preliminary literature review and impact assessment of the entire Navigation Study project area and all the options for navigation improvement presented in the Corps' 1982 Reconnaissance Report. Following this submission, the Corps split the study into two portions for future planning and reporting purposes and requested additional information specific to the more limited project areas and navigation improvement options. A third Planning Aid Report that we submitted in February 1985 (USFWS 1985) presented the results of a more detailed literature review on the resources of the upper York and lower Pamunkey Rivers and addressed potential impacts related to the navigation improvement options then considered viable. This letter presents a parallel Planning Aid Report for the York River entrance channel project area and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

It is our understanding, based on a 6 August 1984 meeting with Messrs. Robert Pretlow and Carl Kuhlman of your staff, that the navigation improvement options for the York River entrance channel have been narrowed down to maintaining the existing -37 foot deep, 750 foot wide, two-lane channel or to deepening this channel to depths of -38, -39 or -40 feet. Overboard disposal into the adjacent Naval Disposal Site or into the Wolf Trap Site approximately ten miles to the north are considered to be the most viable disposal options.

Physical Description

The York River entrance channel runs from the 39 foot depth at the mouth of the York River southeast for approximately eleven miles to a similar depth

near the middle of the lower Chesapeake Bay. The York Spit shoal lies to the northeast, and the Poquoson Flats shoal to the southwest, of the western end of the channel. The 1056 acre Naval Disposal Site lies adjacent to the southeastern terminus of the channel in water that ranges from 32 to 37 feet in depth.

The average seasonal and annual salinity and temperature profiles for the project area were presented in an earlier report (USFWS 1985). To summarize, the average annual salinity is in the range of 22 to 26 parts per thousand (ppt), with seasonal extremes averaging between 18 and 28 ppt. Temperature profiles range from a well-mixed condition in the winter with a water temperature of approximately 5° C to a thermally stratified condition in the summer with average temperatures ranging from 23.5° C at the bottom to 25.5° C at the surface.

We found no information that would indicate a potential for problems related to water or sediment quality within the project area.

Biological Resources

There should be no significant adverse impacts to wetland habitats due to any of the project options under consideration. The closest submerged aquatic vegetation beds are located more than one mile away from the channel (USFWS 1984).

We found no detailed information on benthic community structure or population density in the vicinity of the entrance channel, although Boesch (1971) developed a species list for this area. In the absence of any evidence that the entrance channel area or the Wolf Trap disposal site harbor any unique characteristics or exceptionally diverse or productive benthic communities, we see no basis for special consideration of benthic community impacts at this planning stage. If the Corps determines that maintaining or deepening the entrance channel is justified, we recommend sampling of the benthic resources of the Naval Disposal Site in sufficient detail to allow ready comparison with the community of the alternative Wolf Trap Site. The benthic community surveys conducted in the Wolf Trap area in conjunction with the Baltimore Channel deepening study should be used to guide development of the most efficient and economical study design for examining the Naval Disposal Site (i.e., expected sample variability and required sample size, survey and analysis methods, etc.).

None of the project options should result in significant adverse impacts to either oyster (Crassostrea virginica) or hard clam (Mercenaria mercenaria) resources. As we identified in our earlier report (USFWS 1984), oyster resources in the lower York and the lower Chesapeake Bay have been severely impacted by the virus MSX and predatory oyster drills (Urosalpinx cinerea and Eupleura caudata) and are not presently found there in commercially exploitable concentrations. Hard clams are present only at low density within the

project area, although medium to high densities are located northwest of the landward end of the entrance channel on the York Spit and south and southwest of the entrance channel on the Poquoson Flats. These commercially exploitable quantities of hard clams are located far enough away from the project area that we expect no adverse impacts to these resources.

The area around the York River entrance channel, particularly the area around the southeastern end, supports an extensive blue crab (Callinectes sapidus) dredging fishery during December through March. Watermen consider this area, the York Spit Channel vicinity, and the Thimble Shoals Channel vicinity as the three most important winter crab dredging grounds in Virginia (Van Engel, pers. comm.). Since the channel and the Naval Disposal Site encompass more than 2,000 acres of valuable crab wintering ground, our preliminary recommendation is for the Corps to plan on the need to avoid channel dredging during the period of mid-November through March. Further consideration of the Naval Disposal Site will require a detailed assessment of its present value as a crab wintering area and the likely impact of disposal activities on this habitat value.

The project area also supports a heavy crab potting fishery beginning in March or early April. However, since the early potting is concentrated on the slopes of the York Spit and the Poquoson Flats and gradually moves closer to shore (Van Engel, pers. comm.), we anticipate that channel dredging and disposal will have little impact on this fishery.

A small conch dredging fleet, comprised of six or seven boats, is active in the project area during May through September (DiCosimo, pers. comm.).

We do not expect that any of the dredging or disposal options under consideration will adversely affect finfish resources, or their related commercial and sport fishing activities, within the project area. A number of poundnet sets are regularly fished on and near the York Spit and the Poquoson Flats. Figure 1 shows the distribution of poundnets during 1979, although it must be recognized that the number and location of the poundnets varies from year to year. The three closest poundnets to the entrance channel during the spring of 1985 are located on the York Spit--two nets to the east of the York Spit Light and one to the north of the landward end of the channel (Kriete, pers. comm.). The poundnet fishery generally extends from March through October. Figure 2 shows areas of recognized sport fishing value within the project area.

Sea turtles, particularly Kemp's Ridley (Lepidochelys kempii) and sub-adult loggerhead (Caretta caretta) sea turtles, are likely to be present within the project area from May through October. Sea turtles, all of which are Federally listed as threatened or endangered species, use the Chesapeake Bay as a seasonal foraging ground and reach their peak abundance in the Bay during June. Little is known about specific travel routes, areas of concentration, or foraging areas, although telemetry studies presently being con-

ducted by personnel from the Virginia Institute of Marine Science should yield valuable information. Until that information is available, we can neither accurately assess potential impacts of the project to sea turtles nor recommend appropriate mitigative measures. We recommend that the Corps consult with the National Marine Fisheries Service regarding the turtles.

We appreciate this opportunity to supplement our previous Planning Aid reports, and we look forward to further participation in your study of project alternatives. Please contact Mr. Gary Frazer at our Gloucester Point sub-office (ph. 804/642-7180) if we can provide any additional information.

Sincerely,

George M. Ruddy

for Glenn W. Kinser, Ph.D.
Supervisor
Annapolis Field Office

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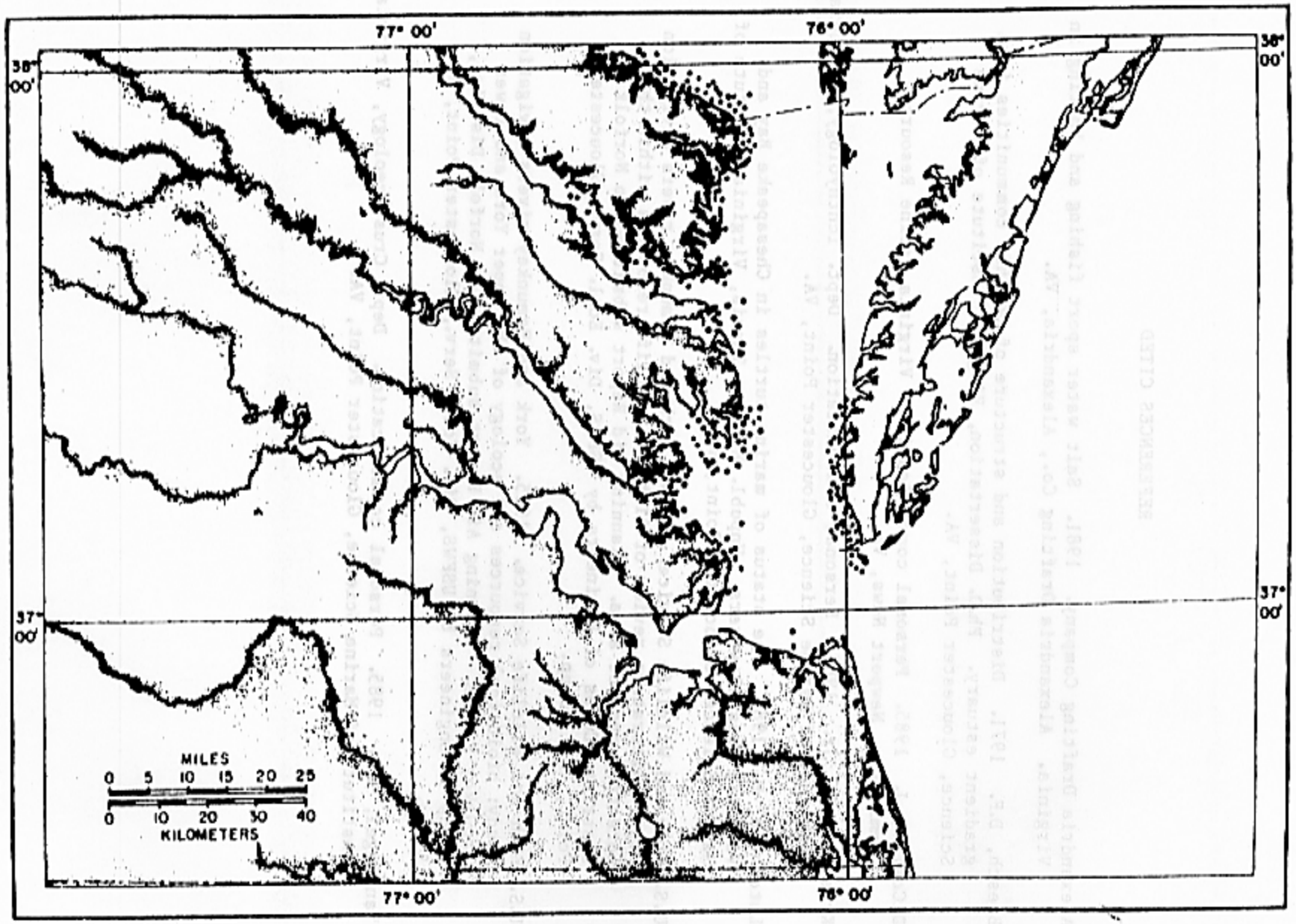

Figure 1. Distribution of poundnet sets active for at least part of the 1979 fishing season (adapted from Lutcavage 1981).

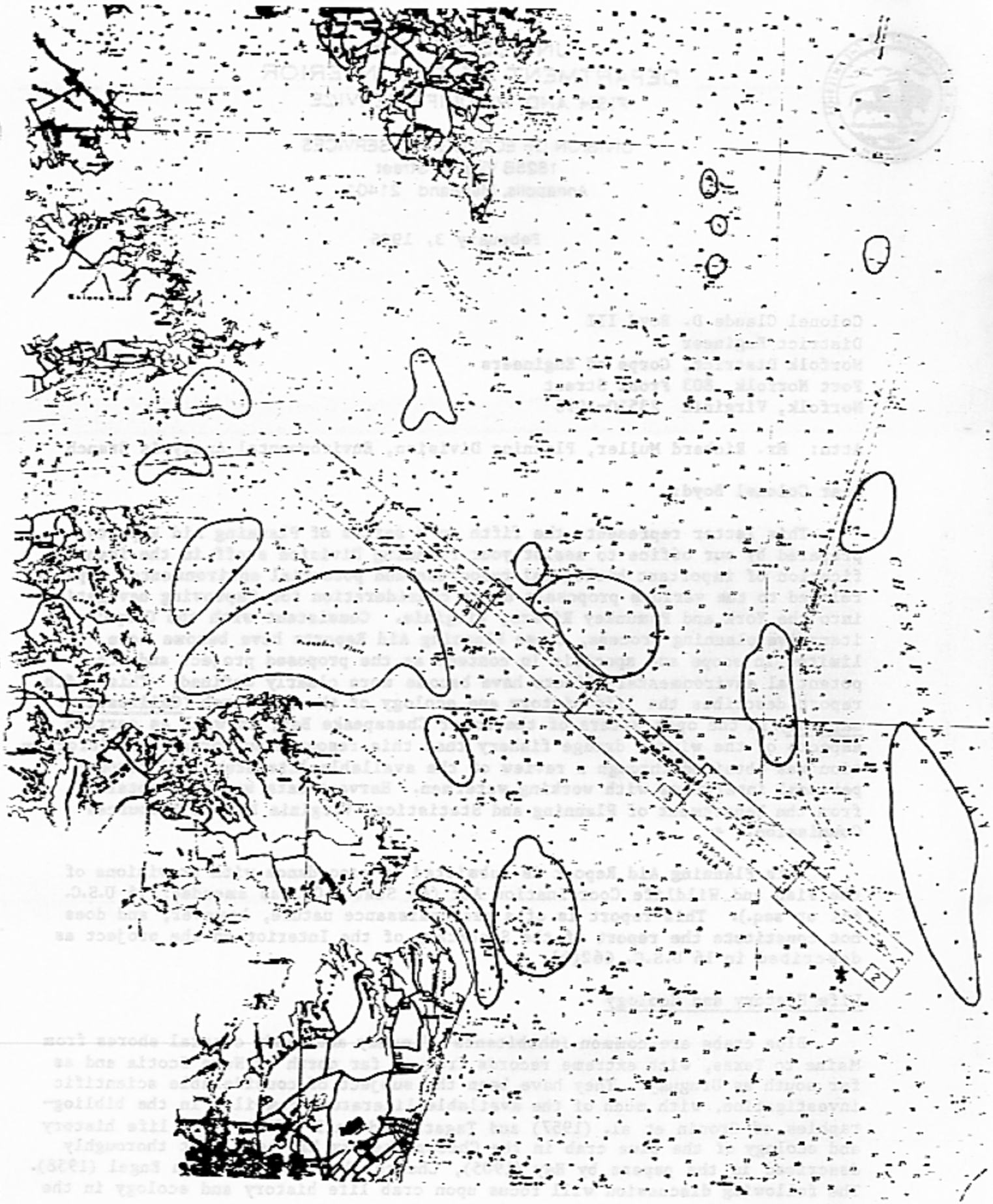

Figure 2. Recognized sport fishing areas within the project area (Alexandria Drafting Co. 1981).

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

DIVISION OF ECOLOGICAL SERVICES
1825B Virginia Street
Annapolis, Maryland 21401

February 3, 1986

Colonel Claude D. Boyd III
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Mr. Richard Muller, Planning Division, Environmental Analysis Branch

Dear Colonel Boyd:

This letter represents the fifth in a series of Planning Aid Reports prepared by our office to assist your Planning Division staff in the identification of important biological resources and potential environmental impacts related to the various proposals under consideration for improving navigation into the York and Pamunkey Rivers, Virginia. Consistent with the Corps' iterative planning process, these Planning Aid Reports have become more limited in scope and specific in content as the proposed project and its potential environmental effects have become more clearly defined. This fifth report describes the life history and ecology of the blue crab (Callinectes sapidus) in the open waters of the lower Chesapeake Bay, as well as certain aspects of the winter dredge fishery that this resource supports. Our information was obtained through a review of the available literature and through personal interviews with working watermen. Harvest data was also obtained from the Department of Planning and Statistics, Virginia Marine Resources Commission.

This Planning Aid Report is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). This report is of a reconnaissance nature, however, and does not constitute the report of the Secretary of the Interior on the project as described in 16 U.S.C. 662(b).

Life History and Ecology

Blue crabs are common inhabitants of muddy and sandy coastal shores from Maine to Texas, with extreme records from as far north as Nova Scotia and as far south as Uruguay. They have been the subject of considerable scientific investigation, with much of the available literature compiled in the bibliographies of Cronin et al. (1957) and Tagatz and Hall (1971). The life history and ecology of the blue crab in the Chesapeake Bay has been most thoroughly described in the papers by Hay (1905), Churchill (1919), and Van Engel (1958). The following discussion will focus upon crab life history and ecology in the open waters of the lower Chesapeake Bay.

The lower Bay serves as the primary spawning area for the Chesapeake Bay population of blue crabs. Female crabs mate during the period of early May into October, with a peak in late August and early September, while they are in the soft crab state following the last shedding of their hard exoskeleton. After mating, the adult, sexually mature females ("sooks") begin to migrate to the lower Bay for spawning.

Two major downstream annual migrations have been observed along the western shore of the Bay. The first migration peak occurs in May and consists of some recently mated females but mostly of sooks mated the previous fall that were unable to reach the lower Bay before low temperatures forced them to overwinter. The second migration peak occurs in October and November following the late summer peak in mating. Adult male crabs ("jimmies" or "channelers") do not take part in this migration to more saline waters, but instead remain in the brackish waters of tidal rivers and the upper Bay. This different pattern of movement results in a distinct preponderance of adult female crabs in the lower Bay, particularly during the winter.

Two to nine months elapse between mating and egg-laying. Those crabs that mate in May can produce the first egg mass ("sponge") in August, with hatching occurring approximately two weeks later. Most females mature and mate in August and September, however, with egg-laying delayed until the following May or June. The peak of this spring sponge production occurs during the last week of May and the first two weeks of June. After the second egg-laying peak in August, there is a rapid decrease in the number of spawning females, with no sponge crabs generally found later than mid-September.

As the egg mass matures and hatching becomes imminent, the sooks move closer to the mouth of the Bay to release their larvae (Hester 1983). Until recently it was thought that the blue crab larvae were primarily retained in the lower Bay, with later stages occurring at depths dominated by saline water inflow that facilitated their retention in the Bay (Sandifer 1975, Goy 1976). However, recent studies have shown that blue crab larvae are found at or seaward of the Bay entrance and that more than 75 percent remain in the neuston (the assemblage of organisms found at the water surface layer) during development to metamorphosis (Sulkin et al. 1982, McConaugha et al. 1983, Provenzano et al. 1983). Hester (1983) recently proposed a physical mechanism involving the action of wind stress on shallow waters as a means for crab larvae to be retained in sufficient proximity to the Bay entrance to allow for their return at the proper time.

Following larval development and metamorphosis, the tiny (0.1 inch wide) "first-stage" crabs begin their migration to the tidal rivers and the upper Bay. While a wave of small crabs commonly reaches the Virginia tidal rivers by September, most small crabs do not migrate farther north than the Potomac

River before they are halted by cold weather. Subsequent growth is rapid and adult size may be reached one to one and one-half years after hatching.

It is believed that most spent females either move into the deeper waters of the Bay or ocean to die or join an ocean going population that may return to the Bay the following year. The few spent females that remain in the lower Bay over winter are identifiable by their coloration and make up five percent or less of the winter dredge catch.

The vast majority of the crabs that overwinter in the lower Bay are recently mated adult females that have not yet spawned. Churchill (1919) believed that the overwintering sooks move into deeper, and consequently warmer and more thermally stable, waters as winter progresses. As water temperatures fall, the crabs become less active and during cold periods may simply lie on the bottom. In contrast to the commonly held belief that overwintering crab burrow into the bottom, both Churchill (1919:123-124) and Sette and Fiedler (1925:13) stated that overwintering crabs in the open Bay do not bury themselves in the substrate. On milder days the crabs appear to move about to some extent, particularly if disturbed. In addition, overwintering sooks appear to school to some degree (Truitt 1934, MacGregor 1950).

With one exception, no information was found in the literature regarding winter habitat selection by bottom type. Van Engel (1962) reported that the best winter dredge catches are made on the edges of broad banks adjacent to the deep channels of the Bay, over muddy-sand bottoms supporting beds of colonial hydroids (Thuiaria argentea) in 25 to 75 feet of water.

To summarize, the primary crab habitat value of the lower Chesapeake Bay in the vicinity of the York River entrance channel is as an area of concentration and overwintering of adult females from the entire Bay population of blue crabs prior to their spawning near the mouth of the Bay.

Winter Dredge Fishery

As stated in our most recent Planning Aid Report (USFWS 1985), the proposed project has the potential to conflict with the winter dredge fishery for blue crabs. This dredge fishery extends from as far north as Wolf Trap off Mathews County out to the mouth of the Bay, but the areas of most intensive and consistent use are the deep waters in and along the channels of the lower Bay (J.W. Freeman, Sr., pers. comm.) (Fig. 1). The areas along the York River entrance channel, the York Spit channel and the Thimble Shoals channel are considered by watermen to be the three best dredging areas in the lower Bay (W.A. Van Engel, pers. comm).

A winter dredge fishery for crabs has been active in Virginia waters since about 1900, with relatively few changes in the methods of dredging or

gear since that time (Van Engel 1962). Dredge boats range in length from less than 32 to more than 60 feet, and generally carry a captain and a crew of two or three. Larger vessels tow two dredges simultaneously from opposite sides of the boat, while smaller vessels drag a single dredge over the stern. The dredge itself is fastened to the hauling chain through an eye attached to the metal bridle on the dredge frame. A two-dredge boat can make from 65 to 100 ten-minute dredge hauls on an average day, lifting the dredges alternately (Van Engel 1962).

The crab dredging season extends from December 1 through March 31, although the Virginia Marine Resources Commission has the authority to move up the starting date, or extend the closing date, by 15 days. Dredging is allowed only in the open waters of the lower Bay (i.e. none allowed in "rivers, inlets, or creeks") and in the back bays on the ocean side of the Eastern Shore. Daily catch is limited to 25 barrels (75 bushels or approximately 3,000 pounds) per vessel.

The size of the winter crab dredging fleet, as indicated by the number of licensed boats, has increased dramatically in the last twenty years (Fig. 2). Although the number of dredge boats working the Bay increased from only 50 to about 110 between 1921 and 1962, the number of licenses has since increased to 241 in 1984 (VMRC, pers. comm.). The fishing intensity is sufficient to ensure that virtually every portion of the main dredging grounds (Fig. 1) is worked at some time during the dredging season (J.W. Freeman, Sr., pers. comm.). One apparent exception is an area of hard sand bottom located approximately five nautical miles to the south-southeast of the previously used Navy Disposal Site that is considered to be of lesser value to the crab dredge fishery (J.W. Freeman, Sr. and B. Williams, pers. comm.).

Virginia hard crab landings during the months of December through March are presented in Figure 3. It is assumed that these figures are relatively accurate representations of the take by the dredge fleet, as dredging is almost the only means of obtaining crabs from December through March (Van Engel 1962).

The Virginia Marine Resources Commission codes their landings data by gear type and harvest area. The project area lies within harvest area 311 (Fig. 4). Table 1 presents crab dredge landings in harvest area 311 versus total dredge landings in Virginia for the period 1980-84. Harvest area 311 accounts for an average of 67.8 percent of the total Virginia crab dredge harvest. (The data in Table 1 are from a different data set than that used to construct Figure 3. Total dredge harvest figures range from 94.2 percent (1980) to 102.3 percent (1982) of those calculated from Figure 3.)

Project Impacts on the Winter Crab Dredge Fishery

Our impact assessment is based upon the assumptions that project construction and maintenance will most likely use hopper-type dredges and open water disposal into a site in the open Bay. The Service considers the most likely adverse effects of the project on the blue crab resource and its associated winter dredge fishery to be: 1) the direct loss of crabs due to entrainment by the dredge and burial or gill clogging due to discharge of the dredged material; 2) the potential for temporary habitat degradation if dredging or disposal result in a significant change in the bottom type; and 3) temporary disruption of the winter fishery until bottom contours become smooth enough for effective and safe operation of a dredge.

Direct loss of crabs can be minimized by confining the dredging and disposal activities to the period between May 1 and October 31 when water temperatures are high enough to ensure that the cold-blooded crabs are sufficiently mobile and active to permit avoidance of the dredge and disposal plume to the maximum extent possible.

The potential for habitat degradation due to a change in bottom type is very difficult to evaluate because of the near total absence of information on habitat selection by bottom type among overwintering blue crabs. By applying general principles of evaluating open water disposal impacts, however, one can assume that habitat degradation due to changes in bottom type will be minimized by selecting a disposal area with a bottom type compatible with the dredged material (i.e. strive for "like-on-like" disposal) and by selectively placing the dredged material to minimize the area of disturbance.

It was the concensus among the crab dredgers we interviewed, and among other crab dredgers who discussed the project with the watermen we interviewed, that open water disposal would result in the temporary elimination of the disposal area from the pool of productive, workable dredging grounds in the lower Bay. It was assumed that the disposal area would remain out of the dredge fishery base until the bottom contours became sufficiently smooth to allow a crab dredge to be pulled across the bottom without jerking, skipping bottom, or hanging up on obstructions. Estimates for the amount of time this might take ranged from one year or less (L. Hudgins, pers. comm.) to up to two years (J.W. Freeman, Sr., pers. comm.). Mr. Benjamin Williams, a long time crab dredger, was the only waterman contacted who recalled any experience with the effects of open water disposal on the crab dredging fishery. Based upon his experience approximately 10-12 years ago at a disposal site that he thought was approximately one to one and one-half miles west of the Chesapeake Bay Bridge-Tunnel, Mr. Williams recalled that the bottom roughness kept the disposal site out of production for at least one year. He noted no change in productivity once it became workable again. We contacted Mr. Elliot Whitehurst of the Dredging Management Branch of the Norfolk Corps, who felt

that the disposal operation in question was the result of dredging in Little Creek with disposal in a site located approximately five nautical miles due north of the mouth of Little Creek. This site is shown on the current National Oceanic and Atmospheric Administration (NOAA) navigation charts of the lower Bay and is located adjacent to the previously referenced area of apparently lesser value to the crab dredge fishery that lies south-southeast of the Navy Disposal Site.

The long term fate of the dredged material and the length of time that the bottom roughness of the disposal area will keep the area out of the fishery base will depend on a number of factors, including water depth, bed slope, dredged material composition and properties, tidal currents, and weather (Morton 1977). The Service recommends that the Corps investigate the state-of-the-art in predictive analytical models of unconfined aquatic dredged material fate to determine whether such a tool can provide an additional, well-documented estimate of the length of time the disposal area may remain out of the dredge fishery base.

Impacts to the winter crab dredge fishery due to open water disposal can be lessened by selecting a disposal site that has the least value to the fishery. A thorough evaluation of alternative open water disposal sites should be conducted with full consideration given to the value of the alternative sites to the dredge fishery.

The Service appreciates this opportunity to assist in the Corps' evaluation of project need and alternatives. Please contact Gary Frazer of our Gloucester Point office if you have any questions regarding this report or if we can be of further assistance.

Sincerely,

Glenn W. Kinser, Ph.D.
Supervisor
Annapolis Field Office

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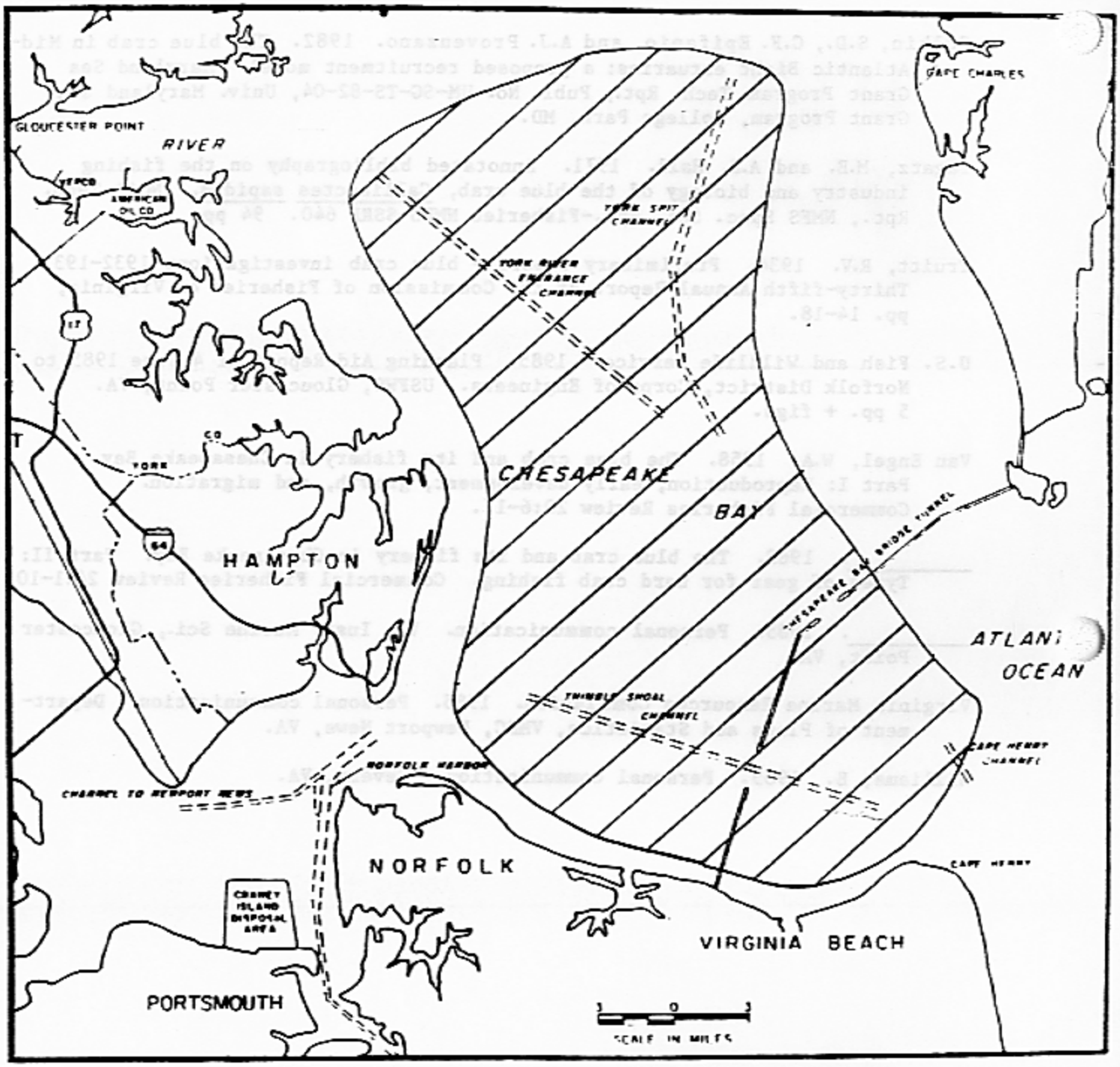

Figure 1. General area in the lower Chesapeake Bay subject to the most consistent and intensive use by the winter crab dredging fleet.

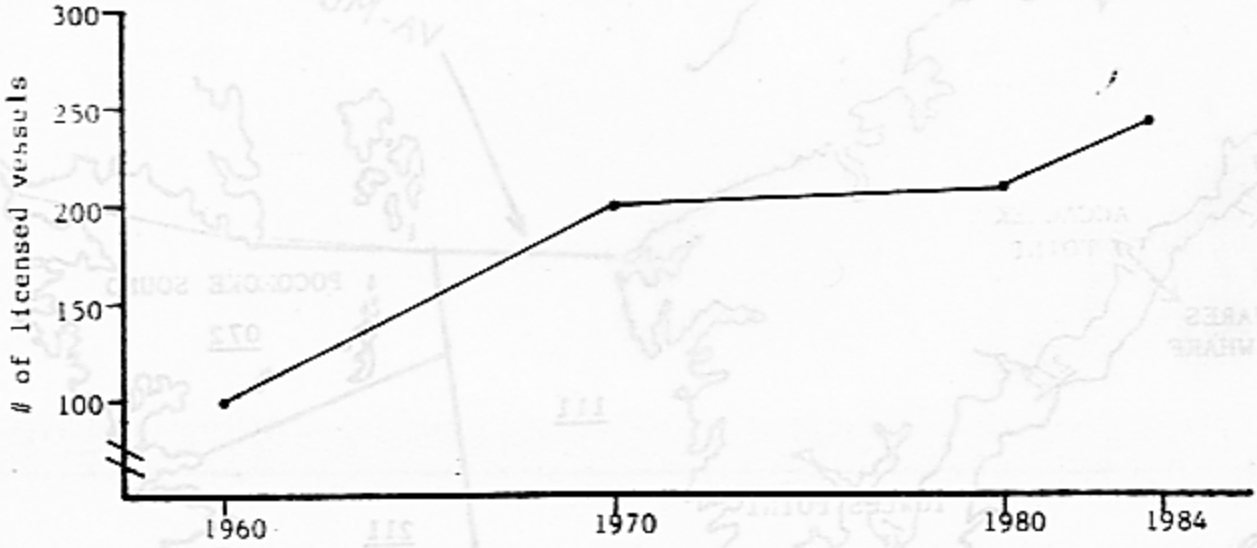

Figure 2. Recent growth in the number of vessels in the winter crab dredging fleet in Virginia (VMRC, pers. comm.).

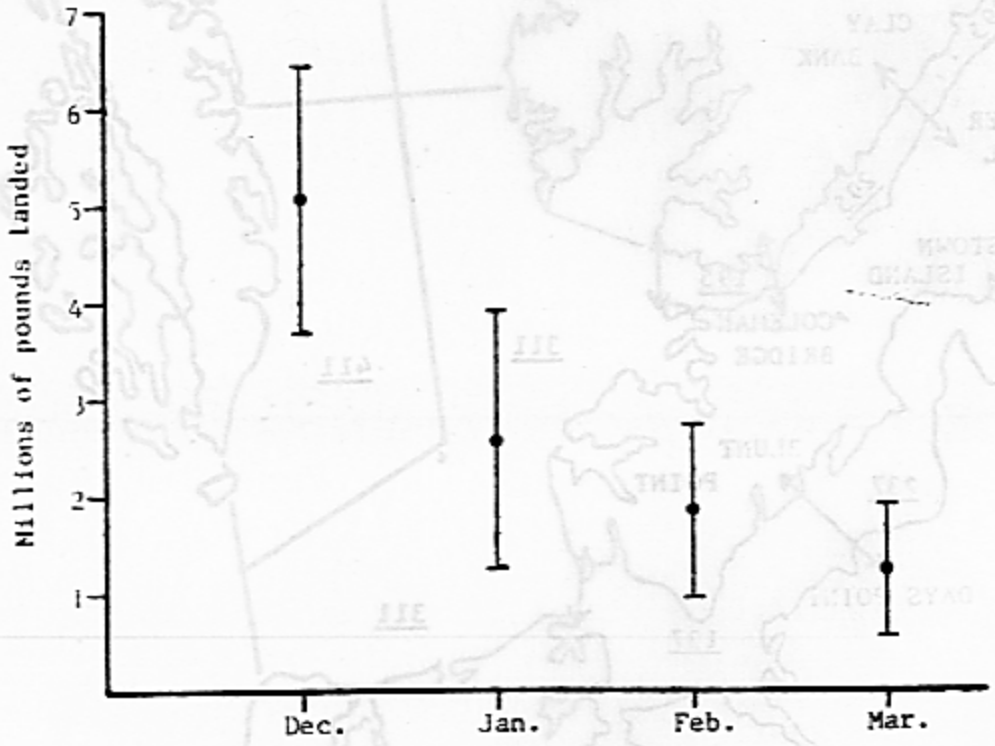

Figure 3. Hard crab landings from the Virginia winter dredge fishery, 1960-84 (mean + std. dev.). (Adapted from Hester (1983) and VMRC (pers. comm.)).

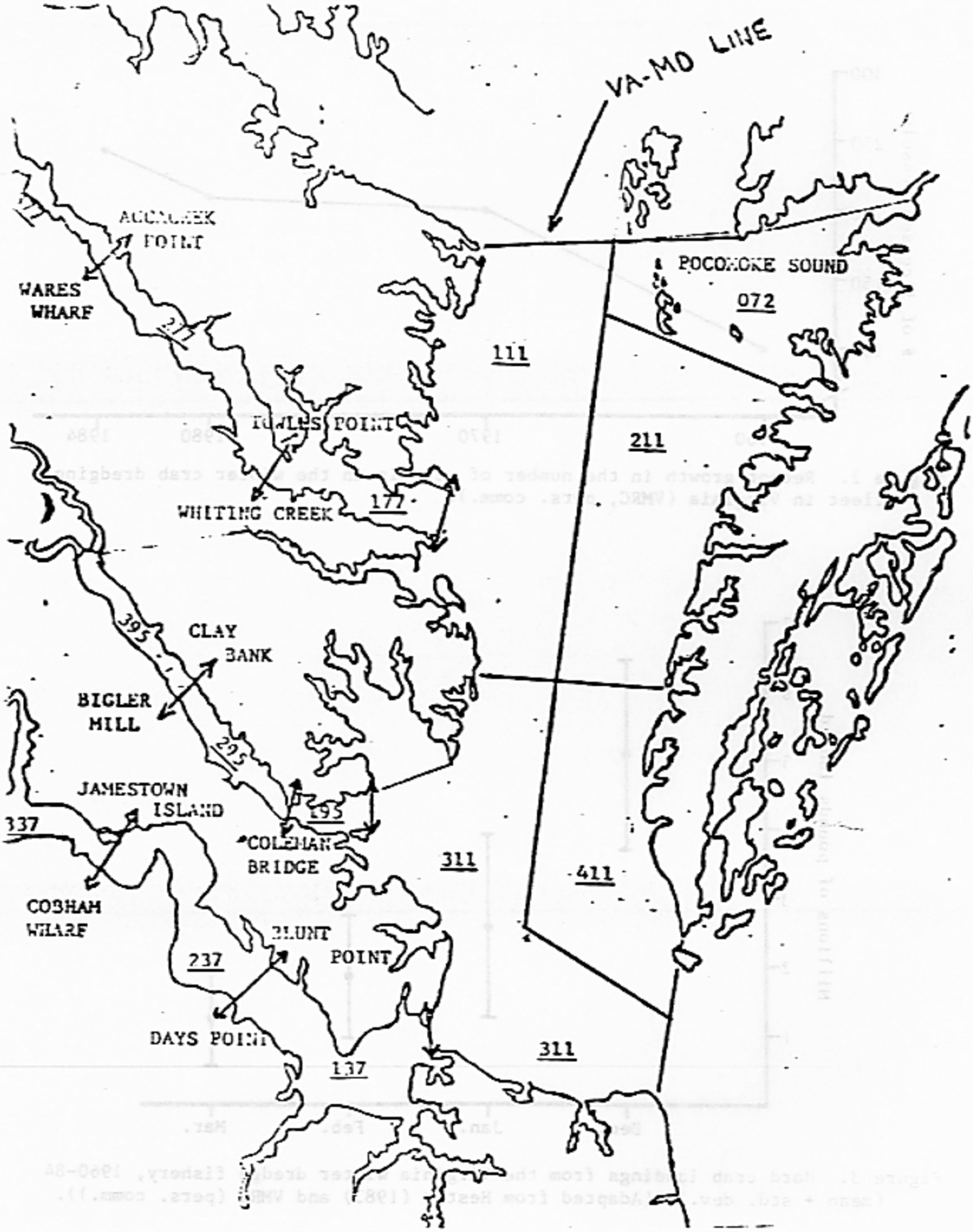

Figure 4. Virginia Marine Resources Commission harvest area codes.

Table 1. Crab dredge landings (lbs.) from VMRC harvest area 311 versus total crab dredge landings in Virginia (VMRC, pers. comm.).

Date	All Harvest Areas	Harvest Area 311	Percent from 311
1980	9,443,300	6,038,000	63.9
1981	10,294,500	6,005,700	58.3
1982	7,678,200	6,235,000	81.2
1983	6,292,500	3,997,600	63.5
1984	10,663,709	7,674,269	72.8

United States Department of the Interior

FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES
1825 VIRGINIA STREET
ANNAPOLIS, MARYLAND 21401

January 29, 1992

Colonel Richard C. Johns
District Engineer
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, VA 23510-1069

Attn: Craig Seltzer

RE: Wolf Trap Disposal Site

Dear Colonel Johns:

This is in reference to Mr. Ogle's letter of November 19, 1991, requesting comments on a proposal to place approximately 1,780,000 cubic yards of material dredged from the York River entrance channel at the Wolf Trap disposal site. The Wolf Trap site was extensively studied by the Virginia Institute of Marine Science for several years beginning in 1983 in connection with the deepening of the York Spit channel. Based on a pre-disposal survey, the site boundaries were realigned to encompass an area of relatively low benthic resource value. Monitoring conducted during and after the dredged material disposal operation showed that the benthos recovered from the initial impact to levels that were similar or in many cases better than the baseline condition.

While there is ample evidence to indicate that Wolf Trap is a good site for open water disposal of dredged material, we prefer disposal options that make use of the material for beneficial purposes. Unfortunately, it appears that there are no reasonable beneficial use options for the present project. Thus, we have no objection to the present proposal for use of the Wolf Trap site, but encourage you to continue to explore the potential for beneficial use options for future projects. If there are any questions, please contact George Ruddy of our Federal Projects staff at (410) 269-5448.

Sincerely,

John P. Wolflin
Supervisor
Annapolis Field Office

United States Department of the Interior

FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES
1825 VIRGINIA STREET
ANNAPOLIS, MARYLAND 21401

June 17, 1992

Colonel Richard C. Johns
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Mr. Robert Pretlow
Planning Division

Re: Navigation Study of York River
Entrance Channel (ER 42/0430)

Dear Colonel Johns:

The U.S. Fish and Wildlife Service (Service) has reviewed the "Draft Detailed Project Report and Environmental Assessment, York River, Virginia, Navigation Study of York River Entrance Channel," dated May 1992. This letter constitutes the report of the Service and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The subject report presents the findings and recommendations of the Norfolk District's study of the navigation problems associated with the entrance channel into the mouth of the York River. The study examined the Federal interest in implementing improvements on the waterway to better serve the commercial and military users located on the lower York River. The waterway is a tributary to the lower Chesapeake Bay immediately north of the urban complex of Norfolk, Virginia Beach, Newport News, and Hampton, Virginia.

The project includes dredging approximately 1.78 million cubic yards of material that will be placed in the Wolf Trap overboard disposal site in the Chesapeake Bay. The York River Entrance Channel will be dredged to a depth of 37 feet and a width of 750 feet. The project is scheduled to extend from the 38 foot contour in the Chesapeake Bay to a point adjacent to the piers at the Naval Supply Center at Cheatham Annex, approximately 11.5 miles above the mouth of the York River. The Virginia Marine Resources Commission has required that the overboard disposal of dredged material be precluded during the period of November 15 through March 30 of each year to minimize impacts to overwintering blue crabs (*Callinectes sapidus*) and the crab dredge fishery.

While the Service has no objection to the selected plan for maintaining the York River Entrance Channel, we do have concerns relative to the potential impacts of this project on sea turtles. Species known to occur in Virginia

waters include loggerhead (Caretta caretta), Kemp's ridley (Lepidochelys kempi), leatherback (Dermochelys coriacea), and green turtles (Chelonia mydas) (Keinath et al., 1987). Of these, loggerhead and Kemp's ridley sea turtles are seasonal visitors to the Chesapeake Bay and may be affected by the subject dredging project. The Service recommends that the Corps contact the National Marine Fisheries Service regarding possible impacts to these species.

Thank you for the opportunity to comment on this document. If we may be of further assistance, please contact William Hester of our Virginia Field Office at (804) 693-6694.

Sincerely,

Karen L. Mayne

Karen L. Mayne
Acting Supervisor
Annapolis Field Office

APPENDIX D

PERTINENT CORRESPONDENCE, COORDINATION COMMENTS, AND DISTRICT RESPONSES

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DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
FORT NORFOLK 803 FRONT STREET
NORFOLK, VIRGINIA 23510-1096

REPLY TO
ATTENTION OF:

November 1, 1983

Environmental Analysis Branch

Mr. Doug Beach
Northeast Region
National Marine Fisheries Service
U.S. Department of Commerce
7 Pleasant Street
Gloucester, Massachusetts 01903

Dear Mr. Beach:

The Norfolk District is conducting a navigation study of the York River. In this study we will determine the need for modification to the existing 22-foot Federal navigation channel between Yorktown and West Point. In addition, we will investigate the entrance channel leading into the York River from the Chesapeake Bay to determine if improvements to and maintenance of it are warranted. The attached map shows the project sites and general area.

While the study is in early stages and there are no specific plans or recommendations, there could be three possible actions considered that might produce adverse environmental impacts. These are: deepening and widening the channels and providing a turning basin; disposing of dredged material overboard, at sea, or on land; and finally, constructing alternative oil pipeline routes underwater, onshore, or a combination of both.

In accordance with Section 7 of Public Law 93-205, the Endangered Species Act, as amended, we wish to commence the coordination process as required of Federal agencies. It is requested that we be furnished an initial list of species that may be

encountered in the study area as shown on the attached map. We are sending the U.S. Fish and Wildlife Services, Annapolis, Maryland, a similar letter of request.

Sincerely,

Frank T. Wootton, Jr., P.E.
Chief, Planning Division

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Services Division
Habitat Protection Branch
14 Elm Street
Gloucester, MA 01930

November 15, 1983

Mr. Frank T. Wooton, Jr.
Chief, Planning Division
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510

Dear Mr. Wooton:

This is in response to your November 1, 1983, request for a list of endangered or threatened species found in the York River Navigation Channel near Yorktown, Virginia pursuant to Section 7 of the Endangered Species Act of 1973, as amended. The threatened loggerhead turtle (Caretta caretta) is a common inhabitant of the lower Chesapeake Bay in the summer months. Dr. Jack Musick at Virginia Institute of Marine Science has been studying the distribution and abundance of sea turtles in the Bay since 1980. He would be a good source for information on this species in the York River area.

Sincerely,

Douglas W. Beach
Wildlife Biologist

United States Department of the Interior

FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES
1825 VIRGINIA STREET
ANNAPOLIS, MARYLAND 21401

January 29, 1992

Colonel Richard C. Johns
District Engineer
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, VA 23510-1069

Attn: Craig Seltzer

RE: Wolf Trap Disposal Site

Dear Colonel Johns:

This is in reference to Mr. Ogle's letter of November 19, 1991, requesting comments on a proposal to place approximately 1,780,000 cubic yards of material dredged from the York River entrance channel at the Wolf Trap disposal site. The Wolf Trap site was extensively studied by the Virginia Institute of Marine Science for several years beginning in 1983 in connection with the deepening of the York Spit channel. Based on a pre-disposal survey, the site boundaries were realigned to encompass an area of relatively low benthic resource value. Monitoring conducted during and after the dredged material disposal operation showed that the benthos recovered from the initial impact to levels that were similar or in many cases better than the baseline condition.

While there is ample evidence to indicate that Wolf Trap is a good site for open water disposal of dredged material, we prefer disposal options that make use of the material for beneficial purposes. Unfortunately, it appears that there are no reasonable beneficial use options for the present project. Thus, we have no objection to the present proposal for use of the Wolf Trap site, but encourage you to continue to explore the potential for beneficial use options for future projects. If there are any questions, please contact George Ruddy of our Federal Projects staff at (410) 269-5448.

Sincerely,

John P. Wolflin
Supervisor
Annapolis Field Office

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat and Protected
Resources Division
Oxford Laboratory
Oxford Maryland 21654

June 5, 1992

Colonel Richard C. Johns
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Dear Colonel Johns:

We have reviewed the DRAFT DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT - YORK RIVER, VIRGINIA - NAVIGATION STUDY OF YORK RIVER ENTRANCE CHANNEL and offer the following comments.

1. On page 2 of the Feasibility Report under "STUDY AREA" you state, "The lower York River study area includes the York River and surrounding land extending from the river mouth upstream to approximately the Naval Supply Center at Cheatham Annex, as shown in figure 1." Figure 1 does not depict the project area as described. In fact the project in its entirety is not depicted on any figure in the report. You should include a proper chart showing the project in its entirety as figure 1.

2. On page 11 of the Feasibility Report under "ENVIRONMENTAL SETTING AND RESOURCES" in the second paragraph you misspelled the common name for "elewives". The proper spelling is ALEWIFE. Also in the next paragraph you have included a reference to "several species of sea turtle". Rare and endangered species, because of their important legal status should be dealt with much more specifically in a separate section entitled "THREATENED OR ENDANGERED SPECIES."

3. On page 53 of the Feasibility Report under "EVALUATION OF DETAILED PLANS" you should add another subheading entitled "THREATENED OR ENDANGERED SPECIES." This section should then be used to discuss, in detail, all of the potential impacts to threatened or endangered species.

4. On page 61 of the Feasibility Report in Figure 10 you should show the upstream terminus of the proposed channel work.

5. On page 62 of the Feasibility Report under "CONSTRUCTION, OPERATION, AND MAINTENANCE" you state that "Work would be accomplished in approximately 5 months utilizing hopper-type dredges." Section 7.04 on page EA-11 of the Environmental Assessment submitted for this project discusses the presence of threatened and endangered species of sea turtles in the project area and identifies potential impacts of dredging on these turtles. Dredging of the York River entrance channel by hopper dredge during the warmer months (May through November) may affect listed species. Formal consultation with the National Marine Fisheries Service is required, pursuant to Section 7 of the Endangered Species Act of 1973 (ESA), as amended, if hopper dredges will be deployed during those months. Hydraulic and clam shell dredging and resultant disposal have lesser impacts on sea turtles, but should be considered through an informal consultation. The Army Corps of Engineers should send a written request for a Section 7 consultation to:

Douglas Beach
Habitat and Protected Resources Division
One Blackburn Drive
Gloucester, MA 01930

A copy of the Environmental Assessment (EA) and any additional reports or materials regarding project plans and sea turtles in the project area should be forwarded with the request to expedite the consultation process. Additional information, including the preparation of a Biological Assessment for NMFS review, may be necessary if a formal consultation is required. Please call Colleen Coogan, at (508) 281-9291, if you have any questions regarding the Section 7 consultation process.

6. The "FINDING OF NO SIGNIFICANT IMPACT" on page EA-i cannot be made until after the Section 7 consultation has been completed pursuant to the ESA, and appropriate measures taken to mitigate any impacts to sea turtles.

7. On page EA-4 of the EA under section 5.02 you state that, "Hydraulic dredging, which is proposed, has far less potential ..." This conflicts with earlier statements that hopper-type dredges will be used. This needs to be clarified.

8. On page EA-6 of the EA under "6. ENVIRONMENTAL STATUTES" Section 6.01 is erroneous. This statement cannot be made until after the Section 7 consultation is completed.

9. Page EA-11 Sections 7.04 and 7.05 under "CONCLUSION:" discuss information from VIMS regarding sea turtles and the project's possible impacts to them. While we realize that VIMS is conducting sea turtle research in the Chesapeake and has the most current data, consultation with VIMS does not meet your requirements under the Endangered Species Act. A formal Section 7 consultation should be conducted with NMFS, as discussed above.

Thank you for the opportunity to comment on this matter. If you have any further questions you may contact Bob Rubelmann at (410) 226-5771.

Sincerely,

Timothy E. Goodger

Timothy E. Goodger
Asst. Coordinator

cc:
EPA-phila
FWS-White Marsh
VCOE
VDGIF
VIMS
VMRC
VWCB

NORFOLK DISTRICT RESPONSES TO NATIONAL MARINE FISHERIES SERVICE COMMENTS OF JUNE 5, 1992

Comment 1. On page 2 of the Feasibility Report under "STUDY AREA" you state, "The lower York River study area includes the York River and surrounding land extending from the river mouth upstream to approximately the Naval Supply Center at Cheatham Annex, as shown in figure 1." Figure 1 does not depict the project area as described. In fact the project in its entirety is not depicted on any figure in the report. You should include a proper chart showing the project in its entirety as figure 1.

Response 1. While it is true that figure 1 does not depict the study area as described, it is not true that "the project in its entirety is not depicted on any figure in the report." Figure 8 does show the entire project area, although it is presented for the purposes of showing the locations of the dredged material placement sites considered during the study. It is agreed, however, that a revised figure 1 is needed in the report. In this regard, figure 1 has been revised to show the location of the Naval Supply Center at Cheatham Annex as well as other areas described under "Study Area."

Comment 2. On page 11 of the Feasibility Report under "ENVIRONMENTAL SETTING AND RESOURCES" in the second paragraph you misspelled the common name for "elewives". The proper spelling is ALEWIFE. Also in the next paragraph you have included a reference to "several species of sea turtle". Rare and endangered species, because of their important legal status should be dealt with much more specifically in a separate section entitled "THREATENED OR ENDANGERED SPECIES."

Response 2. The report has been revised to use the proper spelling of "ALEWIFE" and to include more detailed information on threatened and endangered species.

Comment 3. On page 53 of the Feasibility Report under "EVALUATION OF DETAILED PLANS" you should add another subheading entitled "THREATENED OR ENDANGERED SPECIES." This section should then be used to discuss, in detail, all of the potential impacts to threatened or endangered species.

Response 3. The report has been revised to include a more specific discussion of the potential impacts to threatened or endangered species.

Comment 4. On page 61 of the Feasibility Report in Figure 10 you should show the upstream terminus of the proposed channel work.

Response 4. Figure 10 has been revised to show the upstream terminus of the project.

Comment 5. On page 62 of the Feasibility Report under "CONSTRUCTION, OPERATION, AND MAINTENANCE" you state that "Work would be accomplished in approximately 5 months utilizing hopper-type dredges." Section 7.04 on page EA-ll of the Environmental Assessment submitted for this project discusses the presence of threatened and endangered species of sea turtles in the project area and identifies potential impacts of dredging on these turtles. Dredging of the York River entrance channel by hopper dredge during the warmer months (May through November) may affect listed species. Formal consultation with the National Marine Fisheries Service is required, pursuant to Section 7 of the Endangered Species Act of 1973 (ESA), as amended, if hopper dredges will be deployed during those months. Hydraulic and clam shell dredging and resultant disposal have lesser impacts on sea turtles, but should be considered through an informal consultation. The Army Corps of Engineers should send a written request for a Section 7 consultation to:

Douglas Beach
Habitat and Protected Resources Division
One Blackburn Drive
Gloucester, MA 01930

A copy of the Environmental Assessment (EA) and any additional reports or materials regarding project plans and sea turtles in the project area should be forwarded with the request to expedite the consultation process. Additional information, including the preparation of a Biological Assessment for NMFS review, may be necessary if a formal consultation is required. Please call Colleen

Coogan, at (508) 281-9291, if you have any questions regarding the Section 7 consultation process.

Response 5. The Section 7 Consultation process was initiated for this project by letter sent to Douglas Beach, Northeast Region, National Marine Fisheries Service, dated November 1, 1983. A copy of the Draft EA (May 1992) was sent to the Northeast Region office for comment at the same time the document was sent out for general agency coordination. Another copy of the Draft EA has been furnished to Douglas Beach since your comments were received. Section 7 Consultation has been re-initiated by our letter dated June 18, 1992. Your letter of response dated July 6, 1992 states that "... Hopper dredging of the York River entrance channel during the warmer months (May through November) may affect listed species ... Formal consultation, requiring Biological Assessments, will be required for those projects for which hopper dredges may be utilized from May through November." Based upon your letter and the knowledge that hopper dredging may occur during the restricted period, formal consultation was requested by our letter to NMFS dated July 9, 1992 in which we state that "... Because it appears that we will dredge during the protected window for sea turtles, we are requesting, by this letter, that Formal Consultation pursuant to Section 7 of the Endangered Species Act be initiated immediately."

Comment 6. The "FINDING OF NO SIGNIFICANT IMPACT" on page EA-i cannot be made until after the Section 7 consultation has been completed pursuant to the ESA, and appropriate measures taken to mitigate any impacts to sea turtles.

Response 6. Section 7 consultation has led to the NMFS recommending time-of-year restrictions to protect sea turtles. As presented to NMFS in the Corps letter dated July 9, 1992, if any dredging must take place "... during the time period which is restricted for sea turtles (mid-May through mid-November), precautions would be taken to avoid impacts to sea turtles. These precautions would include the use of a trawl to catch turtles in the vicinity of the dredging operations and relocate them; initiation of an observer program with on-board biologists to document the take of sea turtles by the dredge, and the modification of gear to screen discharge ports for the presence of sea turtle parts (which should <u>not</u> occur with successful relocation efforts)."

With the implementation of these mitigation measures, it is not anticipated that there would be any significant adverse impact to sea turtles, therefore, the Finding of No Significant Impact (FONSI) has been made.

Comment 7. On page EA-4 of the EA under section 5.02 you state that, "Hydraulic dredging, which is proposed, has far less potential ..." This conflicts with earlier statements that hopper-type dredges will be used. This needs to be clarified.

Response 7. A hopper dredge is a type of hydraulic dredge. It does not have a mechanical cutterhead (as in a pipeline dredge) but rather dredged material is sucked up by dragheads as the dredge moves along. The dredged material is deposited in the hoppers and then is bottom dumped or pumped out to the placement site. The text has been expanded to clarify this point.

Comment 8. On page EA-6 of the EA under "6. ENVIRONMENTAL STATUTES" Section 6.01 is erroneous. This statement cannot be made until after the Section 7 consultation is completed.

Response 8. As mentioned previously, Section 7 consultation has been initiated. The statement will be revised to reflect that consultation is in the process of being completed.

Comment 9. Page EA-11 Sections 7.04 and 7.05 under "CONCLUSION:" discuss information from VIMS regarding sea turtles and the project's possible impacts to them. While we realize that VIMS is conducting sea turtle research in the Chesapeake and has the most current data, consultation with VIMS does not meet your requirements under the Endangered Species Act. A formal Section 7 consultation should be conducted with NMFS, as discussed above.

Response 9. See response 6 above and the expanded section of the EA which deals with endangered species.

United States Department of the Interior

BUREAU OF MINES
Intermountain Field Operations Center
P.O. Box 25086
Building 20, Denver Federal Center
Denver, Colorado 80225

TAKE PRIDE IN AMERICA

June 11, 1992

Colonel Claude Boyd III
District Engineer
Norfolk District
U.S. Army Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Dear Colonel Boyd:

Subject: Review of Draft Detailed Project Report and Environmental Assessment for Navigation Study of York River Entrance Channel, Gloucester and York Counties, Virginia (ER 92/430)

As requested by the Director, Office of Environmental Affairs, Department of the Interior, personnel of the Bureau of Mines reviewed the document to determine whether mineral resources would be adversely impacted by the proposed project to improve the entrance channel into the mouth of the York River.

Mineral resources are not discussed in the document but, owing to the nature of the project, we believe minerals would not be affected. Therefore, we have no objection to the report or environmental assessment as presented. Our comments are drawn from available information, are provided on a technical assistance basis only, and may not reflect the position of the Department of the Interior.

If you have questions pertaining to this review, please contact Rodney E. Jeske at (303) 236-3400.

Sincerely,

Bradford B. Williams
Intermountain Field Operations Center

rej/rr

United States Department of the Interior

FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES
1825 VIRGINIA STREET
ANNAPOLIS, MARYLAND 21401

June 17, 1992

Colonel Richard C. Johns
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Mr. Robert Pretlow
Planning Division

Re: Navigation Study of York River
Entrance Channel (ER 42/0430)

Dear Colonel Johns:

The U.S. Fish and Wildlife Service (Service) has reviewed the "Draft Detailed Project Report and Environmental Assessment, York River, Virginia, Navigation Study of York River Entrance Channel," dated May 1992. This letter constitutes the report of the Service and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The subject report presents the findings and recommendations of the Norfolk District's study of the navigation problems associated with the entrance channel into the mouth of the York River. The study examined the Federal interest in implementing improvements on the waterway to better serve the commercial and military users located on the lower York River. The waterway is a tributary to the lower Chesapeake Bay immediately north of the urban complex of Norfolk, Virginia Beach, Newport News, and Hampton, Virginia.

The project includes dredging approximately 1.78 million cubic yards of material that will be placed in the Wolf Trap overboard disposal site in the Chesapeake Bay. The York River Entrance Channel will be dredged to a depth of 37 feet and a width of 750 feet. The project is scheduled to extend from the 38 foot contour in the Chesapeake Bay to a point adjacent to the piers at the Naval Supply Center at Cheatham Annex, approximately 11.5 miles above the mouth of the York River. The Virginia Marine Resources Commission has required that the overboard disposal of dredged material be precluded during the period of November 15 through March 30 of each year to minimize impacts to overwintering blue crabs (Callinectes sapidus) and the crab dredge fishery.

While the Service has no objection to the selected plan for maintaining the York River Entrance Channel, we do have concerns relative to the potential impacts of this project on sea turtles. Species known to occur in Virginia

waters include loggerhead (Caretta caretta), Kemp's ridley (Lepidochelys kempi), leatherback (Dermochelys coriacea), and green turtles (Chelonia mydas) (Keinath et al., 1987). Of these, loggerhead and Kemp's ridley sea turtles are seasonal visitors to the Chesapeake Bay and may be affected by the subject dredging project. The Service recommends that the Corps contact the National Marine Fisheries Service regarding possible impacts to these species.

Thank you for the opportunity to comment on this document. If we may be of further assistance, please contact William Hester of our Virginia Field Office at (804) 693-6694.

Sincerely,

Karen L. Mayne

Karen L. Mayne
Acting Supervisor
Annapolis Field Office

Literature Cited

Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginia's sea turtles: 1979-1986. Virginia Journal of Science. 38(4):329-336.

NORFOLK DISTRICT RESPONSES TO FISH AND WILDLIFE SERVICE COMMENTS OF JUNE 17, 1992

Comment 1. While the Service has no objection to the selected plan for maintaining the York River Entrance Channel, we do have concerns relative to the potential impacts of this project on sea turtles. Species known to occur in Virginia waters include loggerhead (Caretta caretta), Kemp's ridley (Lepidochelys kempi), leatherback (Dermochelys coriacea), and green turtles (Chelonia mydas) (Keinath et al., 1987). Of these, loggerhead and Kemp's ridley sea turtles are seasonal visitors to the Chesapeake Bay and may be affected by the subject dredging project. The Service recommends that the Corps contact the National Marine Fisheries Service regarding possible impacts to these species.

Response 1. See response to NMFS letter comment 6.

DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
FORT NORFOLK, 803 FRONT STREET
NORFOLK, VIRGINIA 23510-1096

REPLY TO
ATTENTION OF

June 18, 1992

Environmental Analysis Branch

Mr. Douglas Beach
National Marine Fisheries Service
Northeast Region
Habitat and Protected Resources Division
One Blackburn Drive
Gloucester, MA 01930

Dear Mr. Beach:

As discussed between you and Mr. Craig Seltzer of my staff today by phone, we are re-initiating the consultation process, pursuant to Section 7 of the Endangered Species Act of 1973, on the "Navigation Study of York River Entrance Channel, York River, Virginia." Letters in our files (enclosures 1 and 2) indicate that Section 7 consultation was initiated in November, 1983 with your agency. Your recommendation at that time was to consult Dr. Jack Musick at the Virginia Institute of Marine Science (VIMS) regarding the presence of sea turtles in the lower Chesapeake Bay. The results of our discussions with VIMS are presented in the Draft Environmental Assessment (EA), page EA-11, dated May 1992. The EA and Feasibility Report were submitted for comment to the Oxford Laboratory and to the Northeast Region Director by letter of May 14, 1992. Our biological assessment regarding threatened and/or endangered sea turtles is included in this document.

We are requesting, by this letter, that Informal Consultation pursuant to Section 7 of the Endangered Species Act be re-initiated immediately.

If you have questions on the Draft EA or Feasibility Report, or if we can provide additional information to expedite the consultation process, please contact Mr. Craig Seltzer, study oceanographer, at (804) 441-7767.

Sincerely,

Robert V. Ogle, P.E.
Chief, Planning Division

Enclosures

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGINIA 23511-6287

445-
2032
11000
18 JUN

From: Commander, Atlantic Division, Naval Facilities Engineering Command
To: U.S. Department of the Army, Norfolk District Corps of Engineers Planning Division (Attn: Robert Pretlow)

Subj: YORK RIVER, VIRGINIA (ENTRANCE CHANNEL)

Ref: (a) U.S. Army COE, Norfolk District memo CENAO-PL-F (1105-2-10b) of 15 May 92; same subject
(b) U.S. Army COE, Norfolk District ltr of 14 May 92; same subject
(c) Draft "Navigation Study of York River Entrance Channel, York River, VA"

1. Per reference (a), the following information is submitted:

Berthing Area	Annual Maintenance & Operation Cost
Fuel Depot Yorktown	$40,000
NSC Cheatham Annex	$230,000
NWS Yorktown	$1,100,000

2. The berthing area at NWS Yorktown (Pier R-3) has a depth of 42 feet. No further pier depth dredging is necessary for berthing of the AORs which require a depth of 37 feet. Therefore, no additional costs are envisioned as a result of the proposed York River dredging project.

3. As requested in reference (b), reference (c) has been reviewed and the following comments are submitted:

a. The Yorktown Fuel Depot should be listed as a military facility under the "Military Facilities" section of the report.

b. The "Division of Plan Responsibilities" section of reference (c) refers to "Federal funding". It is our understanding that this term does not mean "Navy funding", but refers to appropriations which would be obtained by the U.S. Army Corps of Engineers.

Quality Performance . . . Quality Results

445-6193

2032MM
11000
18 JUN 1992

Subj: YORK RIVER, VIRGINIA (ENTRANCE CHANNEL)

4. If we have incorrectly comprehended this term, or if you have any comments or questions, please contact this office at 445-2334.

T. C. Horsch

THOMAS C. HORSCH
By direction

NORFOLK DISTRICT RESPONSES TO DEPARTMENT OF THE NAVY COMMENTS OF JUNE 18, 1992

Comment 1. The Yorktown Fuel Depot should be listed as a military facility under the "Military Facilities" section of the report.

Response 1. A description of the Yorktown Fuel Depot has been added to the report under the "Military Facilities" section. The location of the depot has been added to figure 3.

Comment 2. The "Division of Plan Responsibilities" section of reference (c) refers to "Federal funding". It is our understanding that this term does not mean "Navy funding", but refers to appropriations which would be obtained by the U.S. Army Corps of Engineers.

Response 2. The term "Federal funding" in the "Division of Plan Responsibilities" section of the report refers to appropriations which would be obtained through the Civil Works Program by the Corps.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

June 19, 1992

Colonel Richard C. Johns
Department of the Army
Corps of Engineers
Norfolk District
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

RE: Navigation Study of York River Entrance Channel, York River, Virginia-- Environmental Assessment

Dear Colonel Johns:

In accordance with the National Environmental Policy Act (NEPA), Section 309 of the Clean Air Act, and Section 404 of the Clean Water Act, we have reviewed the Environmental Assessment (EA) for the above referenced project.

EPA supports the Corps' selected plan to modify the York River Channel which was originally dredged in 1951. The proposed modification calls for increasing the depth of the 750' wide, 11 mile long channel to 38' to improve the safe and efficient movement of vessels; however, we are concerned about the following environmental impact:

* Sea turtles and dredging. The Virginia Institute of Marine Science (VIMS) has indicated that sea turtles tend to congregate outside the rivermouths in the lower Chesapeake Bay. Loggerheads, a threatened species, have been known to frequent the area, and it is suspected that Kemp's Ridleys, an endangered species, may also be present though on a more limited basis (p. 11 of EA). The proposed Hopper dredge has been known to be fatal to sea turtles. EPA strongly recommends that the Corps utilize shields and deflectors during dredging to minimize harm to the sea turtles.

Thank you for the opportunity to review this environmental assessment. Should you require additional information, please call Mary Ann Boyer of my staff at (215) 597-3634 or Bridget Tuthill at (215) 597-1168.

Sincerely,

for Diana Esher, Chief
Environmental Planning and Assessment Section

06/22/1992 15:46 FROM RMD-ESD REGION 3 TO 88044176 46 P.03

NORFOLK DISTRICT RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS OF JUNE 19, 1992

Comment 1. The proposed modification calls for increasing the depth of the 750' wide, 11 mile long channel to 38' to improve the safe and efficient movement of vessels; however, we are concerned about the following environmental impact:

Sea turtles and dredging. The Virginia Institute of Marine Science (VIMS) has indicated that sea turtles tend to congregate outside the rivermouths in the lower Chesapeake Bay. Loggerheads, a threatened species, have been known to frequent the area, and it is suspected that Kemp's Ridleys, an endangered species, may also be present though on a more limited basis (p. 11 of EA). The proposed Hopper dredge has been known to be fatal to sea turtles. EPA strongly recommends that the Corps utilize shields and deflectors during dredging to minimize harm to the sea turtles.

Response 1. Discussions regarding sea turtles have been expanded in the Final EA. Our consultation with VIMS and the NMFS have led to the following recommendations regarding sea turtles:

If any dredging must take place during the time period which is restricted for sea turtles (mid-May through mid-November), precautions would be taken to avoid impacts to sea turtles. These precautions would include the use of a trawl to catch turtles in the vicinity of the dredging operations and relocate them; initiation of an observer program with on-board biologists to document the take of sea turtles by the dredge, and the modification of gear to screen discharge ports for the presence of sea turtle parts (which should not occur with successful relocation efforts). With the implementation of these mitigation measures, it is not anticipated that there would be any significant adverse impact to sea turtles.

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MD 21203-1715

REPLY TO
ATTENTION OF

CENAB-OP-B (1130) 26 June 1992

MEMORANDUM FOR Commander, U.S. Army Engineer District, Norfolk
803 Front Street, Norfolk, VA 23510-1096,
ATTN: CENAO-PL

SUBJECT: Draft Detailed Project Report and Environmental Assessment, Navigation Study of York River Entrance Channel, York River, Virginia

1. Reference multiple letter, Plan Formulation Branch, Norfolk District, 14 May 1992, subject as above.

2. The following comments are provided on the subject report:

a. Page 3, Figure 1: The location of the Naval Supply Center at Cheatham Annex should be shown on Figure 1 since it is referenced in the text. The "Rappahannock River Channel" should be changed to the "Rappahannock Shoal Channel".

b. Page 5, paragraph 3, The Baltimore Harbor and Channels: Insert "50-Foot" on line 1 between "...Channels" and "project was...". Delete "1958 and" from line 2. Change "Rappahannock River" to "Rappahannock Shoal" on line 4.

c. Page 7, paragraph 1, The Cape Henry Channel: Change "2.3 miles" to "3 miles" on line 3.

d. Page 7, paragraph 2, The York Spit Channel: Insert "for a width of 800 feet" between "... 50 feet" and "was completed..." on line 4.

e. Page 7, paragraph 3, The Rappahannock Shoal Channel: Insert "to a depth of 50 feet and a width of 800 feet" between "Initial construction" and "was completed..." on line 4.

f. Page 17, paragraph 1, line 8: Change "long" to "large".

g. Page 18, paragraph 2, line 4: Change "southwesterly "T" shaped pier" to southeasterly "T" shaped pier".

h. Page 22, paragraph 2, line 4: Capitalize "navy".

i. Page 25, paragraph 2, line 1: "the Federal maintenance of" is redundant and should be deleted.

j. Page 25, paragraph 3, line 7: Change "concerning" to "about".

k. Page 41, paragraph 2, line 9: Change "49" to "48" to correspond with the 48-foot project depth referenced at the top of the page.

l. Page 50, paragraph 2, line 2: Change "18,000,000" to "15 million".

m. Page 50, paragraph 3, line 6: Change "second" to "fourth".

n. Page 52: Have any beneficial uses other than beach nourishment been investigated?

o. Page 54, paragraph 1, line 4: Change "fill" to "gill".

p. Page 54, paragraph 3, line 10: Change "eastern" to "western".

q. Page 61, Figure 10: Change "Rappahannock River Channel" to Rappahannock Shoal Channel".

r. Page 65, Table 13, Account 12.b: Change "dredging - required depth of 39 feet" to "dredging - required depth of 38 feet".

s. Page EA-5, paragraph 5.05, line 2: Change "18,000,000" to "15 million".

t. Page EA-6, paragraph 5.10, line 3: Change "second" to "fourth".

u. Page EA-11, paragraph 7.04, line 16: Change "Limunlus" to "Limulus".

v. Page A-19, paragraph 21, line 1: Change "18,000,000" to "15 million".

w. Page A-20, paragraph 24, line 3: Change "first" to "fourth".

CENAB-OP-B
SUBJECT: Draft Detailed Project Report and Environmental Assessment, Navigation Study of York River Entrance Channel, York River, Virginia

3. If you have any question regarding these comments please contact Mr. Jeffrey McKee at (410) 962-5632.

FOR THE COMMANDER:

JOHN P. O'HAGAN, P.E.
Chief, Operations Division

NORFOLK DISTRICT RESPONSES
TO U.S. ARMY CORPS OF ENGINEERS, BALTIMORE DISTRICT
COMMENTS OF JUNE 26, 1992

Comment 1. Page 3, Figure 1: The location of the Naval Supply Center at Cheatham Annex should be shown on Figure 1 since it is referenced in the text. The "Rappahannock River Channel" should be changed to the "Rappahannock Shoal Channel".

Response 1. Figure 1 has been revised to show the location of the Naval Supply Center at Cheatham Annex. The "Rappahannock River Channel" has been changed to the "Rappahannock Shoal Channel".

Comment 2. Page 5, paragraph 3, The Baltimore Harbor and Channels: Insert "50-Foot" on line 1 between ". . . Channels" and "project was . . .". Delete "1958 and" from line 2. Change "Rappahannock River" to "Rappahannock Shoal" on line 4.

Response 2. Revision made to final report.

Comment 3. Page 7, paragraph 1, the Cape Henry Channel: Change "2.3 miles" to "3 miles" on line 3.

Response 3. Revision made to final report.

Comment 4. Page 7, paragraph 2, The York Spit Channel: Insert "for a width of 800 feet" between ". . . 50 feet" and "was completed. . . " on line 4.

Response 4. Revision made to final report.

Comment 5. Page 7, paragraph 3, The Rappahannock Shoal Channel: Insert "to a depth of 50 feet and a width of 800 feet" between "Initial construction" and "was completed . . . " on line 4.

Response 5. Revision made to final report.

Comment 6. Page 17, paragraph 1, line 8: Change "long" to "large".

Response 6. Revision made to final report.

Comment 7. Page 18, paragraph 2, line 4: Change "southwesterly "T" shaped pier" to southeasterly "T" shaped pier".

Response 7. Revision made to final report.

Comment 8. Page 22, paragraph 2, line 4: Capitalize "navy"

Response 8. Revision made to final report.

Comment 9. Page 25, paragraph 2, line 1: "the Federal maintenance of" is redundant and should be deleted.

Response 9. Revision made to final report.

Comment 10. Page 25, paragraph 3, line 7: Change "concerning" to "about".

Response 10. Revision made to final report.

Comment 11. Page 41, paragraph 2, line 9: Change "49" to "48" to correspond with the 48-foot project depth referenced at the top of the page.

Response 11. Revision made to final report.

Comment 12. Page 50, paragraph 2, line 2: Change "18,000,000" to "15 million".

Response 12. Revision made to final report.

Comment 13. Page 50, paragraph 3, line 6: Change "second" to "fourth".

Response 13. Revision made to final report.

Comment 14. Page 52: Have any beneficial uses other than beach nourishment been investigated?

Response 14. The possibility of using the dredged material to create additional crab habitat in the lower Chesapeake Bay was explored early in the study process, but was eliminated from further consideration as much of the lower bay already provides such habitat.

Comment 15. Page 54, paragraph 1, line 4: Change "fill" to "gill".

Response 15. Revision made to final report.

Comment 16. Page 54, paragraph 3, line 10: Change "eastern" to "western".

Response 16. Revision made to final report.

Comment 17. Page 61, Figure 10: Change "Rappahannock River Channel" to Rappahannock Shoal Channel".

Response 17. Revision made to final report.

Comment 18. Page 65, Table 13, Account 12.b: Change "dredging - required depth of 39 feet" to "dredging - required depth of 38 feet".

Response 18. Table 13 has been revised to present the cost estimate in the standard account codes. The statement "dredging-required depth of 39 feet" has been eliminated from the table.

Comment 19. Page EA-5, paragraph 5.05, line 2: Change "18,000,000" to "15 million".

Response 19. Revision made to final report.

Comment 20. Page EA-6, paragraph 5.10, line 3: Change "second" to "fourth".

Response 20. Revision made to final report.

Comment 21. Page EA-11, paragraph 7.04, line 16: Change "Limunlus" to "Limulus".

Response 21. Revision made to final EA.

Comment 22. Page A-19, paragraph 21, line 1: Change "18,000,000" to "15 million".

Response 22. Revision made to final report.

Comment 23. Page A-20, paragraph 24, line 3: Change "first" to "fourth".

Response 23. Revision made to final report.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Region
Habitat and Protected
Resources Division
One Blackburn Drive
Gloucester, MA 01939-2298

July 6, 1992

Robert V. Ogle, P.E.
Chief, Planning Division
Department of the Army
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front St.
Norfolk, VA 23510-3097

Dear Mr. Ogle:

This letter is in response to your letter to Douglas Beach, dated June 18, 1992, requesting informal consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended, regarding the York River Entrance Channel project in Virginia. According to the Draft Project Report, the project will modify the entrance channel, extending it into the Chesapeake Bay to the Naval Supply Center at Cheatham Annex. This is expected to take 5 months of dredging by hopper dredge.

Section 7.04 on page EA-11 of the Environmental Assessment submitted for this project discusses the presence of threatened and endangered sea turtles in the project area and discusses potential impacts of dredging on these turtles. Species that may be present include the threatened loggerhead (Caretta caretta) sea turtle and the endangered Kemp's ridley (Lepidochelys kempi) and green (Chelonia mydas) sea turtle. This assessment erroneously implies sea turtles are only taken by dredges when hibernating. While turtles may be more susceptible to lethal takes in hopper dredges in cool waters, NMFS has determined that takes can and do occur any time a hopper dredge is used in areas where sea turtles are present (NMFS, 1991). Hopper dredging of the York River entrance channel during the warmer months (May through November) may affect listed species.

Other dredging projects that may affect endangered and threatened species of sea turtles in the Chesapeake Bay area have also been proposed. These include the Sandbridge Erosion Control Project and the Chesapeake Bay Bridge and Tunnel Project. A review of the Environmental Assessments prepared for these projects indicate that they do not sufficiently assess the potential for endangered species impacts. Formal consultation, requiring Biological Assessments, will be required for those projects for which hopper dredges may be utilized from May through November.

Section 7 regulations, including highlighted sections describing the information needed in a Biological Assessment to allow us to issue a Biological Opinion (50 CFR §402.12), are enclosed.

I suggest we conduct a combined consultation to consider the effects of hopper dredging throughout the Chesapeake Bay and adjacent areas. An August meeting with appropriate members of your staff would facilitate this process. Colleen Coogan, of my staff, can be contacted at (508) 281-9291 to discuss this possibility and assist in coordinating this meeting.

Sincerely,

Thomas E. Bigford

Thomas E. Bigford
Division Chief
Habitat and Protected Resources
Division

Enclosure

cc: cc: USFWS, Moser
F/PR2 - Williams, Ziobro
F/NE02 - Rubelmann
COE - Seltzer, Mansfield

DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
FORT NORFOLK, 803 FRONT STREET
NORFOLK, VIRGINIA 23510-1096

REPLY TO
ATTENTION OF:

July 9, 1992

Environmental Analysis Branch

Mr. Thomas E. Bigford, Division Chief
Habitat and Protected Resources Division
National Marine Fisheries Service
Northeast Region
One Blackburn Drive
Gloucester, MA 01930

Dear Mr. Bigford:

This is in response to your letter of July 6, 1992 regarding our request for Consultation pursuant to Section 7 of the Endangered Species Act for the York River Entrance Channel, Virginia. You have indicated that sea turtle species that may be present in the York River and vicinity include the loggerhead, the Kemp's ridley, and the green sea turtle.

As discussed with Colleen Coogan of your staff, we are in the process of trying to resolve the conflict of time-of-year (permit) restrictions which have been imposed by the Virginia Marine Resources Commission (VMRC) and the time-of-year window for protecting sea turtles. Based upon the Virginia Institute of Marine Science's (VIMS) recommendation on the proposed project, VMRC has required in its permit to the Corps that overboard placement of dredged material be precluded during the period of November 15 through March 30 of each year to minimize impacts to overwintering blue crabs and the crab dredge fishery. Our discussions with sea turtle researcher John Keinath at VIMS indicates that no hopper dredging should take place in the project area during the time period of mid-May to mid-November in order to avoid impacts to sea turtles.

Since the project would take 5 to 6 months to complete, a letter was subsequently sent to VIMS requesting that they provide recommendations to the Corps as to how this apparent conflict could be resolved (enclosure 1). The Corps received a letter from VIMS dated July 1, 1992 (enclosure 2) in which they proposed a number of options that could be implemented that would offer a resolution. Except for using equipment other than a hopper dredge, which is not engineeringly feasible for this project, we then chose to use each of VIMS's recommendations in coming up with the following proposed solution to VMRC:

1. Reduce the time-of-year restriction for the winter crab dredge fishery to two months. This period would be mid-November through mid-January. Well in advance of the dredging/disposal period, commercial watermen would be

notified by the Corps and/or VMRC so that the resource in the channel and disposal sites could be exploited to the maximum extent necessary ahead of the dredging.

2. During the time period which is restricted for sea turtles (mid-May through mid-November), precautions would be taken to avoid impacts to sea turtles. These precautions would include the use of a trawl to catch turtles in the vicinity of the dredging operations and relocate them; initiation of an observer program with on-board biologists to document the take of sea turtles by the dredge, and the modification of gear to screen discharge ports for the presence of sea turtle parts (which should not occur with successful relocation efforts).

As presented in the letter to VMRC, we feel that if both of these recommendations are implemented, the Corps will have adequate time to construct the project, and both the winter crab dredge fishery and the endangered sea turtles will have sufficient protection.

We have not yet received VMRC's response to this proposition.

Because it appears that we will dredge during the protected window for sea turtles, we are requesting, by this letter, that Formal Consultation pursuant to Section 7 of the Endangered Species Act be initiated immediately.

Our Final Environmental Assessment (EA) on the York River Entrance Channel must be completed by the end of July. The Final EA will include all aspects of the required Biological Assessment as described in the Endangered Species Act of 1973, as amended, referenced in your recent letter.

We are very much interested in discussing other (and all) dredging projects in the Chesapeake Bay and vicinity that may affect sea turtles. We have discussed this with Colleen Coogan and have tentatively set a time of the second week of August to have such a meeting here at the Norfolk District. However, because of the need to complete Consultation on the York River Entrance Channel project by the end of July, we are requesting that this project be handled separately at this time.

If you have questions, or if we can provide additional information to expedite the consultation process, please contact Mr. Craig Seltzer, study oceanographer, at (804) 441-7767.

Sincerely,

Robert V. Ogle, P.E.
Chief, Planning Division

Enclosures

COMMONWEALTH of VIRGINIA
Council on the Environment

KEITH J. BUTTLEMAN
ADMINISTRATOR

202 NORTH NINTH STREET
SUITE 900
RICHMOND 23219
804-786-4500
TDD 804-371-7804

Colonel R. C. Johns
District Engineer
U.S. Army Corps of Engineers, Norfolk District
803 Front Street (Fort Norfolk)
Norfolk, Virginia 23510

Dear Colonel Johns:

The Commonwealth of Virginia has completed its review of the Draft Detailed Project Report and Environmental Assessment on the Navigation Study of York River Entrance Channel (hereinafter the Assessment or EA). The Council on the Environment is responsible for coordinating Virginia's review of federal environmental documents and responding to appropriate officials on behalf of the Commonwealth. The following agencies and localities joined in this review:

Department of Conservation and Recreation
Department of Health
Department of Transportation
Department of Waste Management
Marine Resources Commission
Chesapeake Bay Local Assistance Department
Department of Historic Resources
Virginia Institute of Marine Science
Gloucester County
James City County.

In addition, the following agencies and entities were invited to comment:

Department of Game and Inland Fisheries
State Water Control Board
Virginia Port Authority
Hampton Roads Planning District Commission
York County.

Environmental Impacts and Mitigation

1. Endangered, threatened, or rare species. The dredging project proposed in the Assessment will not directly affect any Natural Heritage resources, according to the Department of

Conservation and Recreation's Biological and Conservation Datasystem. These resources are defined in Virginia law as "the habitat of rare, threatened, or endangered plant and animal species, rare or state significant natural communities or geologic sites, and similar features of scientific interest..." (*Virginia Code* section 10.1-209). However, the loggerhead turtle (Caretta caretta) and Kemp's Ridley sea turtle (Lepidochelys kempii), both of which are rare to extremely rare in the Commonwealth, may be present in dredging and disposal areas from May through October. In addition, the diamondback terrapin (Malaclemys terrapin), which is rare in the Commonwealth and a candidate for federally listed status, may also be present in these areas. Accordingly, we believe that the time-of year restriction imposed through the Marine Resources Commission's permit, which limits overboard disposal of dredged material to the period November 15 through March 30, is appropriate and necessary for these species as well as for the overwintering blue crabs and the crab dredge fishery. In addition, we recommend coordination with several agencies to ensure proper compliance with protected species legislation at state and federal levels (see "Regulatory and Coordination Needs," below.)

2. Disposal site. The recommendation by the Marine Resources Commission staff to approve the use of the Wolf Trap alternate disposal site for overboard disposal was based in large part on the findings by the Virginia Institute of Marine Science (VIMS) that benthic populations at the site would enjoy a fairly rapid recovery in two or three years following dredge disposal activities. Depths at this site should not be reduced to less than 9 meters, in keeping with the Institute's recommendations. In these circumstances, the resource value of the area is unlikely to suffer degradation from the project. In this regard, we appreciate the statements in the Assessment that the Corps will follow the Institute's recommendations (including time-of-year restrictions, mentioned above) and that dredged material will "not be placed as a homogenously thick layer" (page EA-6, paragraphs 5.08 and 5.09).

We recommend, also, that the Corps conduct periodic analysis of the disposal area to ensure that it retains its ability to re-colonize rapidly. A post-dredge bathymetric survey of the Wolf Trap site would facilitate the removal of areas approaching the 9-meter minimum depth from future use.

3. Alternative considerations. As VIMS points out, overboard dredged material disposal in the Rappahannock site results in even faster benthic recovery than at the Wolf Trap site; it is measurable in months rather than years. This site does not seem to have been considered in the document.

It may yet be possible to offer material from this dredging project to localities for replenishment of public beaches. The dredge cutterhead may encounter beach-quality sand at several locations along Area 2 of the entrance channel, unless the sand is too deep to be retrieved in practical quantities. Provision of beach-quality sand for the purpose of beach replenishment would be in keeping with Virginia's policy on preferred uses of dredged material, and we recommend that this be done if the circumstances permit. These circumstances are, as the Marine Resources Commission suggests, the availability of sand at a depth which can be reached, and in sufficient quantity to allow its segregation and retrieval for use.

Rather than expanding the Wolf Trap site in the future, should the need arise, we recommend that the Corps make use of approved ocean disposal sites.

4. Other impact areas. This project will not adversely affect any existing or planned recreation facilities. Nor will it affect listed or eligible National Wild and Scenic Rivers or Virginia Scenic Rivers.

We recommend that the Corps ensure the proper management, including as much re-use and recycling as possible, of waste materials from this project.

Regulatory and Coordination Needs

To ensure the protection of rare, threatened, or endangered species, including the turtle species listed above, we recommend that the Corps maintain consultations with the U.S. Fish and Wildlife Service, the Department of Game and Inland Fisheries (telephone (804) 367-1000), and the Virginia Institute of Marine Science (telephone (804) 842-7000). In addition, the Department of Conservation and Recreation's Division of Natural Heritage (telephone (804) 786-7951) should be contacted for new natural heritage information if significant time elapses before the information presented above is used.

The State Water Control Board has issued a Section 401 Water Quality Certification, and the Marine Resources Commission has issued a permit for overboard dredged material disposal, as the document indicates (page EA-6). The project is deemed consistent with Virginia's Coastal Resources Management Program, provided that the Corps complies with all the conditions set out in these permits.

We would have no objection to a Finding of No Significant Impact for this project.

Thank you for the opportunity to comment.

Sincerely,

Keith J. Buttleman

Enclosures

cc: The Honorable Elizabeth H. Haskell
John R. Davy, Jr., DCR
Robert B. Stroube, VDH
Bryan S. McCormick, VDOT
Harry E. Gregori, Jr., DWM
David R. Knowles, MRC
Darryl M. Glover, CBLAD
Ethel R. Eaton, DHR
Thomas A. Barnard, Jr., VIMS
Wesley D. Jones, Gloucester County
Sanford B. Warner, James City County
Raymond T. Fernald, DGIF
Leo C. Snead, Jr., SWCB
J. Robert Bray, VPA
Arthur L. Collins, HRPDC
Daniel M. Stuck, York County

NORFOLK DISTRICT RESPONSES TO COUNCIL ON THE ENVIRONMENT COMMENTS (UNDATED)

Comment 1. *Disposal site.* The recommendation by the Marine Resources Commission staff to approve the use of the Wolf Trap alternate disposal site for overboard disposal was based in large part on the findings by the Virginia Institute of Marine Science (VIMS) that benthic populations at the site would enjoy a fairly rapid recovery in two or three years following dredge disposal activities. Depths at this site should not be reduced to less than 9 meters, in keeping with the Institute's recommendations. In these circumstances, the resource value of the area is unlikely to suffer degradation from the project. In this regard, we appreciate the statements in the Assessment that the Corps will follow the Institute's recommendations (including time-of-year restrictions, mentioned above) and that dredged material will "not be placed as a homogenously thick layer" (page EA-6, paragraphs 5.08 and 5.09).

Response 1. Due to recent concerns expressed by other resource agencies (including VIMS) over sea turtles, and the need for adequate time to construct the project, a letter of request has been submitted to VMRC with the following requests and recommendations:

"1. Reduce the time-of-year restriction for the winter crab dredge fishery to two months. This period would be mid-November through mid-January. Well in advance of the dredging/disposal period, commercial watermen would be notified by the Corps and/or VMRC so that the resource in the channel and disposal sites could be exploited to the maximum extent necessary ahead of the dredging.

"2. During the time period which is restricted for sea turtles (mid-May through mid-November), precautions would be taken to avoid impacts to sea turtles. These precautions would include the use of a trawl to catch turtles in the vicinity of the dredging operations and relocate them; initiation of an observer program with on-board biologists to document the take of sea turtles by the dredge, and the modification of gear to screen discharge ports for the presence of sea turtle parts (which should <u>not</u> occur with successful relocation efforts).

"If both of these recommendations are implemented, the Corps will have adequate time to construct the project (4-6 months), and both the winter crab dredge fishery and the endangered sea turtles will have sufficient protection."

This is the only change that would be made over our previous recommendations for using the Wolf Trap Alternate Site.

Comment 2. We recommend, also, that the Corps conduct periodic analysis of the disposal area to ensure that it retains its ability to recolonize rapidly. A post-dredge bathymetric survey of the Wolf Trap site would facilitate the removal of areas approaching the 9-meter minimum depth from future use.

Response 2. The Baltimore District, in cooperation with VIMS, recently concluded an extensive monitoring of the Wolf Trap Site which took place over a period of approximately 4 years. The results of this monitoring are now being prepared by VIMS into a report which should be available shortly. The findings and recommendations of this report will be used to determine whether future periodic analysis of the site is required. Post-dredging bathymetric surveys will be conducted.

Comment 3. *Alternative considerations.* As VIMS points out, overboard dredged material disposal in the Rappahannock site results in even faster benthic recovery than at the Wolf Trap site; it is measurable in months rather than years. This site does not seem to have been considered in the document.

Response 3. The Rappahannock Site, which was utilized for the placement of material resulting from the dredging of the Rappahannock Shoal Channel, is located north of that channel. The Rappahannock Site is more conveniently (i.e., economically) located for use by Baltimore District projects. Since Norfolk and Baltimore Districts require both sites from a capacity standpoint, Norfolk District has chosen to use the Wolf Trap Site because of its more economical hauling distance from the York River Entrance Channel. The report and EA have been revised to include this information.

Comment 4. It may yet be possible to offer material from this dredging project to localities for replenishment of public beaches. The dredge cutterhead may encounter beach-quality sand at several locations along Area 2 of the entrance channel, unless the sand is too deep to be retrieved in practical quantities. Provision of beach-quality sand for the purpose of beach replenishment would be in keeping with Virginia's policy on preferred uses of dredged material, and we recommend that this be done if the circumstances permit. These circumstances are, as the Marine Resources Commission suggests, the availability of sand at a depth which can be reached, and in sufficient quantity to allow its segregation and retrieval for use.

Response 4. During the Plans and Specifications phase of this project, further investigations will be accomplished to document the location and quality of sand that will be dredged to provide the project dimensions. If based on this information, the Commonwealth or any locality desires the placement of sand on beaches within the vicinity of the project, then the project cost estimate and implementation schedule would each be reviewed and revised as appropriate.

Comment 5. Rather than expanding the Wolf Trap site in the future, should the need arise, we recommend that the Corps make use of approved ocean disposal sites.

Response 5. It is not anticipated that any expansion of the Wolf Trap Site would be contemplated in the future based on information available at this time regarding the future maintenance requirements for the York River Entrance Channel. However, should the situation change in the future, appropriate placement options would be evaluated as warranted.

Comment 6. To ensure the protection of rare, threatened, or endangered species, including the turtle species listed above, we recommend that the Corps maintain consultations with the U.S. Fish and Wildlife Service, the Department of Game and Inland Fisheries (telephone (804) 367-1000), and the Virginia Institute of Marine Science (telephone (804) 842-7000). In addition, the Department of Conservation and Recreation's Division of Natural Heritage (telephone

(804) 786-7951) should be contacted for new natural heritage information if significant time elapses before the information presented above is used.

Response 6. See response to NMFS letter comments 5 and 6. The above-referenced agencies have been contacted regarding sea turtles. Discussions with these agencies have led to the recommendations presented in responses 5 and 6 to the NMFS (above). With these safeguards in place, no significant impacts to threatened or endangered sea turtles are anticipated. DCR will be contacted for an update on the natural heritage information if a significant amount of time passes before the existing information is utilized.

Comment 7. The State Water Control Board has issued a Section 401 Water Quality Certification, and the Marine Resources Commission has issued a permit for overboard dredged material disposal, as the document indicates (page EA-6). The project is deemed consistent with Virginia's Coastal Resources Management Program, provided that the Corps complies with all the conditions set out in these permits.

Response 7. It is the intent of the Norfolk District to comply with all conditions set forth in the Section 401 Water Quality Certification and the Marine Resources Commission permit that are in effect at the time of project construction. As mentioned previously, the Corps is requesting a waiver from a portion of the time-of-year restriction for overwintering blue crabs which is included as a condition in the VMRC permit. This will enable the project to be constructed while avoiding, to the greatest extent possible, impacts to both sea turtles and the overwintering crab fishery.

J. Robert Hicks, Jr.
Director

Administration
Natural Heritage
Planning & Recreation Resources
Soil & Water Conservation
State Parks

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street, Suite 302
TDD (804) 786-2121 Richmond, Virginia 23219-2010 (804) 786-6124 FAX:(804) 786-6141

M E M O R A N D U M

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 3
To Ellie Irons	From Roger Rothman
Co. COE	Co. DCR-DSER
Dept.	Phone # 1-7436
Fax #	Fax #

DATE: June 8, 1992

TO: Ellie Irons
Council on the Environment

FROM: John R. Davy, Jr.
Planning Bureau Manager

SUBJECT: Navigation Study of the York River Entrance Channel

The Department of Conservation and Recreation (DCR) has reviewed the subject project and offers the following comments.

The proposed project is not anticipated to have any adverse impacts on existing or planned recreational facilities nor will it impact any streams on the National Park Service Nationwide Inventory, Final List of Rivers, potential State Scenic Rivers or existing or potential State Scenic Byways.

DCR has also reviewed the dredging and disposal areas in the submitted Navigation Study of the York River Entrance Channel for potential impacts to natural heritage resources. Natural heritage resources (NHR's) are defined by the Virginia Natural Areas Preserves Act as "the habitat of rare, threatened, or endangered plant and animal species, unique or state significant natural communities or geologic sites, and similar features of scientific interest" (sec. 10.1-209 et seq. of the Code of Virginia).

DCR's Biological and Conservation Datasystem documents no occurrences of NHR's likely to be directly impacted by proposed dredging in the York River Entrance Channel. However, we have little information on the open water foraging areas for species that utilize the Chesapeake Bay. For example, the loggerhead sea turtle (Caretta caretta, G3/S1S2/LT/LT) and Kemp's Ridley sea turtle (Lepidochelys kempii, G1/S1/LE/LE) may be present within dredging and disposal areas from May through October. The diamondback terrapin (Malaclemys terrapin, G4/S2/C2/NS), a candidate for federally listed status, may also be present in these areas.

Encl

Due to the legal protected status of sea turtles on the state and federal levels, DCR recommends coordination with the Virginia Department of Game and Inland Fisheries (VDGIF) and the United States Fish and Wildlife Service (USFWS) for compliance with protected species legislation. In addition, we recommend coordination with the Virginia Institute of Marine Sciences (VIMS).

Any absence of NHR data does not necessarily mean that other natural heritage resources do not occur in or adjacent to the project area, but rather that our files do not currently contain information to document their presence. DCR's Biological and Conservation Datasystem is constantly growing and revised. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

An explanation of species rarity ranks and legal status abbreviations is enclosed for your reference.

Thank you for the opportunity to comment on this project.

JRD:ikr

cc: Rebecca Wajda, VDGIF
Ray Fernald, VDGIF
Cindy Schulz, USFWS
R. J. Orth, VIMS
Tim O'Connell, DCR-DNH

Encl

Definition of Abbreviations Used on Natural Heritage Resource Lists
of the
Virginia Department of Conservation and Recreation

Natural Heritage Ranks

The following ranks are used by the Virginia Department of Conservation and Recreation to set protection priorities for natural heritage resources. Natural Heritage Resources, or "NHR's," are rare plant and animal species, rare and exemplary natural communities, and significant geologic features. The primary criterion for ranking NHR's is the number of populations or occurrences, i.e. the number of known distinct localities. Also of great importance is the number of individuals in existence at each locality or, if a highly mobile organism (e.g., sea turtles, many birds, and butterflies), the total number of individuals. Other considerations may include the quality of the occurrences, the number of protected occurrences, and threats. However, the emphasis remains on the number of populations or occurrences such that ranks will be an index of known biological rarity.

S1 Extremely rare; usually 5 or fewer populations or occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.

S2 Very rare; usually between 5 and 20 populations or occurrences; or with many individuals in fewer occurrences; often susceptible to becoming extirpated.

S3 Rare to uncommon; usually between 20 and 100 populations or occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

S4 Common; usually >100 populations or occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.

S5 Very common; demonstrably secure under present conditions.

SA Accidental in the state.

SH Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.

SN Regularly occurring migrants, transients, seasonal non-breeding residents. Usually no specific site can be identified with its range in the state. (Note that congregation and staging areas are monitored separately.)

SU Status uncertain, often because of low search effort or cryptic nature of the element.

SX Apparently extirpated from the state.

Global ranks are similar, but refer to a species' rarity throughout its total range. Global ranks are denoted with a "G" followed by a character. Note that GA and GH are not used and GX means apparently extinct. A "Q" in a rank indicates that a taxonomic question concerning that species exists. Ranks for subspecies are denoted with a "T". The global and state ranks combined (e.g. G2/S1) give an instant grasp of a species' known rarity.

These ranks should not be interpreted as legal designations.

Federal Legal Status

The Division of Natural Heritage uses the standard abbreviations for Federal endangerment developed by the U.S. Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation.

LE - Listed Endangered
LT - Listed Threatened
PE - Proposed Endangered
PT - Proposed Threatened
C1 - Candidate, category 1
C2 - Candidate, category 2
3A - Former candidate - presumed extinct
3B - Former candidate - not a valid species under current taxonomic understanding
3C - Former candidate - common or well protected
NF - no federal legal status

State Legal Status

The Division of Natural Heritage uses similar abbreviations for State endangerment.

LE - Listed Endangered
LT - Listed Threatened
C - Candidate
PE - Proposed Endangered
PT - Proposed Threatened
NS - no state legal status

For information on the laws pertaining to threatened or endangered species, contact:

U.S. Fish and Wildlife Service for all FEDERALLY listed species
Department of Agriculture and Consumer Services Plant Protection Bureau for STATE listed plants and insects
Department of Game and Inland Fisheries for all other STATE listed animals

8/91

Encl

NORFOLK DISTRICT RESPONSES TO DEPARTMENT OF CONSERVATION AND RECREATION COMMENTS OF JUNE 8, 1992

Comment 1. DCR's Biological and Conservation Datasystem documents no occurrences of NHR's likely to be directly impacted by proposed dredging in the York River Entrance Channel. However, we have little information on the open water foraging areas for species that utilize the Chesapeake Bay. For example, the loggerhead sea turtle (Caretta caretta, G3/S1S2/LT/LT) and Kemp's Ridley sea turtle (Lepidochelys kempii, G1/S1/LE/LE) may be present within dredging and disposal areas from May through October. The diamondback terrapin (Malaclemys terrapin, G4/S2/C2/NS), a candidate for federally listed status, may also be present in these areas.

Response 1. See response to NMFS letter comments 5 and 6. Discussions with the NMFS and VIMS have led to the recommendations presented in responses 5 and 6 to the NMFS (above). With the proposed safeguards in place, no significant impacts to threatened or endangered sea turtles are anticipated. While the diamondback terrapin may be found in the area, it is not anticipated that this turtle would be found in the deep channel or placement site associated with the proposed dredging project.

Comment 2. Due to the legal protected status of sea turtles on the state and federal levels, DCR recommends coordination with the Virginia Department of Game and Inland Fisheries (VDGIF) and the United States Fish and Wildlife Service (USFWS) for compliance with protected species legislation. In addition, we recommend coordination with the Virginia Institute of Marine Sciences (VIMS).

Response 2. See response to Council on the Environment, Comment 6.

Comment 3. Any absence of NHR data does not necessarily mean that other natural heritage resources do not occur in or adjacent to the project area, but rather that our files do not currently contain information to document their presence. DCR's Biological and Conservation Datasystem is constantly growing and revised. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

Response 3. DCR will be contacted for an update on the natural heritage information if a significant amount of time passes before the existing information is utilized.

Received by:
Council on the Environment

JUN 3 1992

COMMONWEALTH of VIRGINIA

ROBERT B. STROUBE, M.D., M.P.H.
STATE HEALTH COMMISSIONER

Department of Health
P. O. BOX 2448
RICHMOND, VA 23218

June 1, 1992

TO: Mr. Charles H. Ellis, III
Environmental Program Planner
Council on the Environment

FROM: Robert B. Stroube, M.D., M.P.H.
State Health Commissioner

SUBJECT: Navigation Study of York River Entrance Channel
(92-032F)

The subject project does not adversely impact the programs administered by this agency.

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment

End

If you cannot meet the deadline, please notify Charles Ellis or Ellie Irons at (804) 786-4500 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.

Please return your comments to the Council on the Environment, Room 900, Ninth Street Office Building, Richmond, Virginia 23219. Thank you.

Received by:
Council on the Environment

JUN 5 1992

Ellie Irons
Environmental Program Planner

COMMENTS

The proposed work will have no effect on existing or proposed transportation facilities under the Virginia Department of Transportation's jurisdiction.

(signed) Bryan Scott McCormick (date) June 3, 1992

(title) Environmental Program Analyst

(agency) Virginia Department of Transportation

Encl

Received by:
Council on the Environment
MAY 27 1992

COMMONWEALTH of VIRGINIA

DEPARTMENT OF WASTE MANAGEMENT
11th Floor, Monroe Building
101 N. 14th Street
Richmond, VA 23219
(804) 225-2667
TDD (804) 371-8737

May 22, 1992

TO: Ms. Ellie Irons, Environmental Program Planner, Virginia Council on the Environment

THROUGH: Harry E. Gregori, Jr., AICP, Director
Office of Policy, Planning, and Public Affairs

FROM: Cathy L. Harris, Ph.D., Environmental Program Planner
SARA Title III/Waste Reduction Assistance Program

SUBJECT: EIS Review of "Navigation Study of York River Entrance Channel," by U.S. Army Corps of Engineers (Federal Project # 92-032F)

This is a proposal by the U.S. Army Corps of Engineers to dredge the mouth of the York River, in order to improve the navigability of the channel which serves such commercial facilities as the Amoco Yorktown Refinery, the Virginia Power Yorktown Electric Generating Plant, and such military facilities as the Coast Guard Reserve Training Center, the Yorktown Naval Weapons Station, and the Naval Supply Center at Cheatham Annex.

The necessity for this channel dredging is to improve navigability for ships that travel in the York River: ships loading/unloading petroleum product from the Yorktown refinery; ships bringing fuel to power the electric generating plant; and ships bringing fuel, stores, and ammunition to U.S. Navy ships.

Dredged materials (dredge spoils) will be deposited in the nearby "Wolf Trap (Alternate) Disposal Site" located in the Chesapeake Bay--- which already is the authorized placement area for dredged material resulting from the maintenance of the York Spit Channel, part of the Baltimore Harbor Channel system.

Staff reviewing the proposal have no objection to it, but wish to be apprised of any changes to the proposal, should this occur.

Encl

The project director is advised of the following:

1.) All solid wastes, all hazardous wastes, and all hazardous materials must be properly managed in accordance with all applicable federal, state, and local regulations; and,

2.) To the extent possible, solid wastes generated by this project should be reduced at the source, reused, or recycled, and hazardous wastes should be minimized.

Questions on these issues may be addressed to agency personnel as indicated on the attachment.

Attachment

Encl

List of Contact Persons in the Virginia Department of Waste Management
02/20/92

Solid Waste and Hazardous Waste Regulations

Dr. Wladimir (Walt) Gulevich
(804) 225-2466 or 225-2513

Inquiries about obtaining a U.S. EPA ID Number to Report under RCRA as a Hazardous Waste Generator/Small Quantity Generator

Mr. Stuart Ashton
(804) 225-2867 or 225-2667

Solid Waste Recycling

Mr. Steve Coe
(804) 225-2525
225-2667

Mr. Michael Murphy
(804) 225-3237
225-2667

Superfund/CERCLA

Mr. K.C. Das
(804) 225-2811

Inquiries about Waste Minimization/Pollution Prevention

Ms. Sharon Kenneally-Baxter
(804) 225-2581 or 225-2513

The Virginia Waste Minimization Clearinghouse

Ms. Sheila Sternberg
(804) 371-8716

SARA Title III, Emergency Planning and Community Right-to-Know

Mr. David Timberline
(804) 371-8904

Environmental Assessments

Mr. Berry Wright
(804) 371-2985 or 225-2667

Infectious Waste Management

Mr. Robert Wickline
(804) 225-2321 or 225-2667

General Office

The Virginia Department of Waste Management
11th Floor, Monore Building
101 N. 14th Street
Richmond, Virginia 23219 (804) 225-2667

Encl

During our initial review of the test bore data, it appeared that the dredge cutterhead would encounter beach quality sand at several locations along Area 2 of the entrance channel. Review of the vibracore sampling locations reveal that these deposits are deeper than those to be excavated, if dredging is limited to -39 feet at mean low water.

However, in the event sufficient quantities of sand are encountered, which can be practicably segregated and utilized for beach nourishment, every effort should be made to make this material available to localities expressing an interest therein. Insufficient information is provided in the draft assessment as to the location and volume of sand within the dredge prism to adequately address this question.

Hopefully, our comments will facilitate your review of this proposal. If additional information is deemed necessary, please feel free to contact us.

Sincerely,

David R. Knowles

David R. Knowles
Environmental Engineer

DRK/kmh
HM
CC: U.S. Army Corps of Engineers,
Attn: Mr. Robert Pretlow

Encl

NORFOLK DISTRICT RESPONSES TO MARINE RESOURCES COMMISSION COMMENTS OF JUNE 1, 1992

Comment 1. As noted in the draft report, VIMS recommends that overboard disposal not be permitted to reduce depths at the Wolf Trap Alternate Site to less than 9 meters. Analysis of the disposal area should be conducted periodically to ensure that the area retains it's ability to recolonize rapidly. A post dredge bathymetric survey of the Wolf Trap Site would facilitate the removal of those areas that are approaching 9 meter in depth from future use. Use of approved ocean disposal sites remains preferable to any expansion of the Wolf Trap Alternate Site.

Response 1. See response to Council on the Environment, Comment 2.

Comment 2. During our initial review of the test bore data, it appeared that the dredge cutterhead would encounter beach quality sand at several locations along Area 2 of the entrance channel. Review of the vibracore sampling locations reveal that these deposits are deeper than those to be excavated, if dredging is limited to -39 feet at mean low water.

However, in the event sufficient quantities of sand are encountered, which can be practicably segregated and utilized for beach nourishment, every effort should be made to make this material available to localities expressing an interest therein. Insufficient information is provided in the draft assessment as to the location and volume of sand within the dredge prism to adequately address this question.

Response 2. During the Plans and Specifications phase of this project, further investigations will be accomplished to document the location and quality of sand that will be dredged to provide the project dimensions. If, based on this information, the Commonwealth or any locality desires the placement of sand on beaches within the vicinity of the project, then the project cost estimate and implementation schedule would each be reviewed and revised as appropriate.

COMMONWEALTH of VIRGINIA
CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

R. Keith Bull
Executive Director

805 East Broad Street, Suite 701
Richmond, Virginia 23219

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

June 4, 1992

MEMORANDUM

To: Ms. Ellie Irons
Council on the Environment

From: Darryl M. Glover
Senior Environmental Engineer

Subject: Navigation Study - York River Entrance Channel
York County - Draft Environmental Assessment
Project # 92-032F

We have reviewed the draft environmental assessment for the proposed dredging of the York River entrance channel and overboard placement of material at the Wolf Trap Disposal Site in the Chesapeake Bay.

The proposed project will not impact any Resource Protection Areas. Impacts to aquatic habitat will be temporary. We have no objection to the proposal.

/dmg
Attachments:
c: Mr. C. Scott Crafton
Mr. Charlie Ellis, III, COE
Mr. Michael L. Smiley

eis:92-032F.ea

Encl

COMMONWEALTH of VIRGINIA

Hugh C. Miller, Director

Department of Historic Resources
221 Governor Street
Richmond, Virginia 23219

TDD (804) 786-1934
Telephone (804) 786-3143
FAX (804) 225-4261

June 8, 1992

R. C. Johns
Colonel, Corps of Engineers
District Engineer
Norfolk District
U.S. Army Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Re: Draft Project Report and Environmental Assessment
Navigation Study of York River Entrance Channel
York River, Virginia
VDHR File No. 92-1071-F

Dear Colonel Johns:

Thank you for providing us with a copy of the document referenced above. We have no comments on the draft report and EA at this time.

If you wish to discuss any future changes, please contact Ethel R. Eaton of our staff.

Thank you for your cooperation and assistance.

Sincerely,

Bruce J. Larson
Project Review Supervisor

cc. Ms. Ellie Irons
Mr. Robert Pretlow
Mr. Craig Seltzer

Encl

The College Of
WILLIAM & MARY

Wetlands Program

Virginia Institute of Marine Science
School of Marine Science
P.O. Box 1346
Gloucester Point, Virginia 23062
804/642-7380 Fax 804/642-7097

February 6, 1992

Mr. David Knowles
Environmental Engineer
Marine Resources Commission
P.O. Box 756
Newport News, Virginia 23607

RE: York Spit Dredging and Disposal

Dear David:

We have reviewed the subject proposal from a marine environmental perspective, including the input of Dr. Linda Schaffner who is currently monitoring the Wolf Trap alternate disposal area. Dr. Schaffner has been studying the resource value of the benthic populations both pre- and post-dredging in association with the deepening of Baltimore Harbor and associated channels.

Her research indicates fairly rapid recovery of total benthic populations at the Wolf Trap site over a 2 to 3 year time period. Indications are that the resource value of the area has been enhanced from its previous condition with the placement of dredged material. Recovery of benthic populations at the Rappahannock site has been even faster than that at Wolf Trap; being measured in months rather than years.

In summary, it is our opinion from a marine environmental perspective that the dredging of the York Spit channel is acceptable with disposal at the Wolf Trap alternate site. We would recommend a time-of-year restriction to protect the winter crab-dredge fishery.

If I may answer any questions regarding the contents of this letter, please let me know.

Sincerely yours,

Tom

Thomas A. Barnard, Jr.
Marine Scientist

TAB/jh (I:TAB.YSD)
CC: Craig Seltzer, Corps
Linda Schaffner, VIMS
EPA
SWCB
NMFS
Council Envir.
file

Encl

NORFOLK DISTRICT RESPONSES
TO VIRGINIA INSTITUTE OF MARINE SCIENCE
COMMENTS OF FEBRUARY 6, 1992

Comment 1. In summary, it is our opinion from a marine environmental perspective that the dredging of the York Spit channel is acceptable with disposal at the Wolf Trap alternate site. We would recommend a time-of-year restriction to protect the winter crab-dredge fishery.

Response 1. See response to Council on the Environment, Comment 1.

COMMONWEALTH of VIRGINIA
STATE WATER CONTROL BOARD

Richard N. Burton
Executive Director

P. O. Box 11143
Richmond, Virginia 23230-1143
(804) 527-5000
TDD (804) 527-4261

CERTIFICATION NO. 91-1487

401 CERTIFICATION
ISSUED TO

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

PURSUANT TO SECTION 401 OF THE CLEAN WATER ACT (33USC SECTION 1341)

The State Water Control Board hereby certifies, subject to the special conditions listed herein, that the proposed maintenance dredging of approximately 1,780,000 cubic yards of material from the York River Entrance Channel and placement of the dredged material in the Wolf Trap Disposal Site, Chesapeake Bay, Virginia, as specified in the application submitted to the Board on November 18, 1991 and completed on December 5, 1991, will comply with 1) the Virginia Water Quality Standards which became effective on July 20, 1970 and which are, as amended, in full force and effect under Section 303(a) of Public Law 95-217; 2) other applicable limitations, standards, regulations, and requirements in accordance with the State Water Control Law (Title 62.1-44.2 through 62.1-44.34 of the Code of Virginia (1950), as amended). The Board further certifies that there are no other limitations under Sections 301, 302, and 303 and there is not an applicable standard under Sections 306 or 307 of Public Law 95-217 presently in effect.

The applicant shall immediately notify the Board of any modification of this project and shall demonstrate in a written statement to the Board that said modification will not violate any conditions of this Certification. If such demonstration cannot be made, the applicant shall apply to the Board for a modification of this Certification.

This Certification, after proper hearing, is subject to revocation for failure to comply with the conditions herein. It is issued in accordance with the plans for the project and certifies that the applicant and the project contractor shall not violate the Water Quality Standards to accomplish the project. Any violation of the Water Quality Standards will be subject to abatement and control under the State Water Control Law.

4900 Cox Road, Innsbrook Corporate Center

This certification is valid providing the applicant complies with the following Special Conditions which are made a part of this Certification.

SPECIAL CONDITIONS

1. That all work shall be done in such a manner as to minimize sedimentation of State waters.

2. That all dredging shall be accomplished by hydraulic method.

3. That approximately 1,780,000 cubic yards of material is to be dredged from the York River Approach Channel and transported via hopper dredge for overboard, unconfined disposal at the Wolf Trap Disposal Site.

4. **That prior to the preparation of the bid package for the project, the Army Corps of Engineers shall provide written documentation to the State Water Control Board and the Department of Conservation and Recreation, Shoreline Programs Bureau detailing the availability and suitability of sand resulting from this project for beach nourishment, in order to comply with Section 10.1-704 of the Virginia Code.**

5. That the York River Approach Channel, through this dredging project, shall be returned to its original dimensions of approximately 11 miles long, 39 feet deep and a 750-foot wide (bottom width) over its entire length.

6. That there will be no double-handling of dredged materials in State Waters.

7. That, in protection of the winter crab-dredge fishery, that no dredging shall occur during this seasonally adjustable period. (The VMRC shall specify beginning and ending of the phase)

8. The conditions and limitations as specified in the application shall be adhered to during the life of the project.

9. The permittee shall advise the Executive Director in writing when unusual or potentially complex conditions are encountered which require debris removal or involve potentially toxic substances, and shall not take measures to remove the obstruction, material, or toxic substance, or change the location of the structure until written approval by the Executive Director or his authorized representative is received.

10. That the State Water Control Board's 401 Program staff shall be notified in writing 10 days prior to operations authorized under this Certificate are to begin so that staff inspections of the project can be planned if deemed necessary.

11. Failure to comply with the terms and conditions of this water quality certificate can result in enforcement actions against the permittee and/or the contractor.

12. Acceptance of these conditions does not relieve the applicant of liability for damages caused by violations of State Water Control Board Law or other State law.

13. In issuing this water quality certificate the State Water Control Board and the Commonwealth of Virginia does not assume any liability for the following:

    a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from Natural Causes.

    b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the Commonwealth of Virginia in the public interest.

    c. Damages to persons, property or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

    d. Design or construction deficiencies associated with the permitted project.

    e. Damage claims associated with any future modification, suspension, or revocation of this permit.

14. The use of this water quality certificate may be terminated, revoked and reissued, or requirement for certification waived, upon a finding by the Executive Director that such action would be in the general public interest. Such action shall be taken in accordance with the Commonwealth of Virginia State Water Control Board Regulations.

15. The Executive Director may re-evaluate his decision to require individual certification under this general water quality certificate at any time should the circumstances warrant. Circumstances that could require re-evaluation include, but are not limited to, the following:

a. The permittee fails to comply with the terms and conditions of this certificate.

b. The information provided by the applicant in support of the his/her permit application proves to have been false, incomplete, or inaccurate.

c. Significant new information surfaces which this office did not consider in reaching its original public interest decision to certify the permit.

Such an evaluation may result in a determination that it is appropriate to use the revocation and reissuance, modification, and termination procedures contained in Procedural Rule No. 3 or other subsequent regulation adopted by the State Water Control Board.

16. This water quality certificate, unless revoked and re-issued, terminated, modified or waived, will expire ten years from the date of issuance

By: _____ Date: 4/21/92
Richard N. Burton
Executive Director
State Water Control Board

WILLIAM A. PRUITT
Commissioner
ROBERT D. CRAFT
Chief, Administration and Finance
ROBERT W. GRABB
Chief, Habitat Management
ROBERT J. MARKLAND
Chief, Law Enforcement
JACK G. TRAVELSTEAD
Chief, Fisheries Management

COMMONWEALTH of VIRGINIA

Marine Resources Commission

P. O. Box 756
2600 Washington Avenue
Newport News, Virginia 23607-0756

ASSOCIATE MEMBERS
SIDNEY H. CAMDEN
Eastville, Virginia
GEORGE S. FORREST
Poquoson, Virginia
JOHN W. FREEMANSON
Hampton, Virginia
TIMOTHY G. HAYES
Richmond, Virginia
WILLIAM A. HUDNALL
Heathsville, Virginia
DONALD L. LIVERMAN, III
Virginia Beach, Virginia
PETER W. ROWE
Chesapeake, Virginia
JANE C. WEBB
Newport News, Virginia

May 8, 1992

Mr. Robert V. Ogle
Chief, Planning Division
U.S. Army Corps of Engineers
803 Front Street
Norfolk, Va. 23510-1096

RE: VMRC #91-1487

Dear Mr. Ogle:

Enclosed is the Marine Resources Commission permit for your proposal to place 1,780,000 cubic yards of dredge material generated from the maintenance dredging of the York River Entrance Channel into the 1,100 acre Wolf Trap Alternate Overboard Disposal Site in the Chesapeake Bay east of New Point Comfort and south of Wolf Trap Light.

A yellow placard is also enclosed. This placard reflects the authorized activities for inspection purposes and must be conspicuously displayed on the dredge during dredging and disposal. Failure to properly post the placard will be considered a violation of your permit conditions.

The work authorized by this permit is to be completed by March 31, 1995. All other conditions of the permit will remain in effect.

Sincerely,

Robert W. Grabb
Chief, Habitat Management

RWG/kmh
HM
Enclosure
cc: U. S. Army Corps of Engineers
York County Wetlands Board
Gloucester County Wetlands Board

TDD Information and Emergency Hotline 1-800-541-4646

MRC 30 - 317

VMRC # 91-1487
APPLICANT: U. S. Army Corps of Engineers

COMMONWEALTH OF VIRGINIA
MARINE RESOURCES COMMISSION
PERMIT

The Commonwealth of Virginia, Marine Resources Commission, hereinafter referred to as the Commission, on this 24th day of March 19 92, hereby grants unto U. S. Army Corps of Engineers
803 Front Street
Norfolk, Virginia, 23510-1096

hereinafter referred to as the Permittee, permission to:

XX Encroach in, on or over State-owned subaqueous bottoms pursuant to Section 62.1-3 of the Code of Virginia.

☐ Use or develop tidal wetlands pursuant to Chapter 2.1 of Title 62.1 of the Code of Virginia.

Permittee is hereby authorized to: Place 1,780,000 cubic yards of dredge material generated from the maintenance dredging of the York River Entrance Channel into the 1,100 acre Wolf Trap Alternate Overboard Disposal Site in the Chesapeake Bay east of New Point Comfort and south of Wolf Trap Light. All activities authorized herein, shall be

in conformance with the plans and drawings received October 11, 1991, and November 5, 1991 which are attached hereto and made a part of this permit.

This permit is granted subject to the following standard conditions:

(1) The work authorized by this permit shall be completed by March 31, 1995. The Permittee shall notify the Commission when the project has been completed. The completion date may be extended by the Commission in its discretion. Any such application for extension of time shall be in writing prior to the above completion date and shall specify the reason for such extension and the expected date of completion of construction. All other conditions remain in effect unless revoked by the Commission or the General Assembly.

(2) This permit grants no authority to the Permittee to encroach upon the property rights, including riparian rights, of others.

(3) The duly authorized agents of the Commission shall have the right to enter upon the premises at reasonable times, for the purposes of inspecting the work being done pursuant to this permit.

(4) The Permittee shall comply with the water quality standards as established by the Virginia Water Control Board and all other applicable laws, ordinances, rules and regulations affecting the conduct of the project. The granting of this permit shall not relieve the Permittee of the responsibility of obtaining any and all other permits or authority for the project.

(5) This permit shall not be transferred without written consent of the Commissioner.

(6) This permit shall not affect or interfere with the right vouchsafed to the people of Virginia concerning fishing, fowling and the catching of and taking of oysters and other shellfish in and from the bottom of areas and waters not included within the terms of this permit.

(7) The Permittee shall, to the greatest extent practicable, minimize the adverse effects of the project upon adjacent properties and wetlands and upon the natural resources of the Commonwealth.

(8) This permit may be revoked at any time by the Commission upon the failure of the Permittee to comply with any of the terms and conditions hereof or at the will of the General Assembly of Virginia.

(9) There is expressly excluded from the permit any portion of the waters within the boundaries of the Baylor Survey.

(10) This permit is subject to any lease of oyster planting ground in effect on the date of this permit. Nothing in this permit shall be construed as allowing the Permittee to encroach on any lease without the consent of the leaseholder. The Permittee shall be liable for any damages to such lease.

(11) The issuance of this permit does not confer upon the Permittee any interest or title to the beds of the waters.

(12) All structures authorized by this permit which are not maintained in good repair shall be completely removed from State-owned bottom within three (3) months after notification by the Commission.

(13) The Permittee agrees to comply with all of the terms and conditions as set forth in this permit and that the project will be accomplished within the boundaries as outlined in the plans attached hereto. Any encroachment beyond the limits of this permit shall constitute a Class 1 misdemeanor.

(14) This permit authorizes no claim to archaeological artifacts which may be encountered during the course of construction. If, however, archaeological remains are encountered, the Permittee agrees to notify the Commission, who will, in turn, notify the Virginia Division of Historic Landmarks. The Permittee further agrees to cooperate with agencies of the Commonwealth in the recovery of archaeological remains if deemed necessary.

[illegible]

PERMITTEE—WHITE COPY
COMMISSION—YELLOW COPY
CORPS OF ENGINEERS—PINK COPY

Appendix D

The following special conditions are imposed on this permit:

(15) If any loss or damage to the Commonwealth is caused by or contributed to, in whole or in part, by the Permittee arising from the establishment, operation, or maintenance of said project, the liability of the Permittee therefore shall be determined in accordance with the applicable provisions of the Federal Tort Claims Act of August 2, 1946, as amended.

(16) The yellow placard accompanying this permit document must be conspicuously displayed at the work site throughout the construction phase of the authorized activity.

(17) No overboard disposal of dredged material shall be performed during the period from November 15 through March 30 of any calendar year in order to minimize potential impacts to overwintering blue crabs and the crab dredge fishery.

PERMITTEE—WHITE COPY
COMMISSION—YELLOW COPY
CORPS OF ENGINEERS—PINK COPY

VMRC # 91-1487

A permit issuing fee of $100.00

and a royalty of Exempt

for the N/A

for a total of $100.00 is due and payable upon return of this document signed by the Permittee. This permit consists of five (5) sheets.

PERMITTEE

Permittee's signature is affixed hereto as evidence of acceptance of all of the terms and conditions herein.

In cases where the Permittee is a corporation, agency or political jurisdiction, please assure that the individual who signs for the Permittee has proper authorization to bind the organization to the financial and performance obligations which result from activity authorized by this permit.

PERMITTEE

Accepted for U. S. Army Corps of Engineers

day of 28 April, 1992 By [signature]

(Name) (Title)

Robert V. Ogle, P.E. Chief, Planning Division

State of Virginia

City (or County) of Norfolk, to-wit:

I, Peggy R. Pulington a Notary Public in and for said City (or County) and State hereby certify that Robert V. Ogle Permittee, whose name is signed to the foregoing, has acknowledged the same before me in my City (or County) and State aforesaid.

Given under my hand this 28 day of April, 1992

Notary Public Peggy R. Pulington

My commission expires on the 30 day of November, 1994

COMMISSION

IN WITNESS WHEREOF, the Commonwealth of Virginia, Marine Resources Commission has caused these presents to be executed in its behalf by

Robert W. Grabb, Chief, Habitat Management

(Name) (Title)

MARINE RESOURCES COMMISSION

8th day of May 19 92 By [signature]

State of Virginia

City of Newport News, to-wit:

I, Karen M. Hall a Notary public within and for said City, State of Virginia, hereby certify that Robert W. Grabb whose name is signed to the foregoing, bearing the 24th day of March 19 92, has acknowledged the same before me in my City aforesaid.

Given under my hand this 8th day of May, 1992

Notary Public Karen M. Hall

My commission expires on the 31st day of October, 1996

PERMITTEE—WHITE COPY
COMMISSION—YELLOW COPY
CORPS OF ENGINEERS—PINK COPY

COMMONWEALTH of VIRGINIA

STATE WATER CONTROL BOARD

Richard N. Burton
Executive Director

P. O. Box 11143
Richmond, Virginia 23230-1143
(804) 527-5000
TDD (804) 527-4261

June 12, 1992

Colonel R. C. Johns
Department of the Army
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, Virginia 23510-1096

Re: Draft Detailed Project Report and Environmental Assessment for the Navigation Study of York River Entrance Channel York River, Virginia

Dear Colonel Johns:

We have received and reviewed the Draft Detailed Project Report and Environmental Assessment for the Navigation Study of York River Entrance Channel. Since we have issued a 401 certificate for this project, our comments will essentially reiterate the conditions as outlined in the 401 certificate.

The Corps of Engineers shall follow and adhere to the conditions of the 401 certificate as agreed. All dredging shall be accomplished by hydraulic method with the dredge material being transported via hopper dredge to the Wolf Trap Disposal site for overboard, unconfined disposal. There must be no double handling of the dredge material. All dredging and disposal must remain within the boundaries as indicated in the 401 certificate. The Virginia Marine Resources Commission's time-of-year restriction for dredge disposal shall be strictly adhered to in order to minimize impacts to overwintering blue crabs and the crab dredge fishery. Any deviations from the conditions outlined in the 401 certificate must be reported in writing to the Executive Director of the Virginia Water Control Board.

There is one item not addressed in the 401 certificate that does appear to warrant some consideration. Not all of the dredged sediments are compatible with the sediments at the Wolf Trap Disposal Site. The Wolf Trap Disposal Site is mostly characterized

by fine and very fine sand particles, possibly indicating a higher energy area incapable of accumulating smaller silt and clay particles. The sediments from the York Entrance Channel occur in two different depositional areas. Area 1 is characterized by low-energy, soft, saturated, high-plastic clays, and Area 2 is characterized by a highly variable make-up due to a more energetic and varied placement environment, ranging from soft, high-plastic clays to 99 percent sand. In a higher energy area like the Wolf Trap Disposal Site, the finer sediments (clays and silts) could potentially remain in suspension and be carried by the current out of the Wolf Trap Disposal Site. The Corps of Engineers should address this concern in the final project plan.

We appreciate the opportunity to comment on the Draft Detailed Project Report and Environmental Assessment for this project. If we can be of any further assistance, please feel free to contact Mr. Leo Snead, 804/527-5274), Mr. David Byrd, 804/527-5024), or me at 804/527-5244.

Sincerely,

Tracey E. Harmon

Tracey E. Harmon
Environmental Specialist Senior-Field
Office of Water Resources Management

cc: Leo C. Snead, Jr.
Chester C. Bigelow, III
Robert F. Jackson, TRO

NORFOLK DISTRICT RESPONSES TO STATE WATER CONTROL BOARD COMMENTS OF JUNE 12, 1992

Comment 1. The Corps of Engineers shall follow and adhere to the conditions of the 401 certificate as agreed. All dredging shall be accomplished by hydraulic method with the dredge material being transported via hopper dredge to the Wolf Trap Disposal site for overboard, unconfined disposal. There must be no double handling of the dredge material. All dredging and disposal must remain within the boundaries as indicated in the 401 certificate. The Virginia Marine Resources Commission's time-of-year restriction for dredge disposal shall be strictly adhered to in order to minimize impacts to overwintering blue crabs and the crab dredge fishery. Any deviations from the conditions outlined in the 401 certificate must be reported in writing to the Executive Director of the Virginia Water Control Board.

Response 1. A request has been submitted to VMRC for an abbreviated time-of-year restriction. See response to Council on the Environment, Comment 1. The Corps will adhere to all conditions of the 401 Certificate as agreed.

Comment 2. There is one item not addressed in the 401 certificate that does appear to warrant some consideration. Not all of the dredged sediments are compatible with the sediments at the Wolf Trap Disposal Site. The Wolf Trap Disposal Site is mostly characterized by fine and very fine sand particles, possibly indicating a higher energy area incapable of accumulating smaller silt and clay particles. The sediments from the York Entrance Channel occur in two different depositional areas. Area 1 is characterized by low-energy, soft, saturated, high-plastic clays, and Area 2 is characterized by a highly variable make-up due to a more energetic and varied placement environment, ranging from soft, high-plastic clays to 99 percent sand. In a higher energy area like the Wolf Trap Disposal Site, the finer sediments (clays and silts) could potentially remain in suspension and be carried by the current out of the Wolf Trap Disposal Site. The Corps of Engineers should address this concern in the final project plan.

Response 2. Approximately 15 million cubic yards of dredged material were placed in the Wolf Trap Disposal Site as a result of the

dredging of the York Spit Channel between 1987 and 1989. The fact that the Wolf Trap Site is characterized primarily by fine and very fine sand is more of an indication of the type of sediment that was placed there as a result of that dredging project and less of an indication of a high-energy area incapable of accumulating smaller silt and clay particles. The material to be dredged from the York River Entrance Channel consists mainly of coarse clay and fine sand. The Wolf Trap Site is very large, approximately 7 square miles, and it is believed that, even when considering currents through the site, there is sufficient area to allow for the settling of the coarse clay portion of the material that would be dredged from the York River Entrance Channel.

The College Of
WILLIAM & MARY

Virginia Institute of Marine Science
School of Marine Science

PO Box 1346
Gloucester Point VA 23062-1346
804/642-7000, Fax 804/642-7097, Scan 642-7000

Chartered 1693

July 1, 1992

Colonel R. C. Johns
District Engineer, Norfolk District
Corps of Engineers
803 Front Street
Norfolk, Virginia 23510-1096

Re: York River Entrance Channel Maintenance Dredging

Dear Colonel Johns:

Following receipt of your letter to Dr. Taylor (6/25/92), we have held internal discussions on the impact of the proposed time restrictions on dredging/placement. We understand your concern. As you know, our role is to provide advice to management and regulatory agencies and the comments provided here are offered in that sense.

Both the overwintering activity of blue crabs and the residence of sea turtles in the Bay are cued by water temperature. In the case of blue crabs, settlement into the substrate is thought to occur when water temperatures fall to the range of 10° to 5°. Sea turtles tend to leave the Bay when water temperatures drop to about 18°C to 15°C. The respective restriction windows, 15 November through 30 March (blue crabs) and mid-May through mid-November (sea turtles) are cast as time periods when the respective water temperatures may pertain.

As we see the situation, there are a number of options available for consideration. Some of these may not be feasible in whole or in part, but all appear to be worthy of examination by the regulatory agencies involved.

We see the following options:

1. Reduce the time-of-year restrictions on both ends for both turtles and the winter crab dredge fishery to the minimum necessary to protect the resources and produce a suitable dredging window.

2. Publicize that the York channel will be dredged during the winter of any given year and allow the resource in the channel and disposal sites to be exploited to the maximum extent necessary ahead of the dredging.

VIMS

3. Utilize a dredge plant other than a hopper dredge during the time period when turtle mortalities due to dredging are potentially significant.

4. Deploy a trawl in advance of the dredge to remove turtles from the dredge path as is being done in areas south of Virginia.

5. If dredging goes beyond the mid-May date, monitor turtle mortality due to dredging to determine if dredging has the same impacts to the Chesapeake Bay turtle population as has been seen in more southern areas.

6. Utilize any intrusion of the dredging operation beyond 15 May to field test new methods of reducing turtle mortality due to hopper dredges. It is our understanding that WES is studying this issue.

I believe that the state and federal agencies involved can utilize one or more of these options to accommodate protection of the resources as well as maintenance of the York River entrance channel. We will be happy to contribute in any way we can.

Sincerely,

Robert J. Byrne

Robert J. Byrne
Acting Dean and Director;
Associate Director for Research

RJB:dfp

cc: Robert Grabb, VMRC
Thomas Barnard, VIMS
Linda Schaffner, VIMS
John Keinath, VIMS

COMMONWEALTH of VIRGINIA

Virginia Port Authority
600 World Trade Center
Norfolk, Virginia 23510
Cable Address Vastports
Telephone (804) 683-8000
Telecopier (804) 683-8500
TWX 710 8811231

BOARD OF COMMISSIONERS

J. Robert Bray
Executive Director

March 22, 1990

Colonel Joseph J. Thomas
District Engineer
U.S. Army Corps of Engineers
Fort Norfolk
803 Front Street
Norfolk, VA 23510-1096

Dear Colonel Thomas:

This letter is written in further response to your October 16, 1989, letter concerning improvements to the York River Entrance Channel. In that letter, you indicated that the Norfolk District is currently re-evaluating the needs of the York River users and will require a local sponsor to continue that study effort under Section 107 of the 1960 River and Harbor Act, as amended. The Virginia Port Authority would meet the necessary local sponsor requirements and has been asked to consider study sponsorship.

This is to advise you that the Virginia Port Authority will consent to serve as the study sponsor for the York River Entrance Channel study. This consent is based on my understanding that, although the Section 107 authority normally requires that the local sponsor share in the cost of a study, no cost sharing would be required on the York River study because much of your study effort has already been accomplished and the remaining effort can be completed for $40,000, or less.

With regard to cost sharing on construction, in accordance with the Water Resources Development Act of 1986, the Virginia Port Authority will evaluate the results of the study before making any commitments.

We appreciate your continued efforts on this study. Please call me if I can be of further assistance.

Yours very truly,

J. Robert Bray
Executive Director

djm

cc: Hon. Lawrence H. Framme, III
Secretary of Economic Development

HAMPTON ROADS
PLANNING DISTRICT COMMISSION

REBA S. McCLANAN, CHAIRMAN • ROBERT M. MURPHY, VICE CHAIRMAN • ROBERT G. BAGLEY, TREASURER
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Robert J. O'Neill, Jr., City Manager

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O.A. Spady, Board of Supervisors
Myles E. Standish, County Administrator

JAMES CITY COUNTY
David B. Norman, County Administrator
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Edgar E. Maroney, City Manager

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Joseph A. Leafe, Mayor
James B. Oliver, Jr., City Manager
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James K. Spore, City Manager

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John Hodges, Mayor
Jackson C. Tuttle, II, City Manager

YORK COUNTY
Paul W. Garman, Board of Supervisors
Daniel M. Stuck, County Administrator

June 19, 1992

Colonel R.C. Johns, District Engineer
Department of the Army
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Re: York River Entrance Channel
Dredging (WAW:YORK)

Dear Colonel Johns,

Pursuant to your request of May 14, 1992, the staff of the Hampton Roads Planning District Commission has reviewed the ***Draft Detailed Project Report and Environmental Assessment: Navigation Study of the York River Entrance Channel,*** prepared by the United States Army Corps of Engineers. We have also contacted York County and James City County concerning this matter.

The HRPDC believes that the dredging of the York River Entrance Channel is important for strategic military purposes and necessary for the continued economic well being of the area. We support the comments of York County and strongly recommend close assessment of the County's mention of the "Thorofare" (sic) dredging. A copy of the County's response is enclosed with this letter.

In September of 1990, the US Navy held two siting hearings concerning the homeporting of its new class of supply ship, the AOE-6. One of the four remaining candidate sites at that time was the Yorktown Naval Weapons Station. A decision on the ultimate siting of these ships has not yet been announced, however, the possibility of two of these ships being homeported at the Yorktown NWS should not be overlooked. The AOE-6 has a maximum draft of 39 feet, making it too deep a vessel to reach the Yorktown NWS through the existing channel. The AOE-6, if homeported at the Yorktown NWS, is expected to remain fully fueled and stored for strategic deployment. We would encourage the consideration of this possibility prior to the finalizing of any dredging plan.

HEADQUARTERS • THE REGIONAL BUILDING • 723 WOODLAKE DRIVE • CHESAPEAKE, VIRGI
PENINSULA OFFICE • HARBOUR CENTRE, 2 EATON STREET • SUITE 502 • HAMPTON, VIRGI

Finally, it is the opinion of the HRPDC staff that the York River Dredging Project is consistent with local and regional plans. We appreciate the opportunity to review this project and hope that our comments are of assistance to you. If you have any questions, please give Todd Grissom or John Carlock a call at (804) 420-8300.

Sincerely,

Arthur L. Collins
Executive Director/Secretary

TAG:dls
Enclosure
cc: Ms Ellie Irons, Council on the Environment
Ms. Cindy Taylor, York County

NORFOLK DISTRICT RESPONSES TO HAMPTON ROADS PLANNING DISTRICT COMMISSION COMMENTS OF JUNE 19, 1992

Comment 1. In September of 1990, the U.S. Navy held two siting hearings concerning the homeporting of its new class of supply ship, the AOE-6. One of the four remaining candidate sites at that time was the Yorktown Naval Weapons Station. A decision on the ultimate siting of these ships has not yet been announced, however, the possibility of two of these ships being homeported at the Yorktown NWS should not be overlooked. The AOE-6 has a maximum draft of 39 feet, making it too deep a vessel to reach the Yorktown NWS through the existing channel. The AOE-6, if homeported at the Yorktown NWS, is expected to remain fully fueled and stored for strategic deployment. We would encourage the consideration of this possibility prior to the finalizing of any dredging plan.

Response 1. The Norfolk District has maintained coordination with the Navy throughout the study process in an effort to stay up-to-date on the Navy's existing and future channel requirements. Based on those requirements identified by the Navy during the conduct of the District study and those of the commercial channel users, it was determined that a 37-foot project best served the needs of the waterway users. The District staff has been aware of the Navy's investigations regarding the homeporting of the AOE-6 vessel; however, detailed evaluation of this potential on the York River has not been accomplished because a final decision has not been reached by the Navy because limited information was available during the accomplishment of the District study. The AOE-6 vessel, with a maximum draft of 39 feet, would require a channel of approximately 43 feet mean low water to provide the 3.5-foot underkeel clearance determined by Corps investigations to be necessary for safe and efficient navigation. The cost for such a project would be greater than $40 million and would not be justified on the basis of the commercial benefits that would be received. The cost of implementation of the channel increment between 37 feet and 43 feet would, therefore, be the responsibility of the Navy. The District is available to discuss this further with the Navy if the York River is selected as a homeport site for the AOE-6 vessel.

COUNTY OF YORK

COUNTY ADMINISTRATOR
Daniel M. Stuck

JUN 1992
RECEIVED
HRPDC

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BOARD OF SUPERVISORS
Mary F. Sinclair
District 1
Dennis F. Gardner
District 2
Paul W. Garman
District 3
James W. Funk
District 4
Jere M. Mills
District 5

VIRGINIA

June 16, 1992

R. C. Johns
Colonel, Corps of Engineers
District Engineer
803 Front Street
Norfolk, Virginia 23510-1096

Dear Colonel Johns:

RE: Navigation Study of York River Entrance Channel

York County has reviewed the Draft Detailed Project Report and the Environmental Assessment on the "Navigation Study of York River Entrance Channel, York River, Virginia" and offers the following comments:

- The County applauds the efforts of the Corps of Engineers to keep the York River navigable for strategic military purposes. The Coast Guard Reserve Training Center, the Yorktown Naval Weapons Station, and the Naval Supply Center at Cheatham Annex are an integral part of the York County community, providing jobs for area residents and jointly participating in many County projects. Dredging the York River channel to provide appropriate depths for large draft vessels ensures the continued operation of these military bases.

- The County also appreciates the needs of commercial vessels that use the York River for transporting crude oil and fuel oil to the Amoco Oil Refinery and the Virginia Power Yorktown Electric Generating Plant. These industries contribute to the economic well-being of the County. Providing petroleum deliveries through overland routes could significantly affect the production of electricity and refined oil as well as increasing operation costs. We support the proposed dredging project as it is designed to enhance water delivery routes to these industries.

- In addition to the water-dependent industries mentioned in the report, the tourist industry is important to York County. One of the most significant tourist attractions in the County is the historical area of Yorktown where the waterfront is active with visitors, commercial and recreational boaters, and recreational swimmers. The report does not indicate the anticipated timing for dredging within the vicinity of Yorktown. However, the time frame between Memorial Day and Labor Day should be avoided if possible. Even with the proposed hydraulic method of dredging where suspended sediments should

HW:YOTZK

224 Ballard Street • P.O. Box 532 • Yorktown, Virginia 23690-0532 • (804) 890-3320

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be minimal, the County would prefer that the dredging not occur during the summer tourist season.

- Recognizing that VIMS has reviewed the draft Environmental Assessment and found "no significant adverse impacts to wetlands habitats," it is assumed that the Goodwin Islands which are part of the National Estuarine Research Reserve System, will be affected only minimally or not at all from the proposed dredging. York County supports the Corps efforts to protect this nationally recognized marine habitat.

On a related note, I would like to mention that for several years York County has been exploring, in conjunction with the Corps, options for dredging a channel adjacent to the York River which is known as "The Thorofare." Over time, this channel between Goodwin Islands and the Dandy section of York County has silted in so that it is difficult to navigate even at high tide. An existing commercial marina (Belvin Marine) located on the channel as well as recreational and commercial boaters would benefit from the channel improvements provided by the dredging. Up to this point, the major obstacle to dredging this area has been the inability of the County to find a suitable spoil disposal site as required under the Corps' channel dredging prerequisites. Given your current proposal to dredge the York River Channel Entrance and the proximity of that work to the Thorofare, we would appreciate knowing whether the Wolf Trap site could be used and, if so, whether the Thorofare project could be scheduled.

Thank you for the opportunity to comment on this very thorough report and assessment. If York County can provide any further input, or if there is potential for resurrecting the Thorofare project, please do not hesitate to contact me at (804) 890-3320.

Sincerely,

Daniel M. Stuck
County Administrator

CST:cdc

Attachment

Copy to: Martin Fisher
Art Collins, HRPDC
Ellie Irons, Council on the Environment
J. Mark Carter

YORK
RIVER
WORMLEY CREEK
BELVIN
Goodwin
NECK
Goodwin Neck Estates
MILLS
Creek
HUDGINS
Back
Seaford
CRAB
Seaford Shores
Chisman
Creek
FISH
NECK

NORFOLK DISTRICT RESPONSES TO COUNTY OF YORK ADMINISTRATOR COMMENTS OF JUNE 16, 1992

Comment 1. In addition to the water-dependent industries mentioned in the report, the tourist industry is important to York County. One of the most significant tourist attractions in the County is the historical area of Yorktown where the waterfront is active with visitors, commercial and recreational boaters, and recreational swimmers. The report does not indicate the anticipated timing for dredging within the vicinity of Yorktown. However, the time frame between Memorial Day and Labor Day should be avoided if possible. Even with the proposed hydraulic method of dredging where suspended sediments should be minimal, the County would prefer that the dredging not occur during the summer tourist season.

Response 1. The portion of the selected plan requiring dredging is that portion within the limits of the existing York River Entrance Channel which at its closest point is greater than 5 miles from Yorktown. No dredging would be accomplished in the vicinity of Yorktown.

Comment 2. Recognizing that VIMS has reviewed the Draft Environmental Assessment and found "no significant adverse impacts to wetlands habitats," it is assumed that the Goodwin Islands which are part of the National Estuarine Research Reserve System, will be affected only minimally or not at all from the proposed dredging. York County supports the Corps efforts to protect this nationally recognized marine habitat.

Response 2. No impact to the Goodwin Islands is anticipated.

Comment 3. On a related note, I would like to mention that for several years York County has been exploring, in conjunction with the Corps, options for dredging a channel adjacent to the York River which is known as "The Thorofare." Over time, this channel between Goodwin Islands and the Dandy section of York County has silted in so that it is difficult to navigate even at high tide. An existing commercial marina (Belvin Marine) located on the channel as well as recreational and commercial boaters would benefit from the channel improvements provided by the dredging. Up to this point, the major

obstacle to dredging this area has been the inability of the County to find a suitable spoil disposal site as required under the Corps' channel dredging prerequisites. Given your current proposal to dredge the York River Channel Entrance and the proximity of that work to the Thorofare, we would appreciate knowing whether the Wolf Trap site could be used and, if so, whether the Thorofare project could be scheduled.

Response 3. The Thorofare is an existing Operations and Maintenance (O&M) navigation project known officially as the "Channel Connecting York River, Virginia with Back Creek to Slaights Wharf." The District has been working with York County for a number of years on finding a suitable dredged material placement site for the maintenance of the project. The material within the channel is mostly sand and the District has encouraged the county to find a beneficial use for the material, such as beach nourishment, within a reasonable distance from the channel. The transport distance from the Thorofare to the Wolf Trap Site is far too great, 16 miles, to be economical for a small O&M project.

Amoco Transport Company
200 East Randolph Drive
Post Office Box 8368
Chicago, Illinois 60680-0368
Fax: 312-856-4553
Telex: 190219
Cable: AMOCOSHIPS

16 June, 1992
Department of the Army
Norfolk District
Corps of Engineers
Fort Norfolk,
803 Front Street
Norfolk VA 23510-1096

Attention: Colonel R. C. Johns, District Engineer

Reference: Draft Detailed Project Report and environmental Assessment on the "Navigation Study of the York River Entrance Channel, York River, VA."

Gentlemen:

We are in receipt of the above captioned report and would offer the following comments:

The "New" berth was designed and constructed to accommodate Amoco's "150's" which are 155,869 deadweight tonnes, 919.2 feet length overall, a beam of 175.9 feet, and a fully laden draft of 50' 04". At a draft of 38 feet, this class of vessel would have a deadweight of nearly 106,000 tonnes, or approximately 100,000 to 103,000 M/T of cargo.

The configuration of Amoco's fleet has changed in recent years, and the 75,000 Dwt. vessels drawing 44.25 feet have been replaced by modern 81,274 MT Dwt. vessels with a maximum draft of 38.76 feet fully laden. The impact of OPA 90 on vessels serving must be considered in conjunction with historic traffic patterns on this route, as it has created a trend for wider, shallow draft vessels with segregated ballast as replacement for older, narrower, deeper draft vessels. It is therefore recommended that you should consider 80,000 Dwt. vessels with a maximum draft of 39-40 feet, an L.O.A. of 765-775 feet, and a beam of 145 feet be used as a basis for your considerations.

Amoco's 40,000 Dwt. vessels are 632 feet L.O.A., 105 feet beam, with a draft of 32 feet.

The transhipment of cargoes in the Caribbean is a viable alternative only when the needs of a minimum two reception

facilities are met.

While minor, we would also note that the CSX system is utilized by the refinery in lieu of the Chessie system.

In appendix B, page 3 paragraph 5, the government no longer has import allocations.

When the available crude oil shore tankage segregations are taken into consideration, the maximum size cargo desirable at Yorktown would be in the 500-700,000 barrel range; that is to say, a light loaded 150M Dwt. vessel would be the largest vessel to be considered for discharge at Yorktown in the foreseeable future.

With regard to your separate query on maintenance costs for the docks, there has been no maintenance dredging effected since the dock was built in the early 1980's.

We hope that the foregoing is of assistance to you and we look forward to your final report. Should you require any additional information, please do not hesitate to contact us.

Very Truly Yours,

C. E. Heliker
Port Captain

cc: L. McVay, Manager, Amoco Oil Co., Yorktown
P. F. Rooney, Amoco Oil Co., Yorktown
J. M. Norausky
E. M. Kelly
F. A. Milanesio
P. F. Skelton
S. E. Clark

NORFOLK DISTRICT RESPONSES TO AMOCO TRANSPORT COMPANY COMMENTS OF JUNE 16, 1992

Comment 1. The configuration of Amoco's fleet has changed in recent years, and the 75,000 Dwt. vessels drawing 44.25 feet have been replaced by modern 81,274 MT Dwt. vessels with a maximum draft of 38.76 feet fully laden. The impact of OPA 90 on vessels serving must be considered in conjunction with historic traffic patterns on this route, as it has created a trend for wider, shallow draft vessels with segregated ballast as replacement for older, narrower, deeper draft vessels. It is therefore recommended that you should consider 80,000 Dwt. vessels with a maximum draft of 39-40 feet, an L.O.A. of 765-775 feet, and a beam of 145 feet be used as a basis for your considerations.

Response 1. The variations is vessel size were accounted for in the sensitivity analysis contained in appendix B. The changes suggested would not change the formulation process presented in the report or change the selection of the recommended project.

Comment 2. Amoco's 40,000 Dwt. vessels are 632 feet L.O.A., 105 feet beam, with a draft of 32 feet.

The transhipment of cargoes in the Caribbean is a viable alternative only when the needs of a minimum two reception facilities are met.

While minor, we would also note that the CSX system is utilized by the refinery in lieu of the Chessie system.

In appendix B, page 3, paragraph 5, the government no longer has import allocations.

When the available crude oil shore tankage segregations are taken into consideration, the maximum size cargo desirable at Yorktown would be in the 500-700,000 barrel range; that is to say, a light loaded 150 Dwt. vessel would be the largest vessel to be considered for discharge at Yorktown in the foreseeable future.

Response 2. The comments are noted and the report has been revised as deemed appropriate.

Comment 3. With regard to your separate query on maintenance costs for the docks, there has been no maintenance dredging effected since the dock was built in the early 1980's.

Response 3. Appendix B has been revised to exclude the reference to Federal import allocations.

Hampton Roads Maritime Association
INCORPORATED

228-236 E. PLUME STREET
P. O. BOX 3487
NORFOLK, VIRGINIA 23514-3487
PHONE (804) 622-2639
FAX (804) 622-6302

President's E Award for Export Service

July 17, 1992

Colonel R. C. Johns, District Engineer
U. S. Army Corps of Engineers
803 Front Street
Norfolk, Virginia 23510

Dear Colonel Johns:

Hampton Roads Maritime Association (HRMA) wishes to go on record in support of the York River Entrance Channel Project. HRMA concurs with the need to increase the navigational efficiency and safety of the existing channel to better serve the commercial and military users of the York River.

Currently, crude oil, fuel oil and petroleum products are transported into the York River in tankers, ranging in size from 35,000 DWT to 150,000 DWT with maximum load drafts between 37 and 51 feet. The current controlling depth forces vessels to light load in order to safely navigate channels. Since these vessels are unable to enter the York River fully loaded, much of the transportation benefits associated with their size are lost. Therefore, the more efficient movement of oil should result in significant savings in the form of reduced transportation costs.

Hampton Roads Maritime Association supports the deepening of the York River Entrance Channel and would be pleased to offer additional comments if so requested. Additionally, our Harbor-Anchorage-Dredging Committee has reviewed this issue in the past and strongly endorses this project.

Sincerely yours,

W. S. Hull

W. S. HULL
Chairman, Harbor-Anchorage
Dredging Committee

WSH/dwp

COMMONWEALTH of VIRGINIA

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Virginia Port Authority
600 World Trade Center
Norfolk, Virginia 23510
Cable Address Vastports
Telephone (804) 683-8000
Telecopier (804) 683-8500
TWX 710 8811231

J. Robert Bray
Executive Director

July 23, 1992

Colonel Richard C. Johns
District Engineer, Norfolk District
U.S. Army Corps of Engineers
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510-1096

Dear Colonel Johns:

The Virginia Port Authority has reviewed the Draft Detailed Project Report and Environmental Assessment dated May 1992 for the proposed navigation project at the entrance to the York River, Virginia. We support the implementation of the selected plan which consists of the modification of the Federal project on the York River to include further improvement of the entrance channel under Section 107 of the 1960 River and Harbor Act, as amended, to an authorized depth of 37 feet and width of 750 feet.

We have reviewed and understand that the Port Authority's estimated share of the cost of the construction of the project is $1,715,000 with the Federal government's share estimated at $3,185,000, for a total project construction cost of $4,900,000. Of the $1,715,000, $1,225,000 is the initial estimated contribution required during project construction, while the remaining $490,000 is the contribution required at the end of construction or overtime, up to 30 years, with interest. The Federal government will bear 100 percent of the cost of project operation and maintenance over the 50-year life of the project.

Implicit in our statement of support for the selected plan is a willingness to, prior to project construction, enter into a Local Cooperation Agreement (LCA) with the Federal government. We understand the project cost sharing requirements contained in the Water Resources development Act of 1986 (Public Law 99-662), as

amended, and intend to provide all required items of local cooperation prior to project construction in accordance with the Act.

With the foregoing in mind, I am authorized to advise you that it is the intent of the Commonwealth of Virginia to provide the items of local cooperation as detailed in the LCA with the understanding that the expenditure of state funds in accordance with the provisions thereof will be dependent upon authorization by the Virginia General Assembly and Governor and that the tender of such funds to the United States will be pursuant to valid statutory and regulatory authority which is in the effect at such time as the written agreement between the Commonwealth of Virginia and the Corps of Engineers is executed.

We appreciate the opportunity to comment on the project report and Environmental Assessment. Please call me if I can be of further assistance in moving this project closer to implementation.

Yours very truly,

J. Robert Bray
Executive Director

cc: Robert R. Merhige, III

JOH82723

Virginia Pilot Association

TELEPHONE: 804-496-0995
CABLE ADDRESS: VAPILOT

3329 SHORE DRIVE
VIRGINIA BEACH, VIRGINIA 23451

July 29, 1992

R. C. Johns, Colonel
Army Corps of Engineers
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510

Dear Colonel Johns:

After reviewing the "Navigation Study of York River Entrance Channel," we, the Virginia Pilot Association along with Amoco Transportation Company, agree with your selected plan of a 37' project depth plus a 1' over dredge of the York River entrance channel.

Sincerely,

Robert H. Dozier, III
Vice President

RHD/kg

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Northeast Region
Habitat and Protected
Resources Division
One Blackburn Drive
Gloucester, MA 01939-2298

October 5, 1992

Robert V. Ogle, P.E.
Chief, Planning Division
Department of the Army
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front St.
Norfolk, VA 23510-3097

Dear Mr. Ogle:

We have received the Environmental Assessment (EA) on the Navigation Study of the York River, Virginia, Entrance Channel and your letter of September 21, 1992 requesting initiation of formal consultation, pursuant to Section 7 of the Endangered Species Act of 1973, as amended (ESA). Our preliminary review of the EA indicates it may contain sufficient information to be considered an ESA Biological Assessment, although further information may be needed. The ESA regulations implementing Section 7 (50 CFR § 402.14) allow 90 days for formal consultation to occur, and an additional 45 days for the National Marine Fisheries Service to issue a Biological Opinion. If we need any additional information or an extension of the consultation period we will coordinate with your office.

Please call Colleen Coogan at (508) 281-9291, if you have any questions or need additional information.

Sincerely,

Thomas E. Bigford

Thomas E. Bigford
Division Chief

cc: F/PR2 - Williams, Ziobro
F/NEO2 - Rubelmann

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1335 East-West Highway
Silver Spring, MD 20910
THE DIRECTOR

MAR 30 1993

E 4/5

Mr. Robert V. Ogle, P.E.
Chief, Planning Division
Department of the Army
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front St.
Norfolk, Virginia 23510-3097

Dear Mr. Ogle:

This responds to your request for formal consultation for dredging of the York River Entrance Channel by hopper dredge. The enclosed Biological Opinion finds that hopper dredging of the Channel during the period between May and November may adversely affect endangered Kemp's ridley and green turtles and humpback whales and threatened loggerhead turtles. However, the best available information indicates that these species are not present in the channel in large enough numbers to be jeopardized by the project as currently proposed.

This Biological Opinion includes an Incidental Take Statement that, pursuant to Section 7 (b)(4) of the Endangered Species Act, authorizes the incidental taking of endangered species while specifying the measures necessary to minimize the impact of dredging on sea turtles. The annual take level authorized for this project is one (1) documented Kemp's ridley or green turtle or fifteen (15) documented loggerhead turtles by injury or mortality. Consultation must be reinitiated if: (1) The amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals impacts of the project that may affect listed species in a manner or to an extent not considered thus far in our opinions; (3) the identified activities are modified in a manner that causes an adverse effect to listed species not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the project.

The Biological Opinion also includes Conservation Recommendations. These recommendations should be seriously considered as means to minimize impacts on sea turtles and humpback whales and are intended to assist the U.S. Army Corps of Engineers in promoting the conservation and recovery of listed species.

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

I look forward to your continued cooperation in future consultations.

Sincerely,

Nancy Foster, Ph.D.
Acting Assistant Administrator
for Fisheries

Enclosure

ENDANGERED SPECIES ACT

SECTION 7 CONSULTATION

BIOLOGICAL OPINION

Agency: U.S. Army Corps of Engineers
Norfolk District

Activity: Consultation in accordance with Section 7(a) of the Endangered Species Act regarding channel deepening and subsequent maintenance by hopper dredge in the York River Entrance Channel, Chesapeake Bay, Virginia

Consultation Conducted By: National Marine Fisheries Service
Northeast Regional Office

Date Issued: MARCH 30, 1993

Background:

The Army Corps of Engineers, Norfolk District (COE) first initiated informal consultation regarding dredging of the York River Entrance Channel, pursuant to Section 7 of the Endangered Species Act, on November 1, 1983, when they requested a list of species present in the York River Navigation Channel, near Yorktown Virginia as part of their navigation study of the river. The threatened loggerhead (Caretta caretta) was identified as a common inhabitant of the lower Chesapeake Bay, and references for more information were given in a letter dated November 15, 1983.

Consultation was reinitiated on June 18, 1992. The National Marine Fisheries Service (NMFS), in a letter dated July 6, 1992, informed the COE that several listed species of sea turtle occurred in the project area. It was stated that hopper dredging during the period from May through November might, by lethal take, affect these threatened and endangered species. A meeting was held on September 16, 1992, to discuss hopper dredging activities planned for the Chesapeake Bay. NMFS discouraged the use of hopper dredges in the Chesapeake from May through November and indicated that formal consultation would be required to consider the impact of the numerous dredging projects being planned in the Bay unless those projects would occur between December and April. The Virginia Marine Resources Commission (VMRC) has issued conflicting restrictions from November through March, disallowing dredge disposal during this period for the protection of overwintering crabs. Because of this conflict and existing deadlines, the COE requested completion of the York River consultation while they develop a Biological Assessment for

the entire Bay. The Corps initiated formal consultation regarding the York River Entrance Channel dredging on September 21, 1992. The "Navigation Study of York River Entrance Channel Final Detailed Project Report and Environmental Assessment" (USACOE, 1992) was submitted to NMFS as a Biological Assessment.

Proposed Activities:

This description of the project area and proposed activities are taken from the Final Environmental Assessment conducted for the York River Entrance Channel Navigation study (USACOE 1992).

The York River flows southeasterly into the lower Chesapeake Bay, between and parallel to the James and Pinkatank Rivers. The York is a tidal river, 34 miles in length, and includes a maintained navigable channel. The COE deepened and widened the natural entrance channel to the York in 1952, and has maintained the approximately 11 mile long channel from the 39 foot contour of the Chesapeake Bay to a point about 4 miles east of the mouth of the York River (Figure 1). The proposed project would deepen and widen shoaled portions of the entrance channel and maintain the channel at 37' deep by 750 feet wide.

The project, as proposed, would employ a hopper dredge for both the initial and maintenance dredging to excavate the material and dispose of it overboard in the Wolf Trap disposal area north of the channel, and would take approximately 4 months. In their Environmental Assessment (USACOE, 1992) the Corps indicated they would attempt to reduce affects of dredging on sea turtles by minimizing dredging activities from May through November, screening equipment when necessary and employing observers during warmer months to monitor the incidental take of sea turtles.

Listed Species Likely to Occur in the Project Area

Listed species under the jurisdiction of NMFS that occur in the project area and may be affected by the proposed activities include:

ENDANGERED:
Sea turtle:
(1) Kemp's ridley turtle - Lepidochelys kempi
(2) leatherback turtle - Dermochelys coriacea
(3) hawksbill turtle - Eretmochelys imbricata
(4) green turtle - Chelonia mydas
Whale:
(1) Humpback whale - Megaptera novaeangliae

THREATENED:
Sea turtle:
(5) loggerhead turtle - Caretta caretta

Green turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered whenever they occur in U.S. waters.

Biology and Distribution

Kemp's ridley turtle (Lepidochelys kempi)

Of the seven extant species of sea turtles of the world, the Kemp's ridley is in the greatest danger of extinction. The only major nesting area for this species is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; Hildebrand 1963). Virtually the entire world population of adult females nest annually in this single locality (Pritchard 1969a).

When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the early 1970's, the world population estimate of mature female Kemp's ridleys had been reduced to 2500-5000 individuals. The most recent estimate of the total population of sexually mature female Kemp's ridleys, based on total number of nests and the average number of nests per female per year, is approximately 490 turtles (Pritchard 1990; Byles, pers comm 1991).

Nothing is known about the movements of hatchling Kemp's ridley turtles, although it is believed that they may be controlled by current patterns: either the loop current for northward transport or an eddy for southward transport with occasional transportation through the Florida Straits via the Gulf Stream system (Hildebrand 1982). Juvenile Kemp's ridley turtles are known to occur in eastern United States coastal waters from Florida to Canadian portions of the Gulf of Maine (Lazell 1980). Pritchard and Marquez (1973) suggest that passive transportation via the Gulf Stream up the eastern coast of the United States may be the usual dispersal pattern of young Kemp's ridley turtles. They speculate that turtles feed and grow rapidly during passive transport, and by the time they reach offshore waters of New England are large enough for active swimming. Morreale et al (1992), however, hypothesize that passive drifting would result in only sporadic occurrence of ridleys in the northeast United States and that the observed annual occurrence suggests some alternative mechanism. Regardless of the mechanism, ridleys enter northeast coastal embayments when water temperatures approach 20°C (Burke et al 1989, Musick et al 1984) and become benthic feeders. Sea turtles leave the northern embayments in the fall, when water temperatures cool (Burke et al 1991).

Standora et al (1992) gives evidence for directed movements of Kemp's ridleys south, out of northeast coastal waters, as temperatures drop below 14°C, generally in late October (Morreale, pers comm 1992). Keinath et al (1987) observe sea turtle emigration from the Chesapeake Bay when waters drop below 18°C in November.

Adult and juvenile Kemp's ridley turtles feed primarily in shallow coastal waters on bottom-living crustaceans (Hildebrand 1982). Organisms identified from stomachs include crabs (Polyonchus, Hepatus, Callinectes, Panopeus, Mineppe, Ovalipes, Calappa, Portunus, Arenaeus, Limulus, Libinia, Cancer), fish (Lutjanus, Leiostomus) and mollusks (Noculana, Corbula, Mulinia, Nassarius) (Bellmund et al 1987, Burke et al 1990(a) and (b), Dobie et al. 1961; Pritchard and Marquez 1973). All of these genera are forms common in the Gulf of Mexico and along the eastern coast of the United States.

Workers in the Chesapeake Bay area have indicated that Kemp's ridleys feed primarily on blue crabs in that embayment, and frequently occur in waters less then 5 meters deep over grass beds such as those found in the Mobjack Bay, just north of the project area (Lutcavage 1981, Musick et al 1984, Keinath et al 1987, Byles 1988). According to one worker, the mouth of the York River may be a particularly important area for ridleys:

> "This distribution may be an artifact of sampling effort but the paucity of ridleys in poundnets from other areas support the likelihood that ridleys aggregate in the grass beds at the mouth of the York River." (Lutcavage, 1981)

Kemp's ridleys and loggerheads are apparently segregated by prey items and habitat preference in the Chesapeake Bay (Lutcavage 1981, Keinath et al 1987, Byles 1988). Similar segregation is not seen in other northeast embayments such as the Delaware Bay (Eggers, 1989) and the Long Island Sound (Burke et al, 1990 (a)).

Leatherback turtle (Dermochelys coriacea)

The leatherback turtle is found throughout the waters of the Atlantic, Pacific, Caribbean and the Gulf of Mexico (Ernst and Barbour 1972). Leatherbacks are distributed pelagically and feed primarily on jellyfish such as Stomolophus, Chryaora, and Aurelia (Rebel 1974). They may come into shallow waters if there is an abundance of jellyfish nearshore. Nesting of the leatherback is almost entirely in tropical waters. In the eastern Caribbean, nesting occurs in the Dominican Republic and on islands near Puerto Rico.

Shoop and Kenney, 1992, observed leatherbacks during summer months scattered along the continental shelf from Cape Hatteras to Nova Scotia. Relative concentrations of leatherbacks were

seen off the south shore of Long Island and off New Jersey. Leatherbacks in these waters are thought to be following their preferred prey, jellyfish including Cyanea sp (Lazell 1980, Shoop and Kenney 1992).

Workers in the Chesapeake have observed leatherbacks in the mouth of the Bay during summer months (Byles 1988). Sightings of 2-3 leatherbacks at the mouth of the York River have been reported in some years (Musick et al 1986).

Hawksbill turtle (Eretmochelys imbricata)

The hawksbill turtle is relatively uncommon in the waters of the continental U.S. Hawksbills prefer coral reefs, such as those found in the Caribbean and Central America. However, there are accounts of hawksbills in south Florida and a surprising number are encountered in Texas. Most of the Texas records are small turtles, probably in the 1-2 year class range. Many of these captures or strandings are of individuals in an unhealthy or injured condition (Hildebrand 1982). The lack of sponge-covered reefs and the cold winters in the northern Gulf of Mexico, probably prevent hawksbills from establishing a viable population in this area.

Hawksbills feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. Nesting areas in the western North Atlantic include Puerto Rico and the Virgin Islands.

In the Atlantic, small hawksbills have stranded as far north as Cape Cod, Massachusetts (STSSN database, 1990). Many of these strandings have been observed after hurricanes or offshore storms. Although there have been no reports of hawksbills in the Chesapeake Bay, one has been observed taken incidentally in a fishery just south of the Bay (Anonymous, 1992).

Green turtle (Chelonia mydas)

Green turtles are distributed circumglobally mainly in waters between the northern and southern 20° C isotherms (Hirth 1971). In the western Atlantic, several major nesting assemblages have been identified and studied (Peters 1954; Carr and Ogren 1960; Duellman 1961; Parsons 1962; Pritchard 1969a; Schulz, 1975; Carr et al. 1978). However, most green turtle nesting in the continental U.S. occurs on the Atlantic coast of Florida (Ehrhart 1979). Only one nest has been reported on the Florida panhandle (Schroeder, pers comm).

While nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle's life is spent on the foraging grounds. Some of the principal feeding pastures in the western Atlantic Ocean include: upper west coast of Florida, northwestern coast of Yucatan

peninsula, south coast of Cuba, Mosquito Coast of Nicaragua, Caribbean coast of Panama, scattered areas along Colombia, and scattered areas off the Brazilian coast (Hirth 1971). The preferred food sources in these areas are: Cymodocea, Thalassia, Zostera, Sagittaria and Vallisneria (Babcock 1937; Underwood 1951; Carr 1954; Carr 1952; Mexico 1966).

Although no green turtle foraging areas or major nesting beaches have been identified on the Atlantic coast, evidence provided by Mendonca and Ehrhart (1982) indicates that immature green turtles may utilize lagoonal systems during periods of their lives. These authors identified a population of young green turtles (carapace length 29.5 - 75.4 cm) believed to be resident in the Mosquito Lagoon, Florida. The Indian River system, of which Mosquito Lagoon is a part, supported a green turtle fishery during the late 1800's (Ehrhart 1983), and these turtles may be remnants of this historical colony. Additional juvenile green turtles occur north to the Long Island Sound, presumably foraging in coastal embayments. In North Carolina, green turtles are known from estuarine and oceanic waters. Recently, green turtle nesting has occurred on Bald Head Island, just east of the mouth of the Cape Fear River, on Onslow Island, and on Cape Hatteras National Seashore. No information is available regarding the occurrence of green turtles in the Chesapeake Bay, although they are presumably present in very low numbers.

Loggerhead turtle (Caretta caretta)

The threatened loggerhead is the most abundant species of sea turtle occurring in U.S. waters. Like Kemp's ridleys, they commonly occur throughout the inner continental shelf from Florida through Cape Cod, Massachusetts. Aerial surveys of loggerhead turtles at sea north of Cape Hatteras indicate that they are most common in waters from 22 to 49 m deep, although they occur from the beach to waters of 4481 m (Shoop and Kenney. 1992). They enter northeast coastal embayments when water temperatures approach 20°C (Burke et al 1989, Musick et al 1984) to feed on benthic invertebrates. Loggerheads leave the northern embayments in the fall when water temperatures drop. Keinath et al (1987) observed sea turtle emigration from the Chesapeake Bay when water temperatures cool to below 18°C, generally in November.

The preferred prey of the loggerhead turtle include mollusks, crustaceans and sponges (Mortimer 1982). Crabs and conchs were identified (Carr 1952) as the most frequently found items in stomachs, although loggerheads often eat fish, clams, oysters, sponges and jellyfish. Ernst and Barbour (1972) included marine grasses and seaweeds, mussels, borers, squid, shrimp, amphipods, crabs, barnacles and sea urchins among the foods of loggerhead turtles. The horseshoe crab (Limulus polyphemus) has been identified as a major food source of loggerheads in Mosquito Lagoon, Florida and the Chesapeake Bay (Mortimer 1982, Keinath et

al 1987); however, spider crabs (Libinia sp.) and rock crabs (Cancer irroratus) have been determined as the primary components of loggerhead diet in the Long Island Sound (Burke et al 1990(a).

In the Chesapeake Bay, loggerheads are found commonly from May through October, with peak numbers observed in June (Lutcavage, 1981) in water depths of 4 to 20 meters (Musick et al, 1984). Mark-recapture studies have shown that loggerheads in the Bay exhibit strong foraging site fidelity within and between seasons (Musick et al 1984, Byles 1988). The mouth of the York River is one of the observed foraging sites. Loggerheads are observed there up to 2 km upriver, with the York spit acting as the northeastern boundary (Musick et al 1984, Byles 1988). Byles (1988) tracked 12 loggerheads taken in pound nets from the mouth of the York River from 1981 through 1984. Observed positions, shown in Figure 2, indicate loggerheads frequent the edge of the York River Entrance Channel, where they would certainly be susceptible to entrainment by hopper dredges.

Humpback Whale (Megaptera novaeangliae)

Humpback whales are found throughout the oceans of the world, migrating from tropical and subtropical breeding grounds in winter to temperate and arctic feeding grounds in summer (Evans, 1987). Several stocks occur in the northwestern Atlantic. Adults and newborns of the Gulf of Maine stock migrate from summer feeding grounds off the coast of New England to winter breeding grounds along the Antillean Chain of the West Indies, primarily on Silver and Navidad Banks north of the Dominican Republic. Some individuals remain in the Gulf of Maine year round.

Until recently, humpback whales in the mid-Atlantic were considered transients. Few were seen during aerial surveys conducted over a decade ago (Shoop et al 1982). However, since 1989, sightings of feeding juvenile humpbacks have increased along the coast of Virginia, peaking during the months of January through March in 1991 and 1992 (Swingle et al, 1993). Studies conducted by the Virginia Marine Science Museum indicate that these whales are feeding on, among other things, bay anchovies and menhaden. In concert with these sightings, strandings of humpback whales have increased in the mid-Atlantic during this time, with 32 strandings between New Jersey and Florida since January 1989. Sixty percent of those that were closely investigated showed signs of entanglement or vessel collision (Wiley et al, 1993).

Assessment of Impacts:

This assessment is based on a review of the July 1992 Final Detailed Project Report and Environmental Assessment for the Navigation study of the York River entrance channel (USACOE, 1992), the 1988 Section 7 formal consultation conducted on maintenance dredging of the Cape Canaveral shipping channel (NMFS,SER 1988), and the literature cited in the bibliography.

Hopper dredges are known to lethally take sea turtles in channels in which the turtles occur (NMFS, SER 1988). In their report entitled "Decline of the sea turtles: Causes and prevention," the National Research Counsel's Committee on Sea Turtle Conservation estimated that dredging mortalities, along with boat hits, were second only to fishery interactions as a source of probable lethal takes of sea turtles. At least 178 sea turtles were observed taken on monitored dredges in the Cape Canaveral and King's Bay entrance channels between 1980 and 1991 (Dickerson et al. 1991). Eighty-nine percent of these observed takes were lethal. Turtles pulled into the dragheads are forced through the pumps and crushed. Observers attempt to identify remains, which are generally small sections of viscera, bones, shell, or other materials that are deposited in the hopper with the dredged bottom materials. Screens on collection baskets and skimmers, as well as in areas of lateral overflow, collect neutrally buoyant particles which are monitored by the observer (Slay and Richardson 1988). While some sea turtle takes can be documented through these observations, NMFS believes that most cannot be detected (NMFS, SER 1988).

Sea turtle studies conducted by the Virginia Institute of Marine Science (VIMS) incorporated aerial surveys, mark/recapture programs and radio/sonic/satellite telemetry. These studies indicate turtles enter the Chesapeake Bay when water temperatures approach 20°C, generally in late May, and remain foraging in the Bay until declining water temperatures force emigration, in November of most years (e.g., Lutcavage 1981). Both loggerheads and ridleys are captured in pound nets in the lower York River (Lutcavage 1981, Byles 1988) and VIMS has identified the mouth of the York River as an important foraging area for subadult loggerhead sea turtles, with Kemp's ridleys foraging in adjacent grass beds (Lutcavage 1981, Musick et al 1984, Keinath et al 1987, Byles 1988).

Byles (1988) employed radio telemetry to track 12 loggerheads and 2 Kemp's ridleys encountered in pound nets in the Chesapeake Bay between 1981 and 1984. His data are presented in Figures 2 and 3, overlaid with the COE map of the York River Entrance Channel. These data indicate that, in the project area, loggerheads frequent the York River Entrance Channel while ridleys remain in the shallow grass areas of the Mobjack Bay (Byles 1988). These observations suggest that severely endangered Kemp's ridleys likely transit the project area, but are likely not present in

large numbers. While only 2 ridleys were tracked, workers in the Chesapeake believe that this observation of habitat segregation is consistent with observed differences in the prey preference of loggerheads and ridleys.

Quantitative stomach content analyses from loggerheads collected in the Chesapeake Bay were presented by Lutcavage (1981). These analyses identified horseshoe crab parts, which have not been found in Kemp's ridley stomachs, in three of six loggerheads (16% to 42% by weight of total stomach contents). No quantitative information regarding Kemp's ridley stomach contents was proffered. These data differ from those presented for sea turtles in New York waters. Burke (1990 a) examined fecal samples from 14 Kemp's ridleys and 25 loggerhead sea turtles collected in the Long Island Sound and found no evidence of prey preference differences. Morreale and Standora (1991) suggest that sea turtles in New York waters may be naive as benthic feeders and therefore prefer slow moving crabs. This may account for feeding difference noted in the Chesapeake Bay, where turtles of later age classes are found.

The association between loggerheads and shipping channels that has been observed in the Chesapeake Bay (Byles 1988 Figure 2) has not been documented in other channels and embayments. Preliminary studies in the Canaveral shipping channel indicate that loggerheads associate with channels only shortly after release, when their behavior seems to be modified by the effects of capture, handling and tagging (Morreale pers comm 1992). After release the turtles drift with tides, which are strongest parallel to channels. Within 48 hours of release, however, tagged sea turtles establish more directed behavior patterns that persist throughout the remainder of the tracking period (up to several weeks) and are not observed in particular association with channels or tidal currents.

These data make it difficult to predict the extent of the potential take of sea turtles by hopper dredges during operations at the York River Entrance Channel. The apparent association of loggerheads to this Channel in the Chesapeake Bay (Figure 1) suggests that it is likely that loggerheads will be taken lethally by entrainment in hopper dredges deployed between May and November. Kemp's ridleys are present at the mouth of the York River (Figure 2), but do not apparently associate with the channels, and therefore presumably would not be as vulnerable to takes by hopper dredging in this Channel. Unfortunately, although this is the best available information, only 2 Kemp's ridleys were observed due to the difficulty of affixing satellite transmitters to these smaller sea turtles. Green turtles are not present in detectable numbers in the Chesapeake Bay, but their presence in waters north and south of the Bay justify their inclusion in any assessment of impacts. Takes may occur, but likely in very low numbers in this area.

Hawksbill and leatherback turtles may occur within the project area. However, because of the comparative rarity of hawksbills in the waters of the continental U.S., they are not likely to be affected by the proposed project. Leatherbacks, because of their pelagic feeding habitat, are not likely to be affected by the proposed dredging operation.

Humpback whales occur in the coastal waters of Virginia from January through March, and rarely venture into the Chesapeake Bay. They would not be directly affected by dredging operations, however transit of vessels to and from the disposal site could result in vessel collisions.

Indirect impacts of the dredging of the York River Entrance Channel to both whales and sea turtles could be expected if the project resulted in increased vessel traffic in the Bay or in the York River. The Project Report (USACOE 1992) indicates that increased development and concurrent vessel traffic is not expected in this area since proposed dimensions are less than original channel dimensions after dredging in 1951-52.

Conclusion:

NMFS concludes that, although deepening and maintenance dredging of the York River Entrance Channel by hopper dredge is likely to lethally take threatened loggerhead sea turtles, it is not likely to jeopardize the continued existence of the loggerhead population. Endangered Kemp's ridleys, green turtles and humpback whales also may be affected; however, use of the project area by these species appears to be infrequent and NMFS believes that the project is not likely to jeopardize the continued existence of Kemp's ridley, green sea turtle or humpback whale populations.

The following factors form the basis for this conclusion:

1) Radio telemetry and tracking of two Kemp's ridleys between 1981 and 1984 (Byles 1988) and anecdotal information regarding prey preferences in the Chesapeake Bay (Lutcavage 1991) indicate Kemp's ridleys may transit the project area, but forage primarily in shallow grass beds north of the channel.

2) Green turtles have not been observed in the project area.

3) In their Environmental Assessment, the COE has indicated that they would attempt to minimize dredging by hopper dredge between mid-May and mid-November, the period during which turtles are most likely to occur in the project area.

Cumulative Effects:

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably

certain to occur within the action area of the Federal action subject to consultation. State regulated fishing activities, including, poundnet, trawl and gillnet fisheries, in the Chesapeake Bay take endangered and threatened sea turtles. These takes are not regulated or reported. It is expected that Virginia will continue to license/permit large vessel and thrill-craft operations which do not fall under the purview of a Federal agency. Increased recreational vessel activity in the Bay will likely increase the number of turtles taken by injury or mortality in vessel collisions.

Most of the loggerhead and Kemp's ridley sea turtles in the Chesapeake Bay are juveniles and sub-adults. Loss of sub-adult sea turtles may be especially detrimental to the recovery of populations. Crouse et al (1987) attempted to explain the decline of loggerhead nesting females. Applying a Leftovitch stage-class matrix model of loggerhead populations on Little Cumberland Island, Georgia, these authors showed that loggerhead population stability is more sensitive to changes in the subadult stage of development than in other developmental stages. Similar sensitivities may exist for Kemp's ridleys and other species.

Reinitiation of Consultation:

Reinitiation of formal consultation is required if: (1) the amount or extent of taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat (when designated) in a manner or to an extent not previously considered, (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the Biological Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

Conservation Recommendations:

Section 7 (a)(1) of the ESA directs Federal agencies to utilize their authorities to promote the conservation and recovery of endangered species. The following conservation recommendations identify actions that the COE can take to assist in the reduction of any potential adverse impacts to loggerhead, green and Kemp's ridley turtles and humpback whales that may result from dredging of the York River Entrance Channel.

1) The COE, in conjunction with their permittee, should confer with local institutions that monitor whale distribution in Virginia Coastal waters to determine whether whales are known to be in the vicinity of the project area. If whales may be present, vessels transitting the area should post a watch for whales, avoid intentional approaches closer than 100 yards when in transit and reduce speeds to below 4 knots.

2) The Final Detailed Project Report and Environmental Assessment (FDPREA, USCOE 1992), prepared for the Navigation Study of the York River Entrance Channel indicates that the sediment to be dredged in the channel is composed of 80 percent clay and 20 percent sand (p. A-22). The disposal area for this dredged material is an average of 12 miles from the channel. The FDPREA states that dredging will be conducted by hopper dredge without indicating why the hopper dredge was chosen. Clamshell dredges are described in a paper presented at the National Workshop on Methods to Minimize Dredging impacts on Sea Turtles on May 11-12, 1988, as being competitive with hopper dredges in jobs with disposal sites within 4 and 20 miles (Lindholm, 1988). The author indicates that the clamshell dredge is the preferred dredge for silts, and as good as the hopper dredge for hard clay. The Corps should continue to investigate the possibility of using another dredge type, such as a clamshell dredge, for this project.

3) If it is determined that a hopper dredge must be used, dredging between mid-May and mid-November should be avoided as much as possible. This will be difficult, since the Virginia Marine Resources Commission does not allow overboard dredge disposal from November 15 through March 30 to protect blue crabs. The FDPREA (USCOE 1992) indicates (p. 67) that some portion of the dredged material may be suitable for beach disposal, and final determination was dependant upon the results of additional investigations. These investigations should be continued, and if possible, beach disposal should be employed during the early Spring or some other portion of the VMRC's overboard disposal closure period.

4) The Corps should conduct or support additional investigations into the distribution, local movements and diet of the Kemp's ridley in the Chesapeake Bay to determine whether ridleys are likely to be in areas where dredging will be required.

5) Formal Endangered Species Act Section 7 consultation regarding the cumulative impacts of all planned hopper dredging in the Chesapeake Bay and Virginia coastal waters on endangered species should be continued.

6) The Norfolk District should support or participate in the Waterways Experiment Station's investigations into modifications of dredges to reduce sea turtle takes and improve methods of monitoring sea turtle takes in hoppers and removing sea turtles from channels prior to dredging. Investigations should consider any and all possible engineering solutions to the problem.

7) The Norfolk District should coordinate with other Corps districts in the Northeast to present a workshop to train dredge/disposal observers in the Northeast Region. Training should be conducted by a NMFS approved observer or an approved training program.

8) The Corps should investigate where turtles may be found in the water column, whether they are feeding in the channel, what factors attract turtles to the channel, what their behavior is in the channel, where they sleep, etc. Information about habitat use in the project area may allow modification of dredging techniques or windows to minimize impacts to turtles.

9) Aerial surveys of the area may be used to identify the presence or absence of sea turtles in waters near the borrow area prior to deployment of an onboard observer. If aerial surveys conducted by experienced personnel do not document the presence of sea turtles, and water temperatures are below 20°C, deployment can be delayed until those conditions change or until June 15, whichever comes first.

10) The Norfolk District should work with WES to develop a protocol for testing and evaluating new draghead designs and/or deflector devices. At some point in the evaluation process, it will be necessary to test the effectiveness of such devices in channels where sea turtles are present. The Corps is responsible for ensuring that applicable permits for scientific research and/or incidental taking are obtained.

Scientific research permits and/or incidental take permits issued under section 10 (a) of the ESA may be necessary to conduct research on sea turtles or dragheads.

Incidental Take Statement

Section 7 (b)(4) of the ESA requires that when an agency action is found to comply with Section 7 (a)(2) and the proposed action may take individuals of listed species, NMFS will issue a statement specifying the impact of such incidental taking, provide reasonable and prudent measures necessary to minimize impacts, and set forth the terms and conditions with which the action agency must comply to implement the reasonable and prudent measures. Incidental taking by the Federal agency or applicant that complies with the specified terms and conditions of this statement, is authorized and exempt from the taking prohibition of the ESA.

Because of observations of sea turtle distribution in the Chesapeake Bay and occurrences of lethal take of sea turtles in hopper dredges deployed in areas where turtle occur, NMFS anticipates that the proposed dredging of the York River Entrance Channel may result in the injury or mortality of loggerhead, Kemp's ridley and green turtles. Therefore, we have established an appropriate low level of incidental take and terms and conditions necessary to minimize and monitor the impact to each species. Pursuant to section 7(b)(4) of the ESA, an annual incidental take (by injury or mortality) of one (1) Kemp's ridley or green turtle or fifteen (15) loggerhead turtles is set for this project. If the incidental take meets or exceeds this level, the COE must reinitiate consultation. If so, the Northeast Region, NMFS, will cooperate with the COE in the review of the project to determine the need for developing further mitigation measures or modifying the remaining dredging activity.

The following terms and conditions are established to implement the reasonable and prudent measures necessary to minimize the impact of dredging the York River Entrance Channel by hopper dredge and to document incidental take, should such take occur.

1. The COE must explain, annually, in writing to the Regional Director, why a hopper dredge, rather than a clamshell or other dredge less likely to impact sea turtles, must be employed in the York River Entrance Channel between May 15 and November 30 of any year.

2. NMFS-approved observers are required on hopper dredges between May 15 and November 30th of any year to monitor the hopper spoil, overflow, screening and dragheads for sea turtles and their remains. These observers must be aboard the dredges for a minimum of 50 percent coverage. Coverage may be increased to 100 percent if the incidental take limit is approached. Weekly summary reports must be submitted to the NMFS' Northeast Regional Office by the observers for review.

3. The hopper dredge must be equipped with screening or baskets to better monitor the intake and overflow of the dredged materials for sea turtles and their remains. These screens should sample at least 70 percent of the overflow area and should

be installed at the applicable area (i.e., the "skimmer funnels" and the starboard and port sides of the vessels, etc.). Every effort should be made to effectively sample the turtle parts which travel through the hopper and exit in the overflow material. New approaches to sampling for turtles parts should be investigated, if possible.

4. A report summarizing the results of the dredging and the sea turtle take must be submitted to the COE and NMFS within 20 working days of completion of the project.

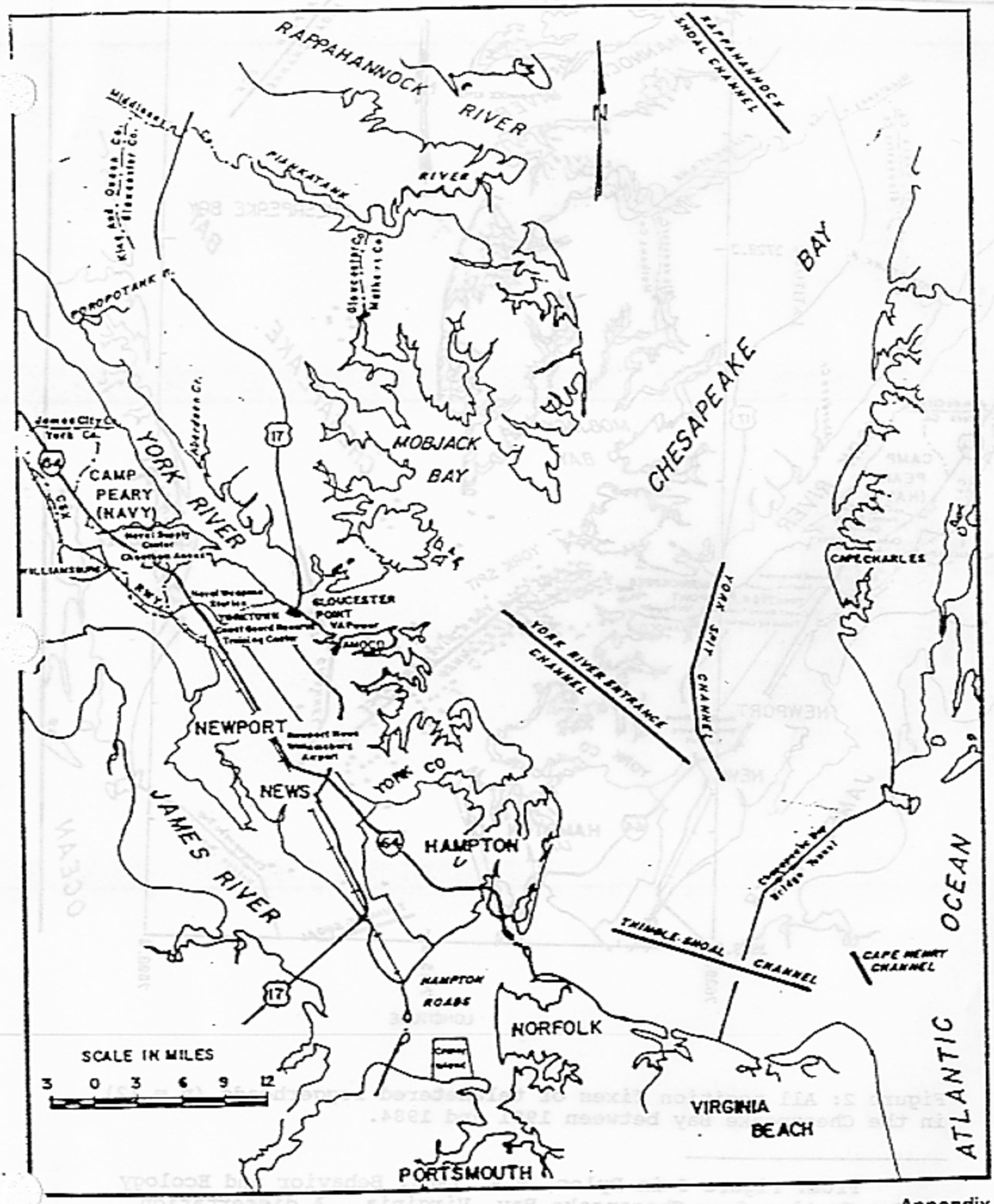

Figure I. Lower York River Study Area

From: Figure 1 in US Army Corps of Engineers. July 1992. Navigation Study of York River Entrance Channel. Final Detailed Project Report and Environmental Assessment

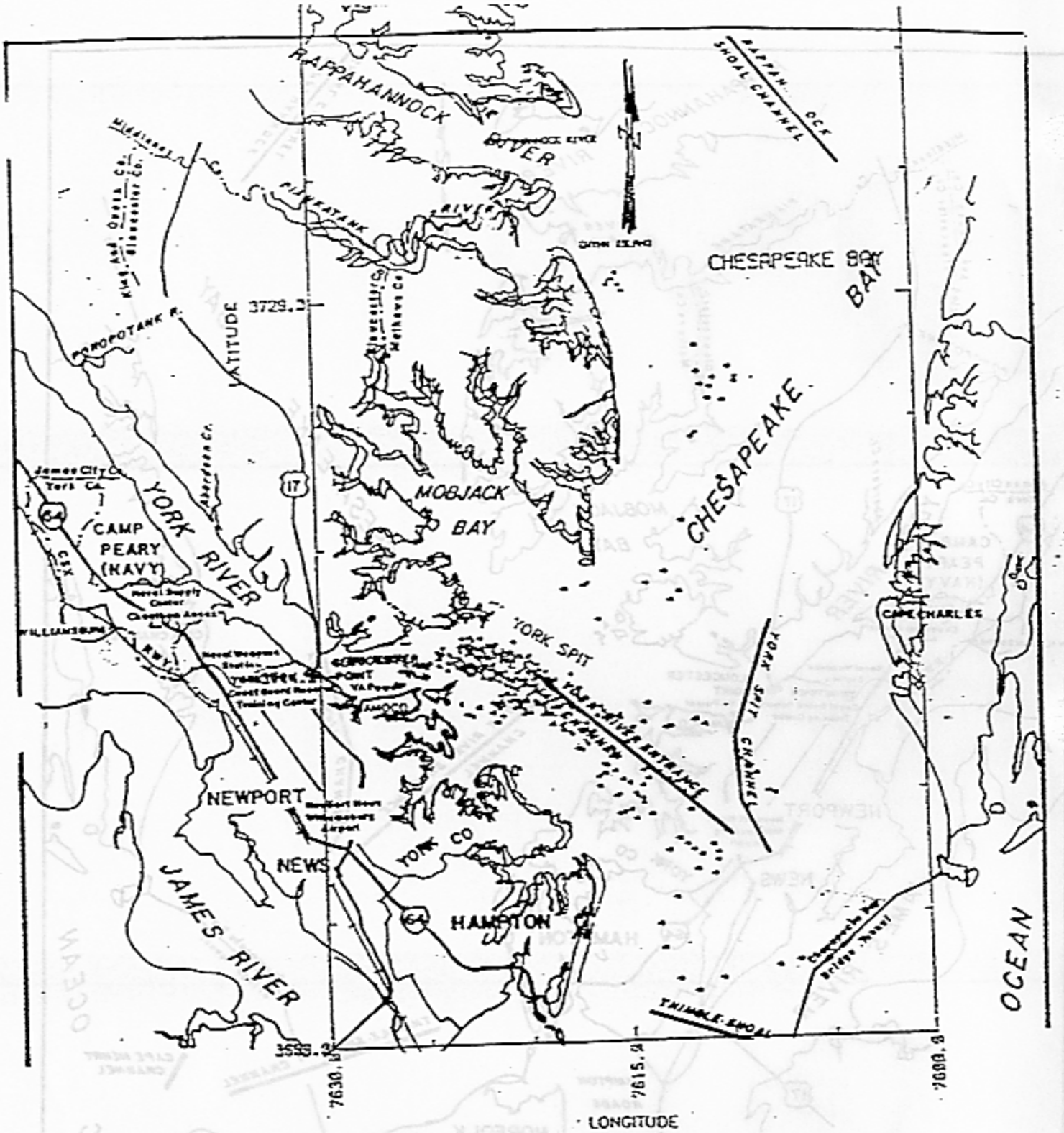

Figure 2: All position fixes of telemetered loggerheads (n = 12) in the Chesapeake Bay between 1981 and 1984.

From: Figure 6 in Byles, R.A. 1988. Behavior and Ecology of Sea Turtles from Chesapeake Bay, Virginia. A dissertation presented to the faculty of the School of Marine Science, The College of William and Mary in Virginia in partial fulfillment of the requirements for the degree of Doctor of Philosophy

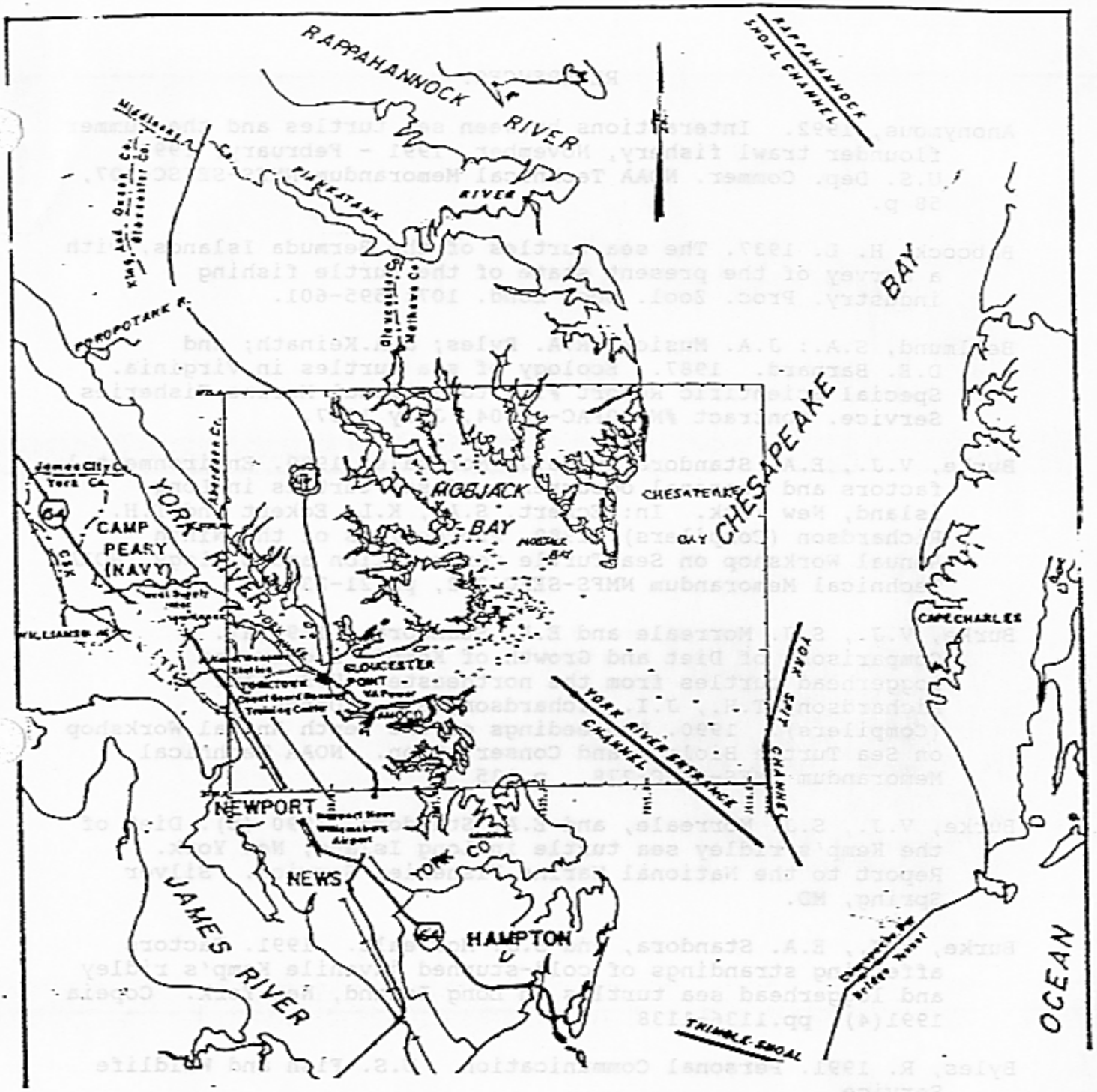

Figure 3: All position fixes of telemetered Kemp's ridleys (n=2) in the Chesapeake Bay between 1981 and 1984.

From: Figure 9 in Byles, R.A. 1988. Behavior and Ecology of Sea Turtles from Chesapeake Bay, Virginia. A dissertation presented to the faculty of the School of Marine Science, The College of William and Mary in Virginia in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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