WARING

US Army Corps
of Engineers
Norfolk District

# FINAL SUPPLEMENT I
# to the
# FINAL ENVIRONMENTAL IMPACT STATEMENT

## and APPENDIX:
## DAM NECK OCEAN DISPOSAL SITE
## SITE EVALUATION STUDY

# NORFOLK HARBOR and CHANNELS, VIRGINIA DEEPENING and DISPOSAL

May 1985

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FINAL
SUPPLEMENT I
to the
FINAL ENVIRONMENTAL IMPACT STATEMENT

Norfolk Harbor and Channels, Virginia
Deepening and Disposal, July 1980

May 1985

The responsible lead agency is the Norfolk District, U.S. Army Corps of Engineers.

Abstract. This supplement addresses modifications to the proposed disposal plan for the Norfolk Harbor and Channels project not discussed in previous project documents. The original project description is contained in the Feasibility Study and Final Environmental Impact Statement (July 1980) where planned disposal of dredged material originating within the harbor is at a confined upland disposal area in Suffolk, Virginia. New work and maintenance material from channels outside Hampton Roads were then, and continue to be, planned for disposal at sea. In December 1980, an addendum to the FEIS was issued to reflect the Board of Engineers for Rivers and Harbors post-review decision. The Board concluded that the plan for confined upland disposal in Suffolk, Virginia should be removed from any further consideration; instead, disposal of dredged material originating within Hampton Roads should be placed in the existing Craney Island diked disposal facility.

The site specifically identified by the addendum for ocean disposal is Norfolk Disposal Site, located 17 nautical miles due east of the Chesapeake Bay mouth. This supplement identifies an expansion of the existing Dam Neck Disposal Site as an additional alternative site for disposal of dredged material.

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## 1. SUMMARY

1.01 The Norfolk Harbor Deepening and Disposal Study is an effort which began as separate studies concurrently initiated to determine the advisability of improving the deep-water channels and adjacent anchorages in Hampton Roads and to determine an overall plan for future disposal of material dredged from the Hampton Roads area. The first of these studies was adopted by the Senate Committee on Public Works by a resolution on 20 June 1969 authorizing a study to determine the advisability of improving the deep-water channels in Hampton Roads and the anchorages adjacent thereto. Subsequently, identical resolutions were adopted by the Senate and House Committees on Public Works on 24 June 1974 and 10 October 1974, respectively, authorizing a study to determine the advisability of providing additional improved anchorage areas in an adjacent to Norfolk Harbor.

1.02 A concurrent investigation had been underway concerning the disposal of dredged material in Hampton Roads. The purposes of this study were to consider possible courses of action to provide for the future disposal of dredged material and to recommend the most beneficial overall solutions with the least social, environmental, and economic cost. The study was undertaken in response to a resolution adopted 3 October 1968 by the Committee on Public Works of the U.S. House of Representatives.

1.03 Since investigations required as a result of these separate resolutions are closely related, it was determined that the reports required under each authority should be combined. The combining of the reports was approved by the Office of the Chief of Engineers.

1.04 Descriptions of the deepening and disposal plans were first presented in the project Feasibility Study (including Final Environmental Impact Statement (FEIS) and Appendices). The study had determined that, for channel and anchorage improvements, the best overall plan responding to the problems and needs of the port of Hampton Roads and surrounding region is to deepen a portion of the existing 45-foot channels to 55 feet; deepen a portion of the existing 40-foot channel to 45 feet; and deepen a portion of the existing 35-foot channel to 40 feet. These dimensions remain unchanged.

1.05 The plan also recommended construction of three sets of fixed mooring anchorage areas capable of handling six vessels at any one time. It is now proposed to replace the fixed mooring concept with a single circular anchorage 55-feet deep with a 1,400-foot radius in naturally deep water near Hampton, Virginia. Also planned is the improvement of one anchorage at Sewell's Point by increasing its radius from 1,200 feet to 1,400 feet and maintaining its depth at 45 feet. All other anchorages, which are part of the project, will be maintained at their authorized depths.

1.06 In considering alternative disposal sites during plan formulation, data pertaining to the quality of bottom materials were based on technical criteria which are no longer considered a reliable basis for the assessment of ecological effects of dredged material disposal. Use of

these criteria indicated that virtually none of the material within Hampton Roads was suitable for open water disposal and would require confined disposal. On this basis, the FEIS recommended the replacement of the Craney Island Disposal Area (CIDA) with a 6,000-acre confined upland dredged material disposal area in the city of Suffolk for the disposal of dredged material from all dredging in the Norfolk Harbor area. Ocean disposal of dredged material originating within Hampton Roads was not presented as a viable alternative in the FEIS. The FEIS did recommend use of a proposed ocean dredged material disposal area, located about 17 nautical miles east of Cape Henry, Virginia, for the disposal of dredged material from the Thimble Shoal Channel and the proposed Atlantic Ocean Channel. This area is known as the Norfolk Disposal Site.

1.07 During review of the report and FEIS by the Board, preliminary results of bioassays of dredged material from channels and anchorages inside Hampton Roads and studies of Norfolk Disposal Site became available. These bioassays, which are more reliable indicators of ecological impacts of dredged material disposal than past technical criteria, were conducted in accordance with Implementation Manual for Section 103 of Public Law 92-532 (Marine Protection, Research and Sanctuaries Act). This manual was developed jointly by the Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers. Initial results indicated that a majority of the material is considered suitable for ocean disposal.

1.08 The enhanced potential for ocean disposal indicated by results of bioassays and other tests lessened the need for a large confined disposal area. Additionally, disposal operations at the Suffolk Site would have destroyed terrestrial habitat, introduced undesirable bird concentrations, and could have an unkown but possibly adverse impact on local groundwater aquifers. In view of these considerations, an Addendum to the FEIS was prepared and coordinated. Dredging requirements remained unchanged by the Addendum, but the Suffolk Site was eliminated therein as a recommended disposal area. Craney Island, with sufficient remaining capacity for containment of remaining dredged material from within Hampton Roads resulting from construction of the deepening project, is no longer being recommended for conveyance of ownership to the Commonwealth of Virginia by the Addendum. Also under the plan recommended by the Feasibility Study and Addendum, dredged material from the existing Thimble Shoal Channel, Cape Henry Channel, and a new channel, the Atlantic Ocean Channel, would be disposed of in the open ocean. The Norfolk Disposal Site was proposed for this purpose in the Addendum.

1.09 Economic and site management considerations for the Norfolk Disposal Site raised a need for availability of other disposal options. This document proposes to supplement the recommended disposal plan with the option for disposal at an expanded version of an existing disposal area offshore of Virginia Beach, Virginia. This area, known as Dam Neck Disposal Site, has been designated by EPA as an interim disposal site. The Dam Neck Site will be reconfigured to provide the required disposal capacity for the project, and thereby enable effective dredged material management.

1.10 Extensive environmental studies have been conducted to assess the effects of continued and more intensive disposal at Dam Neck. None of these studies have indicated a potential for project impacts to have a significant effect on regional fish or shellfish resources. The findings are presented in the attached appendix, and are summarized in the following table. The study documents will be coordinated through Supplemental Information Report (S.I.R.) procedures by early 1986.

1.11 The use of the Craney Island Disposal Area, for the confined disposal of any dredged material from the Norfolk Harbor and Channels Deepening project, is consistent with the operational and economic requirements of the project. Craney Island Disposal Area's capacity will be increased to provide the required disposal capacity by the use of advanced site management methods including use of sub-containment areas, dewatering techniques, dike raising, and other site improvements.

1.12 The use of area beaches and stockpile areas, for the disposal of suitable sandy material from the Norfolk Harbor and Channels Deepening project, is consistent with the operational and economic requirements of the project and the needs of the local, State, and Federal interests. Official interest has been expressed by the U.S. Army (Fort Story), the cities of Hampton, Norfolk, and Virginia Beach, and the Virginia Commission on the Conservation and Development of Public Beaches. Thimble Shoal Channel and the proposed Atlantic Ocean Channel are known to have substantial quantities of suitable material.

1.13 The use of dredged material from the Norfolk Harbor and Channels Deepening project as a borrow source for construction projects is consistent with the engineering, operational, and economic requirements of the project. The Virginia Department of Highways and Transportation has been granted a Corps of Engineers permit for the removal of 2.25 million cubic yards (mcy) of material from the Thimble Shoal Channel for use in the construction of the I-664 Bridge and Tunnel. The conditions of the permit will be consistent with the project deepening requirements.

1.14 It is planned to meet the dredged material disposal needs of the Norfolk Harbor and Channels Deepening project by the selected use of the disposal alternatives described in the FEIS, the Addendum to the FEIS, and this Supplement to the FEIS. No single disposal alternative is expected to meet all environmental and operational requirements during the construction and maintenance of the project. The purpose of providing a range of disposal alternatives is to assure the constructibility, economic viability, and environmental protection requirements of a large and complex harbor deepening project.

## Table 1. DAM NECK DISPOSAL SITE SUMMARY

| Criteria as Listed in 40 CFR 228.6 | Summary of Site Evaluation Study (Appendix) Findings and Conclusions |
|---|---|
| (1) Geographical Location | Approximately 3.5 miles offshore of Virginia Beach. See Figures 4 and 5 for location and Figure 12 for coordinates. |
| (2) Location Relative to Important Resource Areas | Fish migrations into and out of Bay occur through the study area. Blue crabs spawn in lower Bay and larvae develop in offshore waters. Commercial and recreational fishing takes place in offshore waters both north and south of Chesapeake Bay mouth and in vicinity of Dam Neck Site. No interference with resources is anticipated. |
| (3) Distance from Beaches | Site is approximately 3.5 miles from beach at Virginia Beach; net sediment transport at site is negligible. No onshore transport of deposited material is anticipated. |
| (4) Types & Quantities of Materials | Thimble Shoal Channel - clays & silts with some fine to med. sand. — Total Volumes w/Port Improvements: 32.5 m cu. yds.<br>Cape Henry Channel - fine sands with little silt and shell. — 15.5 m cu. yds.<br>Atlantic Ocean Channel - fine sand with little silt, clay, and gravel. — 20.0 m cu. yds<br>TOTAL 68.0 m cu. yds. |
| (5) Surveillance and Monitoring | Surveillance and monitoring easily facilitated due to nearness to shore, shallowness of site and availability of vessels and historical data. |
| (6) Dispersal, Horizontal Transport, Vertical Mixing | General oceanic circulation patterns at Dam Neck Site produce conditions conducive to insignificant net sediment transport. Tides and wind-driven variability act to constrain net movement. Motion tends to be oscillatory and net sediment transport is negligible. Dredged material dumped and deposited near the bottom is not expected to be affected substantially by vertical mixing. Dam Neck Site and surrounding area is a hydraulically stable environment with little potential for significant net movement of dumped dredged material. |

Table 1. DAM NECK DISPOSAL SITE SUMMARY
(Cont'd)

| Criteria as Listed in 40 CFR 228.6 | Summary of Site Evaluation Study (Appendix) Findings and Conclusions |
|---|---|
| (7) Effects of Previous Disposal in Ocean | No significant long term effects have been observed. Dam Neck Site has been used since 1967 - fauna, water quality, and sediment quality found at the site is typical to that found in adjacent, previously undisturbed offshore areas. |
| (8) Interference with other uses of the Ocean | Site is within a larger zone of commercial and recreational finfishing but should not interfere with use of area for fishing. The terminal end of the Atlantic Treatment Plant (HRSD) out-fall is located approx. 6,400 feet to the west of the Dam Neck Interim Disposal Site but will not interfere with operation of the facility. Other known uses of the ocean in the area, including military exercise, can be effectively coordinated to prevent conflict. |
| (9) Existing Water Quality and Ecology | Virginia State Water Control Board has classified the Atlantic Ocean in this area as Class I-B-a: a minimum D.O. requirement of 5.0 mg/1, pH range of 6.0 to 8.5 and a permissible rise above natural temperature of 4.0°F (September-May) and 1.5°F (June-August). Appendix B describes existing water quality in more detail. Ecology typical of inner continental shelf regions and positively influenced by position adjacent to mouth of Chesapeake Bay (Appendix A describes ecology in detail). |
| (10) Potential for Nuisance Species | Site has been used since mid-1960's with no apparent recruitment of nuisance species. Deposition of material composition comparable to that previously dumped is not expected to result in recruitment of nuisance species. |
| (11) Existence of Significant Natural or Cultural Features | Wrecks are known to exist in vicinity of Dam Neck but disposal of dredged material would not adversely disturb or otherwise impact marine archaeological resources in the area. |

Areas of Controversy

1.15 The Suffolk Disposal Site was an area of controversy when the Final EIS was prepared. This site was strongly opposed by the citizens of Suffolk, including local government and business interests. Since this is no longer part of the overall plan, it is no longer an issue.

1.16 The proposed use of Dam Neck is an area of controversy, primarily because average annual disposal quantities will be greater in comparison to the past 20 years. Historically, 20 million cubic yards had been placed in Dam Neck between 1967 and 1982. While this would appear to average about 1.3 mcy per year deposited at the site over a 15-year period, records indicate that about 15 mcy were deposited at Dam neck during a 3-year period, 1967 to 1970, or 5 mcy per year. Ocean dumping rates at Dam Neck reached a peak during a 7-month period during 1969-1970, when over 12 mcy were placed at the site. It is now proposed to place 36 mcy during a construction period of 7 years (deepening Cape Henry and Thimble Shoal Channels, and construction of Atlantic Ocean Channel). The rates of ocean dumping for new work will average about 5 mcy per year, with a maximum of 11-12 mcy during the fourth year of construction. In addition, future maintenance of the deepened channels will require the placement of about 32 mcy during a 50-year period, at a rate averaging 700,000 cubic yards per year. These proposed rates of disposal are the same order of magnitude as historical dredged material disposal rate at the Dam Neck Site.

## 2. NEED FOR AND OBJECTIVES OF ACTION

2.01 Draft and Final Environmental Impact Statements, filed with EPA 6 November 1981 and 23 July 1982, respectively, were prepared for use of Norfolk Ocean Disposal Site. All environmental criteria have been met for long-term disposal of acceptable dredged material. Its distance from the proposed navigation improvements, however, presents economic and site management concerns. In anticipation of the high costs of dredged material transport to Norfolk Disposal Site, disposal at Dam Neck, a significantly closer location, in conjunction with Craney Island Disposal Area, is proposed. This would be for receipt of environmentally acceptable dredged material from channels associated with the Norfolk Harbor Deepening Project. (Craney Island and Norfolk Disposal Sites are discussed in detail in the Final Environmental Impact Statement, Norfolk Harbor and Channels, Virginia-Deepening and Disposal and the Addendum thereto. See references 4 and 5.)

2.02 Dam Neck Disposal Area is an overboard site located offshore of Virginia Beach, Virginia. It has been designated by the United States Environmental Protection Agency as a disposal site, with interim designation, for receipt of dredged material which meets the environmental criteria for ocean disposal. It is currently used for disposal of the majority of the material dredged from maintenance of the authorized Thimble Shoal Channel (45') project, and the Cape Henry Channel (42') portion of the authorized Baltimore Harbor and Channel project.

2.03 The overall configuration of the existing Dam Neck Site is rectangular with its long axis north-south oriented. Dimensions are 22,000 feet by 5,000 feet, and its northwest corner is located 3.6 miles east of Rudee Inlet, which is the only inlet in Virginia south of the Chesapeake Bay mouth. The subsurface elevation of Dam Neck averages between -35.0 and -40.0 mean low water, allowing the site a remaining capacity, when filled to an elevation of -30, feet of approximately 40 million cubic yards. In order to accommodate the increased yardage generated by the deepened project dimensions, the expanded site will have a width tapering from 13,000 to 6,000 feet, a length of 30,000 feet, and a bottom area of 290 million square feet or about ten square miles.

2.04 The Dam Neck Site would be used for the disposal of materials, both new work and maintenance, from deepening the Thimble Shoal and Atlantic Ocean Channels as part of the Norfolk Harbor and Channels project, and deepening Cape Henry as part of the Baltimore Harbor and Channels project. Thimble Shoal and Cape Henry sediments have been disposed at the Dam Neck Site since the mid-1960's. The maintenance dredging of both these channels, and subsequent ocean disposal of the dredged material at Dam Neck, are addressed in previously filed Final Environmental Impact Statements. A recent exception to ocean disposal occurred in 1974 when significant quantities of sandy material were removed from Thimble Shoal Channel and productively used. Over 600,000 cubic yards were used by a private contractor as landfill, and over 700,000 cubic yards removed by Government hopper dredge were stockpiled at Fort Story. Most of this stockpile was then truck hauled to the Virginia Beach oceanfront for the bay front beach and dunes. These events demonstrate that limited amounts of material with suitable qualities are produced by navigation channel dredging and can be used productively.

2.05 Material for the annual replenishment of the authorized beach erosion control project at Virginia Beach is now being partially provided by truck hauling the sand dredged from the Lynnhaven Inlet navigation project. However, a substantial quantity of sand will be required in the future to construct an authorized modification of the Virginia Beach erosion control project and to rebuild or nourish other area shorelines. The U.S. Army Transportation Center has requested the support of Norfolk District in obtaining sand from navigation channel dredging to restore eroded shorelines, rebuild dunes, and establish stockpiles at Fort Story for future renourishment. The cities of Hampton, Norfolk, and Virginia Beach have also expressed interest in obtaining sandy dredged material for placement on their respective Chesapeake Bay beaches. The planned Atlantic Ocean Channel and the eastern end of Thimble Shoal Channel are known to contain sand which could be placed on area beaches. To the maximum extent practicable, the Norfolk District will recommend the placement of suitable quantities and types of dredged material on nearby shorelines, the creation of stockpiles, and other such beneficial uses. However, beneficial use of dredged material must be consistent with all project engineering, environmental, economic, legal, local cooperation, and cost sharing requirements. Based on studies and coordination to date, it is expected that a maximum of about 2 to 2.5 million cubic yards each from Thimble Shoal Channel and Atlantic Ocean Channel could be beneficially used for beach fill, stockpiling, or construction purposes and the balance from these channels placed within the expanded Dam Neck Site.

2.06 Total dredging requirements over a 50-year project life for a deepened Norfolk Harbor and associated channels, including new work dredging and future maintenance, would be approximately 380 million cubic yards. Disposal of this quantity is planned to be divided primarily between Craney Island Disposal Area, Dam Neck Site, Norfolk Site, and both bay and oceanfront beaches. The disposal location selection will be dependent upon quantity and quality of material and local needs. Of immediate concern is new work dredging that would deepen Thimble Shoal Channel and create the Atlantic Ocean Channel. (Natural depths in the latter are greater than the present 45 feet but less than necessary for the proposed 57-foot channel). This dredging would generate approximately 36 million cubic yards of dredged material, all of which is approved for ocean disposal. The Dam Neck Site has the capacity to receive this quantity and is the only ocean site within the overall project area which currently has a designation status.

2.07 The use of the Dam Neck site for ocean disposal requirements will enable sediment management. During channel deepening, the quantities of sandy dredged material removed from Cape Henry, Thimble Shoal, and Atlantic Ocean Channels will likely exceed the immediate needs for sandy material, or local government capability to receive these quantities, at the beaches and land-based stockpile areas. Within the Dam Neck site, areas will be established for stockpiling the sandy materials which are excess to local need or capability. These materials would then be available for future beach nourishment or other needs.

## 3. ALTERNATIVES

3.01 The alternative disposal plans presented in the Norfolk Harbor Deepening and Disposal Study were based on confining all inner harbor dredged material in new permanent diked disposal areas and ocean disposal of suitable sediments from Thimble Shoal and Atlantic Ocean Channels. Other disposal alternatives for the uncontaminated sediments from these outer channels are as follows:

a. Open Water Disposal in the Chesapeake Bay. The material from Thimble Shoal Channel could be deposited in open water areas a short distance from the channel as it had been prior to the 1950's. While this would initially be less expensive than other alternatives, experience has shown that open water disposal near Thimble Shoal Channel has the potential to produce unwanted physical effects. Dumping grounds established south of the channel during the early part of this century had filled to capacity by the late 1940's. Additional materials deposited in or near these areas could possibly cause sedimentation of Little Creek Channel or Lynnhaven Inlet, both of which are authorized Federal navigation projects, or cause resedimentation of Thimble Shoal Channel. This disposal alternative would also have the potential to interfere with U.S. Navy activities in the lower Chesapeake Bay. Open water disposal within the Bay has not been ruled out, but is not being considered at this time.

b. Disposal at Craney Island. Material dredged from the outer channels could be deposited in the Craney Island Disposal Area; however, this alternative has the following disadvantages:

(1) The limited capacity of Craney Island would be unnecessarily reduced by volumes of dredged material which meets or exceeds the requirements for ocean disposal. Craney Island is better utilized for disposal of inner harbor sediments.

(2) As compared to ocean disposal, Craney Island would require several additional hours for each hopper dredge load. This includes increased travel time, and additional time for mooring, setup, and pump-out of the hopper dredge. This would substantially increase the project cost and duration.

(3) Sandy dredged material deposited at Craney Island could ultimately be used for retaining dikes or other construction purposes but would be better used for placement on eroding beaches or tunnel construction.

While disposal of Thimble Shoal and Atlantic Ocean Channel sediments at Craney Island would have no significant adverse environmental effects, this alternative is an inefficient use of existing disposal sites. It is more costly and time-consuming than ocean disposal at the Dam Neck Ocean Disposal Site and will only be used if another less costly, environmentally acceptable, disposal site is not available.

c. Beach Nourishment and Stockpiling. As stated in Paragraph 2.05, an alternative use for limited amounts of sandy dredged material would be direct beach nourishment and stockpiling for future nourishment needs. Norfolk District recommends this alternative to the maximum extent practicable where and when it is consistent with local cooperation, legal, cost-sharing, engineering, and environmental constraints. This could account for less than ten percent of the total dredging requirements at Thimble Shoal and Atlantic Ocean Channels, both new construction and maintenance. The balance of the material would still need to be deposited at an approved ocean disposal site.

## 4. EFFECTED ENVIRONMENT

### Environmental Conditions

4.01 Dam Neck Disposal Site is situated on the nearshore continental shelf, surrounded by productive marine waters usually associated with shallow coastal areas. Due to its proximity to the mouth of the Chesapeake Bay the site is influenced by the flushing and tidal actions associated with the nation's largest estuary.

4.02 Inside the bay mouth is the Port of Hampton Roads, which has a water surface area of 25 square miles formed by the confluence of the James, Nansemond, and Elizabeth Rivers. Hampton Roads is the largest port complex in Virginia. It is located at the southern end of Chesapeake Bay approximately 300 miles south of New York, 180 miles southeast of Washington, D .C., and 20 miles west of the entrance to the Chesapeake

Bay. Hampton Roads is bordered by the cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, Virginia Beach, and Suffolk. These cities are the largest urban grouping in the Commonwealth of Virginia and one of the leading population centers in the South.

4.03 A full discussion of the environmental conditions and marine resources associated with the Dam Neck Site is contained in the attached Appendix (Dam Neck Ocean Disposal Site Evaluation Study).

## 5. ENVIRONMENTAL EFFECTS OF DISPOSAL

### Dam Neck

5.01 Ocean dumping of dredged material involves two basics concerns: (1) the effects of water column perturbations and (2) the effects of sediments settling on the biota of the disposal area. The analysis of potential water column effects entails the determination of limiting permissible concentrations by means of liquid and suspended solid phase bioassays together with determination of the fate of dissolved and suspended material through analysis of mixing zone characteristics. Analysis of effects of dredged material accumulating as bottom sediments emphasizes physiological (as opposed to assumed mechanical or smothering) effects of dredged material on disposal site biota and involves use of solid phase bioassays. Because of the rapid dilution and dispersion of dissolved and suspended materials upon their release in a disposal area, water column perturbations are normally of short duration, and bottom sediments have the greatest overall potential for causing long-term undesirable effects. In the case at hand, however, which involves only material suitable for ocean disposal, this is not considered to be a problem.

5.02 Of further possible concern is the stability of dredged material and its effect on current patterns after disposal. The Dam Neck Disposal Site is situated beyond the effective area of normal offshore-onshore sediment transport processes. During storm events, the wave climate could result in bottom currents sufficient to cause sediment entrainment, but oscillatory water motion coupled with local sediment consolidation would produce insubstantial net transport.

5.03 As stated, material dredged to a 55-foot project depth from Thimble Shoal Channel is acceptable for open ocean disposal. Therefore, the release of dissolved or absorbed chemicals from the sediments will not be a factor.

5.04 The long inhabitation of the Tidewater Virginia area, in relation to the occupation of other areas of the United States, is a result of the presence of natural port facilities. Because of its rich history, the area has numerous sites and structures listed as historical landmarks. None of these will adversely be affected by disposal at the Dam Neck Site. Neither will any known recreational opportunities in the project vicinity be adversely affected by filling of this site with acceptable material. Field investigations, which were coordinated with John D. Broadwater of the Virginia Research Center for Archaeology (VRCA), have

shown that cultural resources will not be impacted by dredging activities. This issue of possible effects of disposal on cultural resources was dismissed during verbal coordination as having no significant impact.

5.05 Overall, disposal at the Dam Neck Site with acceptable materials from Thimble Shoal and Atlantic Ocean Channels will not create any permanent increases in air or noise pollution. Any such increases would be slight and temporary due to additional machinery operation during dredging and disposal. No significant adverse effect on community or regional growth is anticipated. Although temporary, a few jobs would be created for the dredging and disposal operation. Similarly, no adverse impact on public facilities and services is expected. The effect of the project on commercial and recreational fishery resources and water quality is expected to be minor and short term. These effects are discussed in more detail in the appendix.

5.06 The relationship of the proposed plan for use of the Dam Neck Site to various Federal Acts and Executive Orders regarding environmental well-being is summarized in the following table.

Table 2. COMPLIANCE WITH ENVIRONMENTAL STATUTES

| Federal Policies | Compliance (a) |
|---|---|
| Archaeological and Historic Preservation Act, as amended | Full |
| Clean Air Act, as amended | Full |
| Clean Water Act of 1977, as amended | Full |
| Coastal Zone Management Act of 1972, as amended | Full |
| Endangered Species Act of 1973, as amended | Full |
| Estuary Protection Act (PL 90-454) | Full |
| Federal Water Project Recreation Act, as amended | Full |
| Fish and Wildlife Coordination Act, as amended | Full |
| Land and Water Conservation Fund Act of 1965, as amended | Full |
| Marine Protection, Research, and Sanctuary Act of 1969, as amended | Full |
| National Environmental Policy Act of 1969, as amended | Full |
| National Historic Preservation Act of 1966, as amended | Full |
| Rivers and Harbors Appropriation Act of 1899, as amended | Full |
| Watershed and Protection and Flood Prevention Act, as amended | N/A |
| Wild and Scenic River Act, as amended | N/A |
| Floodplain Management (E.O. 11988) | N/A |
| Protection of Wetlands (E.O. 11990) | N/A |

(a) Full - having met all requirements of the Statute for the current stage of planning; N/A - not applicable

## APPENDICES

APPENDIX I - Dam Neck Ocean Disposal, Site Evaluation Study.

APPENDIX II - Comment/Response Section

APPENDIX III - Pertinent Correspondence

## REFERENCES


1. An Assessment of the Ecological Impact of Open Ocean Disposal of Materials Dredged from a Highly Industrial Estuary, final report for period 1 November 1978 to 31 December 1979. Prepared for National Oceanic and Atmospheric Administration by Department of Biological Sciences, School of Sciences and Health Professions, Old Dominion University, Norfolk, VA, September 1980.

2. Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters, Implementation Manual for Section 103 of Public Law 92-532 (Marine Protection, Research, and Sanctuaries Act of 1972), Environmental Protection Agency/U.S. Army Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material, July 1977.

3. Final Environmental Impact Statement, Thimble Shoal Channel (Maintenance Dredging), Norfolk District, U.S. Army Corps of Engineers, Norfolk, Virginia 23510-1096, March 1973.

4. Feasibility Report, Norfolk Harbor and Channels, Virginia, Deepening and Disposal (including Final EIS), U.S. Army Corps of Engineers, July 1980.

5. Final Environmental Impact Statement, Norfolk Harbor and Channels, Virginia - Deepening and Disposal, U.S. Army Corps of Engineers, July 1980.

6. Addendum to Final Environmental Impact Statement for Norfolk Harbor and Channels, Virginia - Deepening and Disposal, U.S. Army Corps of Engineers, December 1980.

# APPENDIX I TO SUPPLEMENT I TO THE FINAL EIS, NORFOLK HARBOR AND CHANNELS, VIRGINIA DEEPENING AND DISPOSAL

## DAM NECK OCEAN DISPOSAL SITE

## SITE EVALUATION STUDY FOR DREDGED MATERIAL DISPOSAL

PREPARED BY

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NORFOLK DISTRICT

MAY 1985

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PURPOSE

1. General - The purpose of this study is to evaluate the Dam Neck Ocean Disposal Site for the permanent designation as a suitably configured ocean disposal site. Such a site is needed to contain dredged material from the maintenance and construction of Federally authorized navigation projects. The site could also be used for the disposal of dredged material from other dredging projects authorized in accordance with Section 103 of the Marine Protection Research and Sanctuaries Act of 1972. The Dam Neck Ocean Disposal Site was selected for evaluation because of its successful utilization as a dredged material disposal site since 1967 and because it was granted an indefinite interim designation by the Environmental Protection Agency in the Federal Register dated 11 January 1977.

2. Evaluation Criteria - The evaluations contained in this study are made with respect to the criteria specified in Parts 228.5 and 228.6 of the Code of Federal Regulations, Title 40 (40 CFR 228).

3. Evaluation Procedures - The procedures used to perform the evaluations in this study are based on the guidance contained in the draft report entitled "Technical Guidance for the Designation of Ocean Dredged Material Disposal Sites" dated October 1983. The procedures specified in the referenced draft report were developed jointly by technical personnel of the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE). This study is one of several pilot studies being conducted to evaluate the utility of the draft technical manual prior to its finalization.

4. Basis for Evaluation - The evaluations made in this study are based on available literature from engineering and scientific studies of the Dam Neck Ocean Disposal Site and vicinity. In addition to available literature, site specific studies made by Norfolk District and its contractors, Old Dominion University (Applied Marine Research Laboratory), the Coastal Engineering Research Center, and the U.S. Fish and Wildlife Service are included in the evaluation.

5. Study Report Format - The report format for this study is generally based on a draft report entitled "Yaquina Bay, Interim Ocean Dredged Material Disposal Site Evaluation Study," dated March 1984, also conducted as a pilot to examine the utility of the guidance manual for site designation.

NEED

6. General - Deep-draft navigation channels within the study area are essential to the economic well-being of the region and the national defense mission of the U.S. Navy. They enhance this country's balance of payments by allowing the economical transportation of about 50 percent of all U.S. coal exports. Because some of these channels are dependent upon hopper dredging methods, a suitable, permanently designated ocean dredged material disposal site is absolutely essential for continued maintenance and construction. The Dam Neck Ocean Disposal Site, suitably expanded and permanently designated, is expected to meet these essential needs. This expectation is based on its site use experience since 1967 and on the site evaluations contained in this study.

Figure 1 shows the existing and proposed channels that require hopper dredging methods with open ocean disposal. The use of sea-going hopper dredges in these channels is essential because of the exposed open bay and ocean conditions, and lack of suitable disposal areas in close proximity to the channels. The Dam Neck Ocean Disposal Site could also be needed for the disposal of material from Norfolk Harbor which is determined to meet ocean disposal criteria if adequate disposal areas in the Norfolk Harbor area were not available. This situation is a result of the Craney Island Disposal Area having a finite capacity and the fact that no replacement for Craney Island has been determined at this time.

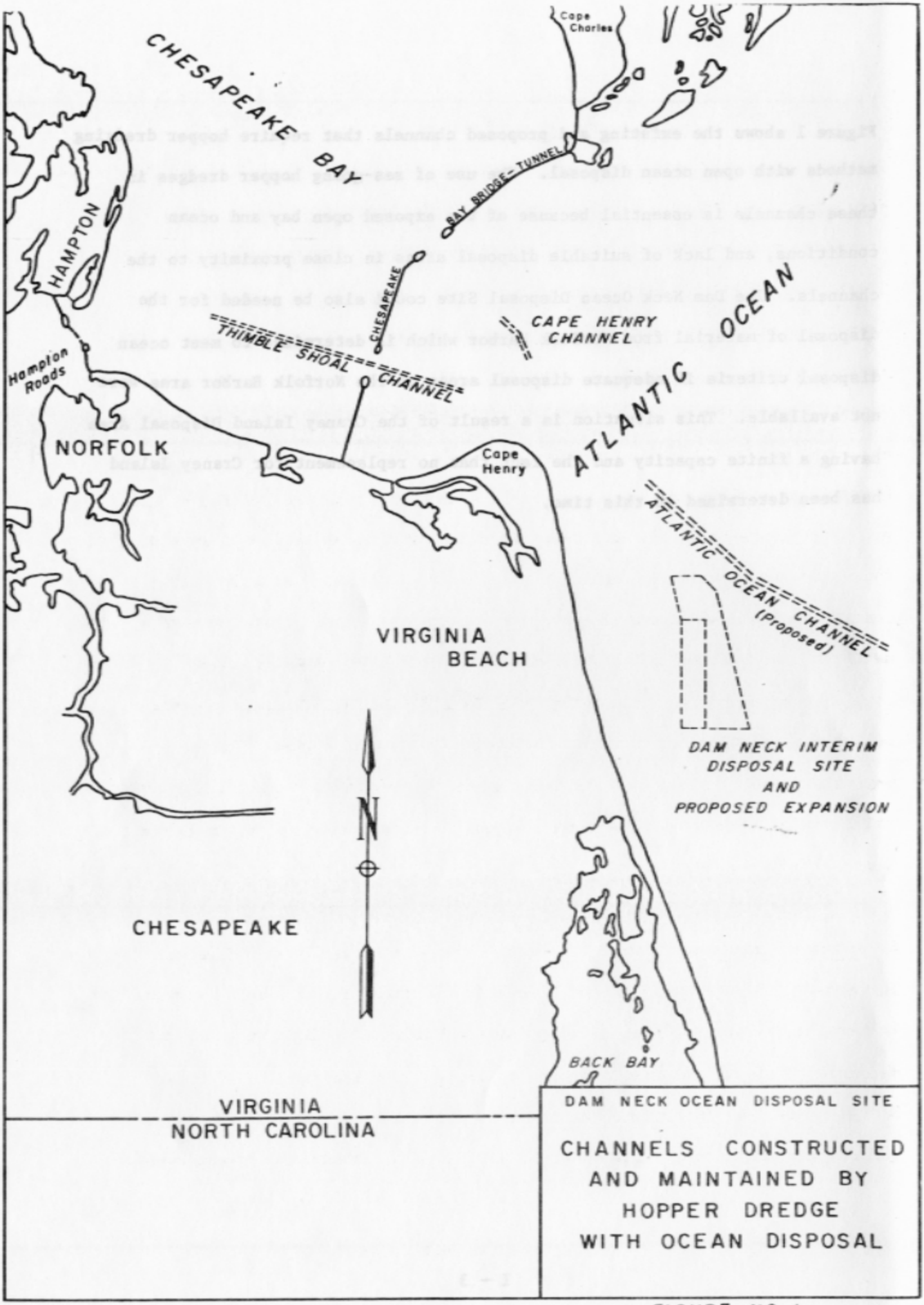

Cape Charles
CHESAPEAKE BAY
BAY BRIDGE - TUNNEL
HAMPTON
CHESAPEAKE
THIMBLE SHOAL CHANNEL
CAPE HENRY CHANNEL
ATLANTIC OCEAN
Hampton Roads
NORFOLK
Cape Henry
ATLANTIC OCEAN CHANNEL (Proposed)
VIRGINIA BEACH
DAM NECK INTERIM DISPOSAL SITE AND PROPOSED EXPANSION
N
CHESAPEAKE
BACK BAY
VIRGINIA
NORTH CAROLINA
DAM NECK OCEAN DISPOSAL SITE
CHANNELS CONSTRUCTED AND MAINTAINED BY HOPPER DREDGE WITH OCEAN DISPOSAL



FIGURE NO. 1

7. Maintenance Dredging Ocean Disposal Needs - There are two deep draft channels presently maintained by hopper dredges with ocean disposal at the Dam Neck site. The Thimble Shoal Channel is in the lower Chesapeake Bay and provides essential deep-draft access to the ports of Hampton Roads. Thimble Shoal Channel is an authorized Federal project which is maintained 45 feet deep and 1,000 feet wide along its 12-mile length. The channel is in exposed waters and must be maintained by seagoing hopper dredges. The Cape Henry Channel, which is also in the lower Chesapeake Bay, provides the entrance channel for all deep-draft traffic proceeding up the Chesapeake Bay. Cape Henry is an authorized Federal channel which is part of the Baltimore Harbor and Channels project. This channel is authorized to be 50 feet deep and 1,000 feet wide, and is now maintained 42 feet deep and 1,000 feet wide over a length of about 2.5 miles. Cape Henry Channel is in the exposed waters at the mouth of the Chesapeake Bay and must be maintained by seagoing hopper dredges. Both of these important deep-draft navigation channels require a suitable ocean disposal site for their continued maintenance. Failure to maintain these channels would result in draft limitations on the using traffic which would ultimately cause severe adverse economic impacts to the ports of Hampton Roads and Baltimore.

8. Channel Improvement Ocean Disposal Needs - As a result of a dramatic increase in the size of commercial vessels, particularly dry bulk carriers and tankers, since the channels serving Hampton Roads and Baltimore were last deepened, there is a compelling need to improve these channels. The Cape Henry Channel was authorized to be deepened from 42 feet to 50 feet in 1970 and an authorization appears imminent to deepen the channels serving Hampton

Roads from 45 feet to 55 feet. These navigation improvements will require hopper dredging methods to deepen Cape Henry Channel, Thimble Shoal Channel, and a new channel in the Atlantic Ocean. This new ocean channel must be constructed to a depth of at least 57 feet in an area that is now about 50 feet in depth over a length of about 11 miles. The majority of the dredged material from these channel improvements must be placed in an ocean disposal site. Some of the dredged material will be suitable for placement at nearby beaches and is expected to be used for that purpose to the extent possible. The Dam Neck Ocean Disposal Site is suitably located and its proposed configuration is adequately sized to accommodate the disposal of dredged material from these channel improvement projects. Failure to provide a suitable ocean disposal site could severely limit the capability to construct these needed improvements which could ultimately result in severe adverse economic impacts to the ports of Hampton Roads and Baltimore.

INTRODUCTION

9. Background - The ocean disposal site at Dam Neck has been in use since 1967 when the Corps deepened Thimble Shoal Channel to its present depth of 45 feet. Since that time all new work and maintenance dredged material from Cape Henry Channel and Thimble Shoal Channel, with limited exceptions, have been deposited at Dam Neck. These deposits included a variety of naturally occurring marine sediments, ranging from silts and clays to fine, medium, and coarse sands. To date, about 20.4 million cubic yards of dredged material have been placed at Dam Neck.

10. In 1977, the EPA designated Dam Neck as an interim ocean disposal site for dredged material. The geographic coordinates for Dam Neck as given in the Code of Federal Regulations (40 CFR 228.12) are: 36 50' 06" N, 75 53' 17" W; 36 46' 28" N, 75 53' 17" W; 36 46' 28" N, 75 54' 19" W; 36 50' 05" N, 75 54' 19" W. The EPA approval of this site was for an interim period pending final designation of the site for continuing use. The use specification (dredged material) and size are based on historical use.

11. The interim disposal site at Dam Neck is rectangular, 5,000 feet by 22,000 feet, or 110 X 106 square feet in area. The average seabed elevation within the site is -38 feet. In the absence of any major port deepening projects, the interim site can continue to accommodate the maintenance dredged materials from Thimble Shoal and Cape Henry for 50 years in the future, estimated at about 13 million cubic yards (mcy). With the deepening of the Norfolk Harbor and Channels and the Baltimore Harbor and Channels projects, a maximum of 36 mcy of new work dredged material may need to be deposited in an ocean disposal site. In addition, with the predicted increases in maintenance requirements subsequent to this new work, a maximum of 32 mcy of maintenance dredged material will need to be deposited in the ocean over a 50-year period.

12. The Dam Neck Ocean Disposal Site has been evaluated in terms of its management and use for present maintenance dredging ocean disposal requirements; for the deposit of new work dredged materials resulting from the incremental construction of the deepened channels, estimated to be a maximum of 36 mcy spread over a minimum seven (7) year construction period; and for future channel maintenance dredging requirements with the deepened channels,

estimated to be a maximum of 32 mcy spread over a fifty (50) year project life. These total disposal quantities required that enlargement of the interim site be evaluated. However, the site has been sized no larger than is necessary to provide an environmentally acceptable and operationally efficient disposal site in accordance with the established criteria. Details of the proposed expanded site are provided in paragraph 98 and in Appendix D, Disposal Site Design Evaluation. Proposed dimensions of the expanded site (figure 11) are 6,000 to 13,000 feet wide and 30,000 feet long, with a bottom area of 290 x 106 square feet.

13. Procedures for Evaluation - Ocean disposal site designation has gotten close scrutiny in the last year (1983). The concern that evaluations were taking too long, costing too much, and very few resulted in final designation, prompted EPA and the Corps to form a joint task force to examine the problem. This task force consisted of policy- and field-level personnel from both agencies. The task force met in September 1983 and prepared a draft procedures manual. This draft manual was published in October 1983 and recommended utilizing existing information to the extent possible. The workbook was developed to provide a general technical framework and guidance for the identification, evaluation, and designation of ocean disposal sites.

14. The site designation process was structured into three major phases in the workbook (figure 2). Phase I included delineation of the general area being considered for site designation and identification and collection of necessary information on resources, uses, and environmental processes for the area. Phase II involved identification of candidate sites within the area

based on information collected and processed in Phase I. The final Phase III was the evaluation of candidate sites and selection of a site or sites for designation.

15. In Phase I (figure 2), the geographic area of consideration must first be defined. Reasonable distance of haul is the determining factor and will be affected by such considerations as available dredging equipment, energy use constraints, costs, and safety. Then, within this delineated area of interest, a preliminary screening process (based on available data) is applied to identify and map reach boundaries for sensitive resources, as well as zones of incompatibility. Such areas may include special fisheries and shell fisheries, navigation lanes, beaches and marine sanctuaries.

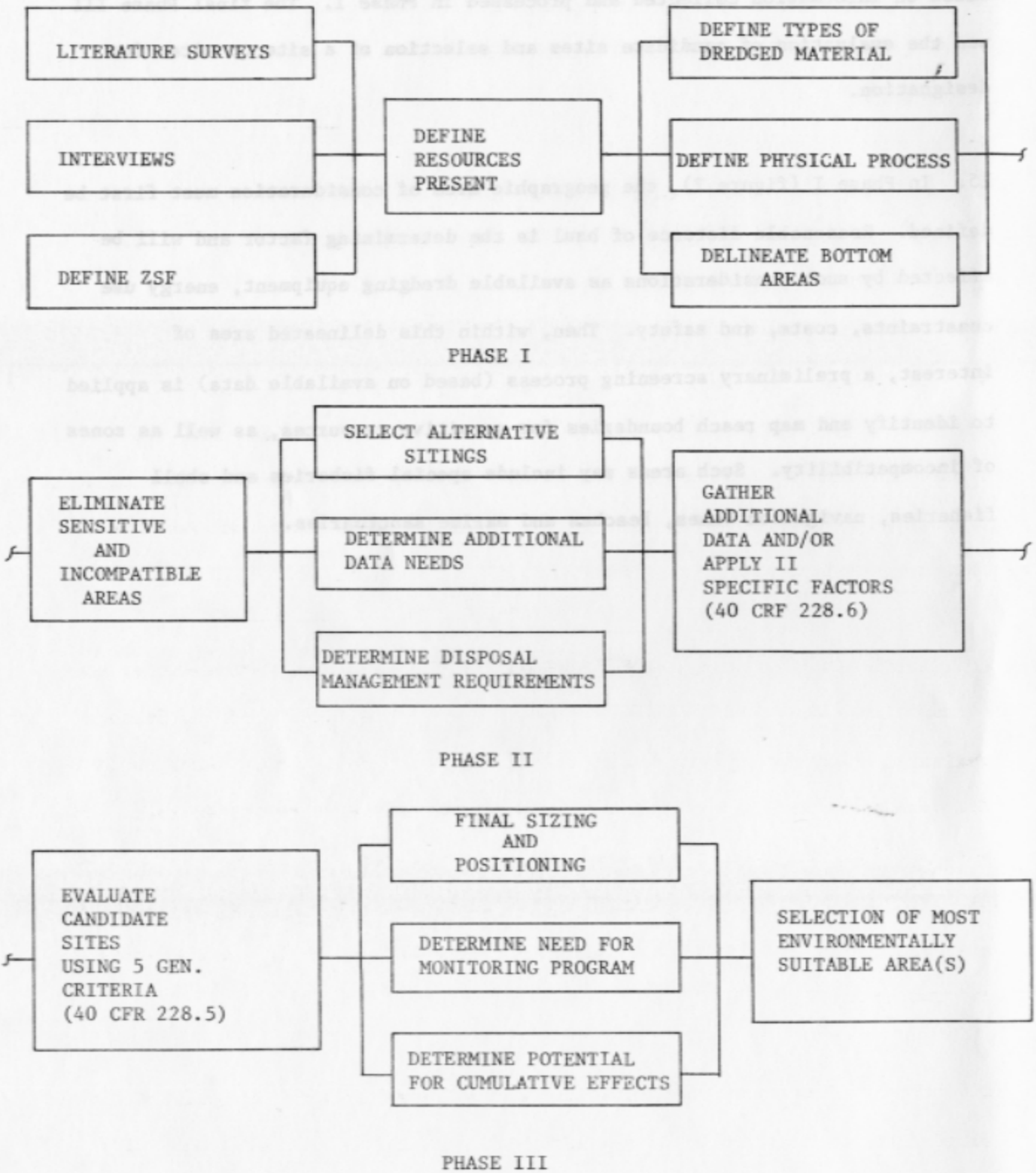



Figure 2. Overall Process for Ocean Dredged Material Disposal Site Evaluation as Detailed in Joint EPA/Corps Task Force Report: "Technical Guidance for the Designation of Ocean Dredged Material Disposal Sites" Oct 1983

16. Upon completion of preliminary screening, additional screening should be conducted, based on the general type of expected dredged material and a general knowledge of physical processes. This screening should delineate bottom areas that may be incompatible with anticipated sediments to be disposed, such as silt on sand. In addition, the secondary screening should ensure establishment of appropriate disposal buffer zones around each such identified sensitive or incompatible use area (figure 2).

17. Except in rare cases, the preliminary and secondary screening will have eliminated sensitive and incompatible areas from further consideration. The remaining areas may be considered as candidate areas for location of an ocean disposal site or sites. At this point, the selection of alternative sites for further evaluation becomes a matter of informed judgment.

18. During Phase II, fundamental issues are resolved and a determination made of additional data requirements. Candidate sites are identified for further evaluation considering their environmental aspects and other concerns, such as disposal management requirements. Phase II is considered completed when adequate data and information are available to address the 11 specific factors (40 CFR 228.6, Table 1) for each site under consideration. If additional data are required, steps should be immediately initiated to obtain the necessary information.

19. Phase III consists of evaluation of candidate sites and the selection of site(s) for designation. The environmental suitability of each alternative site for designation as an Ocean Dredged Material Disposal Site (ODMDS) will

be determined. Necessary evaluations are to be based on Part 228.6 "Specific Criteria for Site Selection" of the EPA Ocean Dumping Regulations and Criteria, Federal Register, 11 January 1977. Utilizing evaluations under Part 228.6, final will be made in accordance with Part 228.5 "General Criteria for Selection of Sites" (table 2).

20. In the event the evaluation, using the 11 specific factors and 5 general criteria (tables 1 and 2), shows an existing site to be environmentally unacceptable for continued use, a search for an alternate site or sites should be indicated. This search would follow the screening and evaluation sequence delineated previously for new sites.

21. The process outlined above was specifically structured for the identification and designation of new sites for ocean disposal of dredged material. However, with certain exceptions, this process will also apply to designation studies of historically used dredged material disposal sites which EPA has designated on an interim basis.

22. The primary objective of designation studies for historically used, interim-designated sites is to evaluate the suitability of each such site for continued use. Establishment of the initial geographic zone of consideration (Phase I) for this site evaluation study should be based specifically on the existing site location and estimated zone of potential impact. At the same time, the evaluation must consider both existing, as well as anticipated future disposal requirements for each selected site.

23. If the evaluation indicates that the existing site is environmentally acceptable for continued disposal of dredged material, the site should be the prime candidate for final designation. However, any possible environmental or operational advantages that might be gained by relocation of the site should be investigated. If there is no substantive environmental or operational advantage to relocating the site, the final designation of the existing interim designated site is recommended.

24. Format - This report will constitute a site evaluation study, as required in 40 CFR, Parts 228.4 (e), 228.5, 228.6 and 228.12. The main body of the report addresses specifically all criteria and factors required in Parts 228.5 and 228.6. Technical information used to discuss these criteria and factors are collected in technical appendices A through D at the end of this report.

SITE EVALUATION CRITERIA

25. General - The Marine Protection, Research and Sanctuaries Act (MPRSA) requires that site evaluation be performed prior to final designation for continued use as an ocean disposal site. A site evaluation study is defined in 40 CFR 228.2(c) as:

> "The collection, analysis, and interpretation of all pertinent information available concerning an existing disposal site, including but not limited to, data and information from trend assessment surveys, monitoring

surveys, special purpose surveys of other Federal agencies, public data archives, and social and economic studies and records of affected areas."

26. These studies are used to comply with and discuss criteria and factors listed in Parts 228.5 and 228.6. Criteria and factors are listed in tables 1 and 2.

Table 1. ELEVEN SPECIFIC FACTORS FOR SITE SELECTION (40 CFR 228.6)

1. Geographical position, depth of water, bottom topography, and distance from coast.

2. Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.

3. Location in relation to beaches or other amenity areas.

4. Types and quantities of wastes proposed to be disposed of and proposed methods of release, including methods of packaging the waste, if any.

5. Feasibility of surveillance and monitoring.

6. Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current velocity, if any.

7. Existence and effects of present or previous discharges and dumping in the area (including cumulative effects).

8. Interference with shipping, fishing, recreation, mineral extraction, desalination, shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.

9. Existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.

10. Potential for the development or recruitment of nuisance species within the disposal site.

11. Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.

Table 2. GENERAL CRITERIA FOR THE SELECTION OF SITES

(40 CFR 228.5)

a. The dumping of material into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with

other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.

b. Locations and boundaries of disposal sites will be chosen so that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery.

c. If at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet criteria for site selection set forth in section 228.5-228.6, the use of such sites will be terminated as soon as suitable alternative disposal sites can be designated.

d. The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and to permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study.

e. EPA will, whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used.

27. Zone of Siting Feasibility (ZSF) - The Draft EPA/Corps Technical Guidance (October 1983) requires that ocean disposal sites be designated within a feasible radius from the point of dredging. This is called the Zone of Siting Feasibility (ZSF). The guidance also states that certain exceptions will apply when the primary objective is to designate historically used dredged material disposal sites which have an EPA interim designation status. For these existing sites, the initial geographic zone of consideration (ZSF) is based on the existing site location and the estimated zone of potential impact. For the Dam Neck Interim Site, this guidance would dictate a very limited area of consideration. Furthermore, there would be no need to consider relocating the site unless substantive environmental or operational advantages could be gained. The Interim Site size is to be expanded and managed to accommodate new work material; this was considered in evaluation of the impact area.

28. This study will expand the ZSF to include areas in proximity to the Dam Neck Interim Site which have previously been considered or could be considered for the ocean disposal of dredged material. The Dam Neck site continues to be used for maintenance dredging, and has been identified as a disposal site for the deepening of Cape Henry and Thimble Shoal Channels in the Chesapeake Bay and construction of a bay entrance channel in the Atlantic Ocean. The EPA is considering the designation of a new disposal site known as the Norfolk Site.

This Norfolk Disposal Site could be used to provide flexibility to long-term disposal requirements. The ZSF will encompass the limits of the proposed Norfolk Site and the historically used Dam Neck Site.

29. Important factors to be considered in delineating the ZSF are:

a. Type of dredging and disposal plant;

b. Navigation restrictions;

c. The costs of transportation to the disposal site and the overall costs of the navigation project;

d. Political boundaries;

e. Distance to the edge of the continental shelf;

f. Feasibility of monitoring and surveillance.

30. The type of dredging and disposal plant to be used for the navigation channel dredging is an important factor in defining the ZSF. For Thimble Shoal Channel, Cape Henry Channel, and the new Atlantic Ocean Channel, experience has shown that channel dredging with disposal of the dredged material at sea is feasible only with the use of sea-going hopper dredges. The dredging industry has several medium and large class self-propelled hopper

dredges within a mobilization distance to the project area. These dredges are certified for operations in the ocean, and are well-suited for ocean disposal. Operationally, the offshore haul distance for ocean-certified dredges is limited by a 5 to 7 day fuel supply, or a 1000 mile to 1500 mile round trip. Other considerations are clearly more constraining in delineating the ZSF. Alternatives to the Dam Neck site which increase the dredged material haul distance will also increase the exposure to adverse sea or weather conditions, increase the total dredging contract time, and increase the overall project duration. An increased haul distance may also result in an inefficient use of available dredge time or an uncompetitive costly bidding process.

31. The draft of the dredge at the time it dumps its load is a limiting factor. Large sea-going dredges have loaded drafts approaching 30 feet. Thus the 30-foot depth contour in the ocean will be considered as the inshore limit to the ZSF. There are no other known shallow non-navigable areas that would further restrict hopper dredge operations, such as wrecks, rock outcroppings or shoal areas. Currents are normally slight throughout the year and will not be a navigation constraint. Storm conditions may at times limit the dredging activity because of visibility and sea conditions, not because of currents. Such storm events occur several times during the year. Storms will increase the dredging time and contract duration but are not in themselves an absolute limiting factor in determining the ZSF.

32. The costs of transporting dredged material from Cape Henry Channel, Thimble Shoal Channel, or the Atlantic Ocean Channel to the disposal site are

proportional to the haul distance and required hopper dredge time. While these costs are the major component of the total dredging costs of these channels, it must be kept in mind that the channels are only segments of larger navigation projects serving the ports of Baltimore and Hampton Roads. As such the channel segments are not individually viewed with respect to benefit-cost analyses. Both the Baltimore Harbor and Channels and the Norfolk Harbor and Channels deepening projects are strongly justified, with benefit-cost ratio (BCR) exceeding 3.0 (Baltimore 5.5, Norfolk 3.6). Although ocean disposal costs are important components of the total navigation project costs, they would not have a serious effect on the BCR unless the total project were only marginally justified. Since both projects are strongly justified, it is not appropriate in this case to compare ocean disposal costs to the overall navigation project costs. However, it is important to compare the disposal costs of alternatives to the Dam Neck site to show their relative economic merits.

33. The cost of dredged material disposal can be compared in relative terms for various ocean disposal sites provided that other operational costs are held constant. A typical hopper dredge operational cycle consists of dredging (pumping) time, turning time, sailing time to and from the disposal area and dumping time. If all elements of the operational cycle except the round trip sailing time to the disposal area are held constant, then the relative costs for various ocean disposal alternatives are based primarily on distance from the dredging area. As the distance offshore to an ocean disposal site increases, other factors should be considered. With increases in sailing

time offshore, the following factors are affected: (1) increased exposure to severe or limiting sea conditions, (2) increased occurrence of mechanical breakdowns, (3) increased contract duration and supervision/administration costs, and (4) project benefits take longer to achieve and are lost. The costs of these effects are difficult to determine with respect to individual contractors and projects and in any case are usually small when compared to the costs directly attributable to sailing time. The following comparison and tables will only consider the effects of sailing distance and time on disposal costs, and will only use the new work quantities for channel deepening.

34. The following dredge plant operational characteristics will be used for the comparison of disposal costs:

Dredge Plant - Trailing Suction Hopper Dredge

Dredge Class - Medium Class

Total Operating Cost - $42,000/day; $29.17/min

Average Sailing Speed - 10 mph

Nominal Hopper Capacity - 3600 CY

Average Load - 2200 CY

Table 3. TRIPS TO DISPOSAL AREA

| Channel to be Dredged | Total New Work Dredging Quantity | Average Quantity Per Load | Total Trips |
|---|---|---|---|
| Thimble Shoal Channel | 23,500,000 CY | 2200 CY | 10,682 |
| Atlantic Ocean Channel | 10,000,000 CY | 2200 CY | 4,545 |
| Cape Henry Channel | 2,800,000 CY | 2200 CY | 1,273 |

35. In order to depict the wide range of disposal costs that may be encompassed by the zone of siting feasibility and the continental shelf, the following sites will be used for comparative purposes:

Site A is simply the area alongside or near the various dredging areas, for this comparison it is considered to be on average 1/2 mile from the dredging area, resulting in a 1 mile round trip distance in all cases.

Site B is the CBJ Buoy at the mouth of the Chesapeake Bay, this site is representative of deep areas near the mouth of the Chesapeake Bay on the inner edge of the zone of siting feasibility.

Site C is the center of the Dam Neck Ocean Disposal Site.

Site D is the center of the proposed Norfolk Ocean Disposal Site, located about 15 nautical miles east-northeast from the CBJ Buoy.

Site E is the approximate edge of the continental shelf located east of the zone of siting feasibility.

36. It should be noted that although all of the above sites are compared on the basis of hopper dredge operations, disposal near the dredging area (Site A) might permit the use of hydraulic-pipeline dredges at lower cost and that the disposal of dredged material at the edge of the continental shelf (Site E) might result in the use of specialized ocean dumping barges which may have different operating costs than hopper dredges.

37. The following tables present the relative disposal costs for deepening the Thimble Shoal Channel, Atlantic Ocean Channel and Cape Henry Channel:

Table 4. THIMBLE SHOAL CHANNEL DISPOSAL COST

| Disposal Site | Round Trip Distance (S.M.) | Sailing Time Per Load (min) | Total Time (min) | Total Disposal Cost (Rounded) |
|---|---|---|---|---|
| A | 1.0 | 6 | 64,092 | $ 1,900,000 |
| B | 20.5 | 123 | 1,313,886 | 38,300,000 |
| C | 39.2 | 235 | 2,510,270 | 73,200,000 |
| D | 54.6 | 328 | 3,503,696 | 102,200,000 |
| E | 160.0 | 960 | 10,254,720 | 299,100,000 |

Table 5. ATLANTIC OCEAN CHANNEL DISPOSAL COST

| Disposal Site | Round Trip Distance (S.M.) | Sailing Time Per Load (min) | Total Time (min) | Total Disposal Cost (Rounded) |
|---|---|---|---|---|
| A | 1.0 | 6 | 27,270 | $ 800,000 |
| B | 13.5 | 81 | 368,145 | 10,700,000 |
| C | 9.2 | 55 | 249,975 | 7,300,000 |
| D | 28.0 | 168 | 763,560 | 22,300,000 |
| E | 130.0 | 780 | 3,545,100 | 103,400,000 |

Table 6. CAPE HENRY CHANNEL DISPOSAL COST

| Disposal Site | Round Trip Distance (S.M.) | Sailing Time Per Load (min) | Total Time (min) | Total Disposal Cost (Rounded) |
|---|---|---|---|---|
| A | 1.0 | 6 | 7,638 | $ 200,000 |
| B | 7.0 | 42 | 53,466 | 1,600,000 |
| C | 26.0 | 156 | 198,588 | 5,800,000 |
| D | 37.5 | 225 | 286,425 | 8,400,000 |
| E | 150.0 | 900 | 1,145,700 | 33,400,000 |

Table 7. TOTAL DISPOSAL COST FOR ALL THREE CHANNELS

| Disposal Site | Thimble Shoal Channel Cost | Atlantic Ocean Channel Cost | Cape Henry Channel Cost | Total Disposal Cost |
|---|---|---|---|---|
| A | $ 1,900,000 | $ 800,000 | $ 200,000 | $ 2,900,000 |
| B | 38,300,000 | 10,700,000 | 1,600,000 | 50,600,000 |
| C | 73,200,000 | 7,300,000 | 5,800,000 | 86,300,000 |
| D | 102,200,000 | 22,300,000 | 8,400,000 | 132,900,000 |
| E | 299,100,000 | 103,400,000 | 33,400,000 | 435,900,000 |

38. As previously stated, the ZSF will encompass the proposed Norfolk Disposal Site. Since EPA is in the process of designating the Norfolk Site, it would not be practical to consider hauling the material further than this site. Therefore, the seaward extent of the Norfolk Site will be used to determine the radius of the ZSF. Vessels transporting material dredged from Thimble Shoal or Cape Henry Channels would usually conform to the Chesapeake Bay Traffic Separation Scheme and pass the "CBJ" Buoy at the mouth of the Chesapeake Bay. The approximate position of this buoy makes an appropriate radius point for the ZSF. The length of the radius is about 19 nautical miles, in order to accommodate the limits of the proposed Norfolk Disposal Site. The planned Atlantic Ocean Channel is contained within this ZSF. Since the ocean channel will generate a limited percentage of the total disposal requirements, it is not necessary to modify or expand the ZSF on the basis of this single channel.

39. Political boundaries do not, in this case, limit the location of a disposal site. No states other than Virginia, and no nations other than the U.S., are involved in the ocean waters immediately offshore from the Chesapeake Bay mouth.

40. The EPA regulations on ocean disposal (40 CFR 228) require the designation, where feasible, of disposal sites beyond the edge of the continental shelf. In waters offshore of Virginia, the 100-fathom depth contour may be used to define the edge of the continental shelf. The shelf has a slight slope that gradually increases with distance offshore. Seaward

of the 100-fathom depth contour, the seabed slope greatly increases, and within a relatively short distance the seabed is at a depth of 500 fathoms and greater. Using this 100-fathom contour places the edge of the continental shelf at a distance about 70 nautical miles offshore. This is well beyond the limits of the ZSF radius (See figure no. 3). Disposal of dredged material beyond the continental shelf would increase the round-trip haul distance by at least 140 nautical miles, would quadruple the ocean disposal cost, and clearly is not feasible in this case.

41. The feasibility of monitoring and surveillance is another factor to be considered in delineating the ZSF. Surveillance is normally accomplished through routine inspection, reporting requirements, and in some cases pre-dump and post dump surveys by seaworthy Corps vessels. If data-gathering as a part of a monitoring plan is required, certain data could be obtained on the dredging vessel itself. On the other hand, any monitoring data requirements which cannot be satisfied from on board the dredge would require separate, seaworthy monitoring vessels. The availability of suitable vessels does not appear to be a constraint to the ZSF. In formulating monitoring or surveillance plans, the need for and applicability of data and the capability to obtain data should be carefully considered in light of the expected offshore sea and weather conditions.

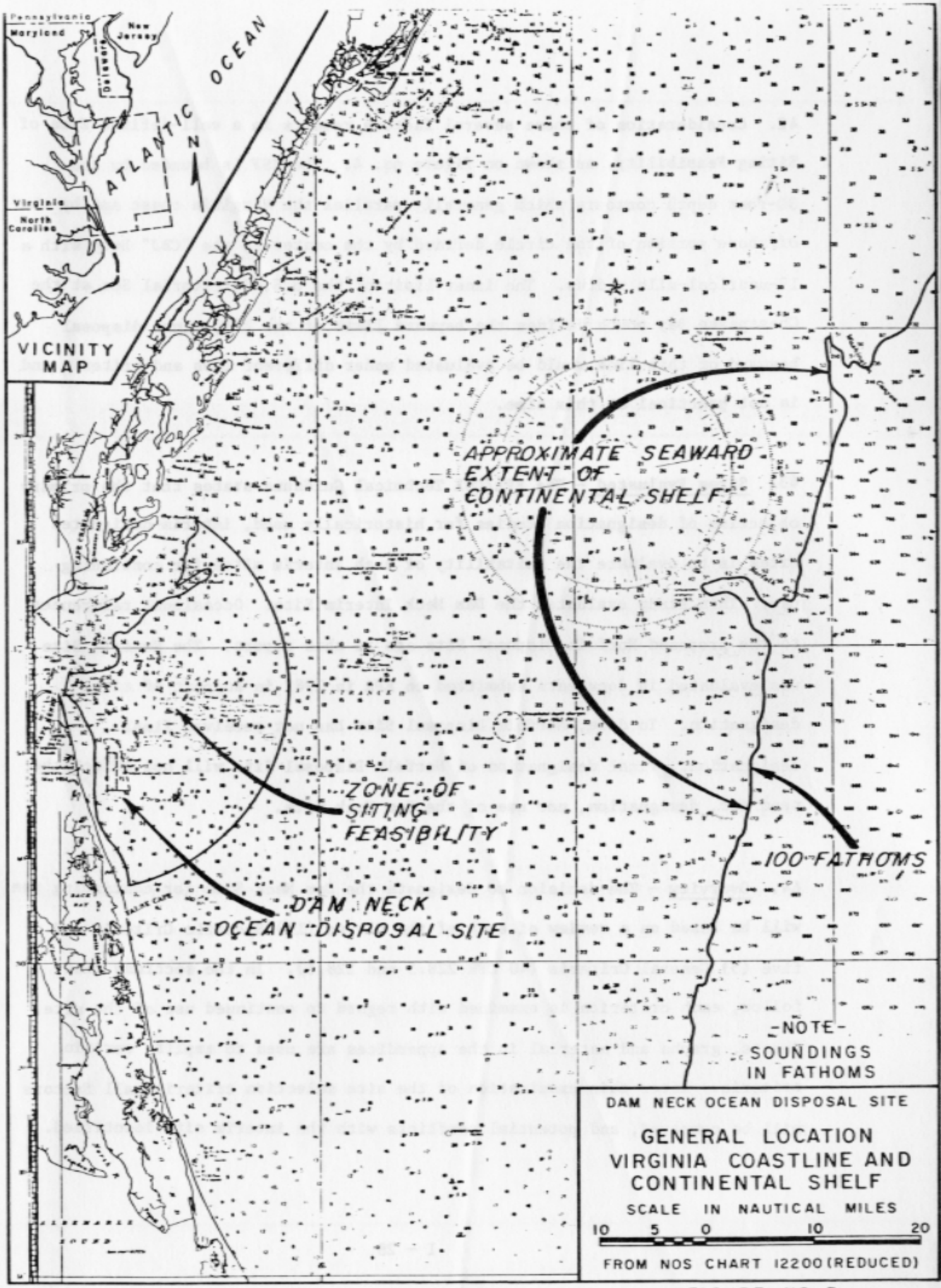

Pennsylvania
Maryland
New Jersey
Delaware
ATLANTIC OCEAN
N
Virginia
North Carolina
VICINITY MAP
APPROXIMATE SEAWARD EXTENT OF CONTINENTAL SHELF
ZONE OF SITING FEASIBILITY
DAM NECK OCEAN DISPOSAL SITE
100 FATHOMS
-NOTE-
SOUNDINGS IN FATHOMS
DAM NECK OCEAN DISPOSAL SITE
GENERAL LOCATION
VIRGINIA COASTLINE AND CONTINENTAL SHELF
SCALE IN NAUTICAL MILES
10 5 0 10 20
FROM NOS CHART 12200 (REDUCED)



FIGURE NO. 3

42. Consideration of these several factors results in a well-defined Zone of Siting Feasibility, as shown on figure no. 4. The ZSF is bounded by the 30-foot depth contours which generally parallel the Virginia coast and by the offshore portion of the circle defined by the center at the "CBJ" Buoy with a 19-nautical-mile radius. The inner limit of the U.S. Territorial Sea at the Chesapeake Bay mouth defines the bayward limit of the ZSF, since disposal bayward of this line would be evaluated under different laws and criteria and is not practical at this time.

43. Sites Evaluated - The EPA/COE Technical Guidance states that the primary objective of designation studies for historically used, interim-designated sites is to evaluate the suitability of such interim sites for continuing use. This study evaluates the Dam Neck Interim Site. Occasional references to the proposed Norfolk Disposal Site are in this report. The Norfolk Site was evaluated in documents submitted to EPA in 1982 in support of site designation. To date, Norfolk Disposal Site has not received final designation. Final designation of Norfolk Disposal Site will not affect the need for, designation, nor use of the Dam Neck Site.

44. Overview - The decision to designate the Dam Neck Site for continuing use will be based on a review of each of the eleven (11) Specific Criteria and five (5) General Criteria (40 CFR 228.5 and 228.6). In the sections that follow, each criterion is examined with regard to continued use of the site. Charts, graphs and material in the Appendices are used to amplify certain criteria. After this examination of the site selection criteria, all factors will be compared, and potential conflicts with the interim site identified.

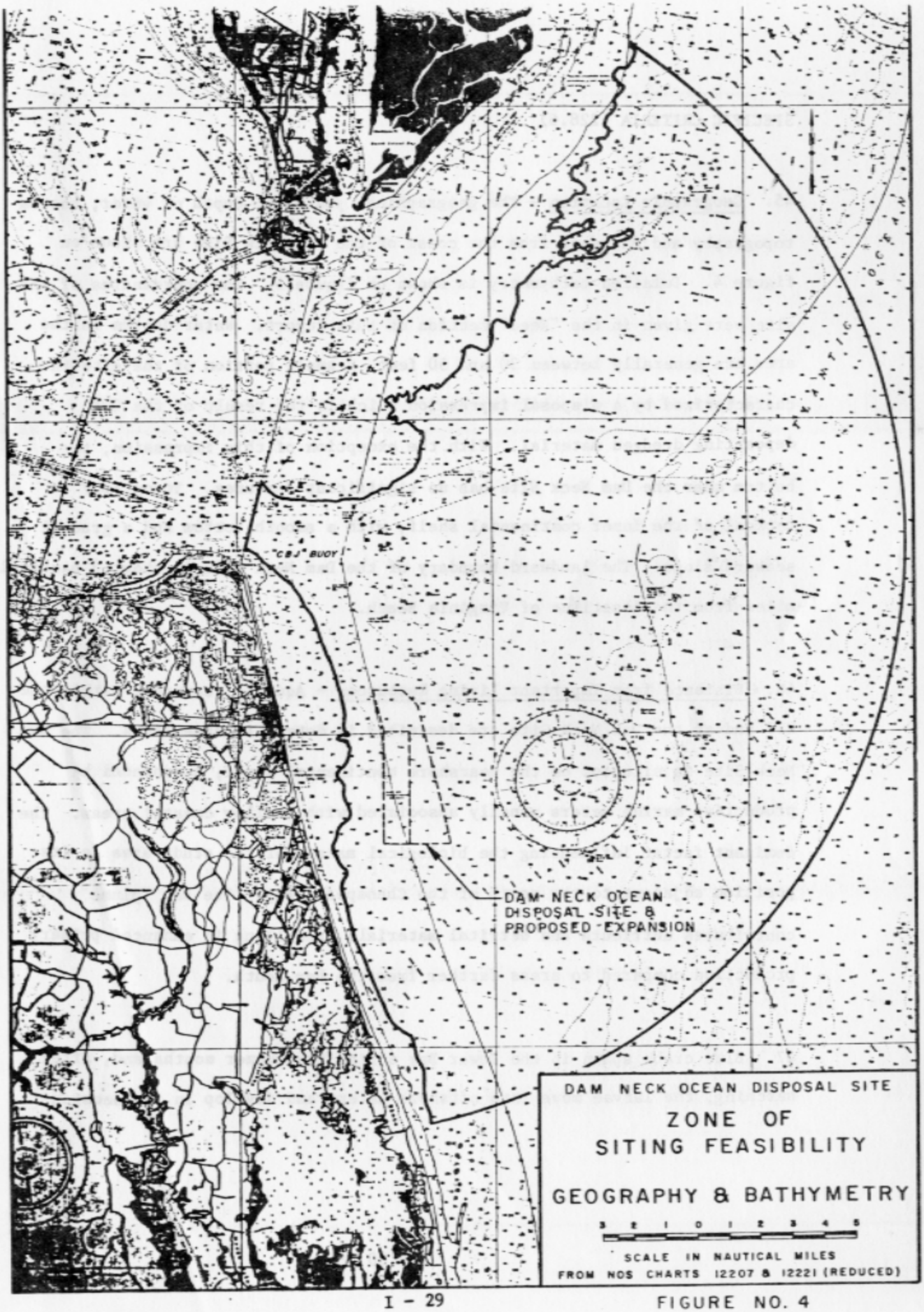

"CBJ" BUOY
DAM NECK OCEAN
DISPOSAL SITE &
PROPOSED EXPANSION
DAM NECK OCEAN DISPOSAL SITE
ZONE OF
SITING FEASIBILITY
GEOGRAPHY & BATHYMETRY
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES
FROM NOS CHARTS 12207 & 12221 (REDUCED)



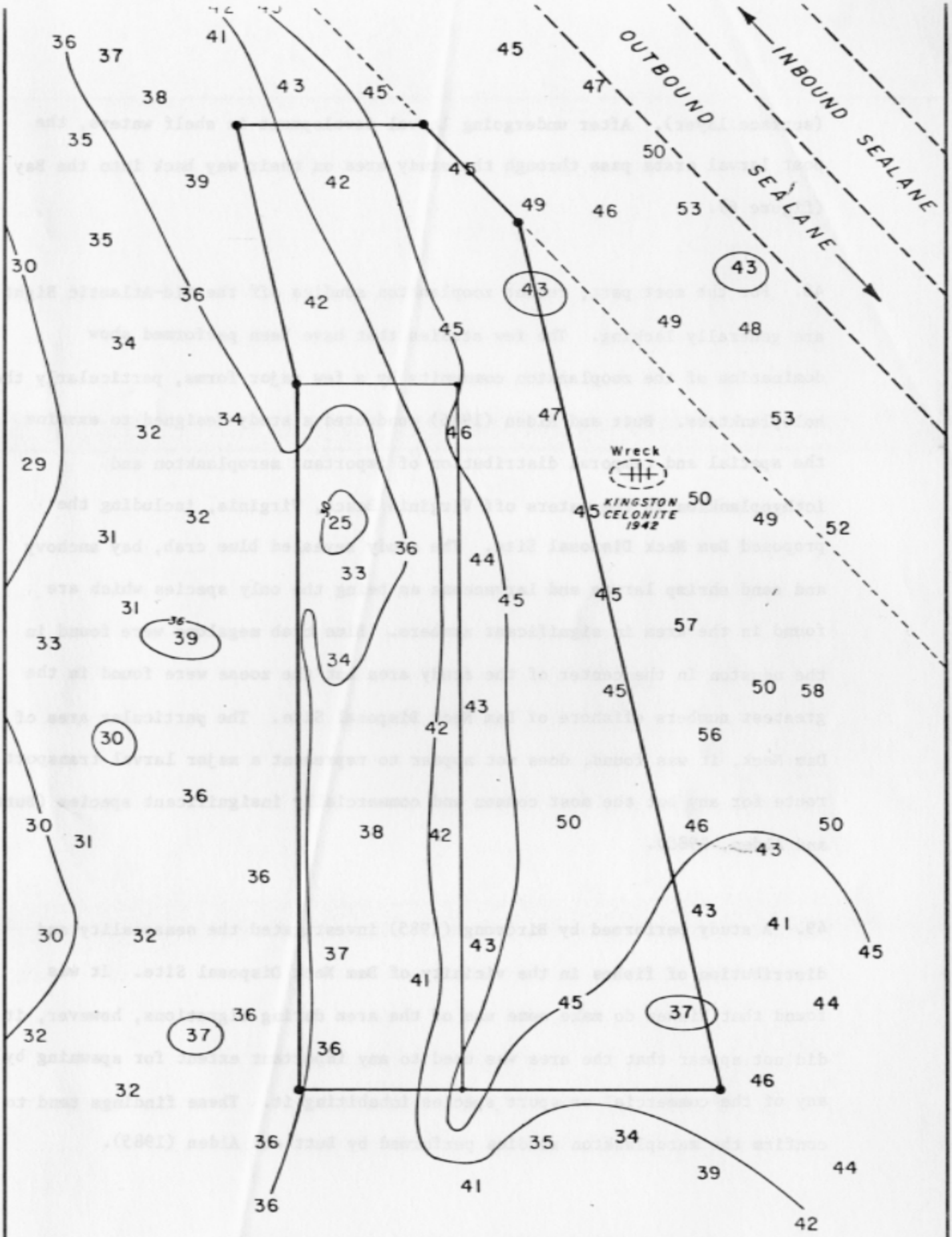
FIGURE NO. 4

SPECIFIC CRITERIA (228.6)

45. Geographic Location - The geographical position, depth of water, bottom topography and distance from the coast of the Dam Neck Site are shown on figure 4. Detailed bathymetry is shown on figure 5. The coordinates of the site were given in the "Need" section of this report. Water depths in the area are generally between 30 and 50 feet. A small portion of the site is characterized by a disposal impression which is the result of the COE depositing dredged material. With the exception of this impression, the bottom near the Dam Neck Site has no significant features. Topography is typical of the inner continental shelf, with a smooth bottom and a gradual seaward slope. The landward boundary of the Dam Neck Site is about 3 nautical miles from the coastline of Virginia Beach.

46. Distance from Important Living Resources - Aquatic resources within the ZSF and at the Dam Neck Site are described in detail in Appendix A. The Dam Neck Site is situated on the nearshore continental shelf, surrounded by productive marine waters usually associated with shallow coastal areas. The dominant factor influencing the biological makeup of the study area is its position adjacent to the mouth of the Chesapeake Bay. The Bay "plume" contributes nutrients and detrital materials, resulting in enhanced primary production compared to areas farther from the Bay mouth.

47. Blue crabs spawn in the lower Bay during the summer months and, after hatching, the larvae move into offshore waters and develop in the neuston




DAM NECK OCEAN DISPOSAL SITE

DETAILED BATHYMETRY

DEPTHS IN FEET BELOW MEAN LOW WATER

(FROM NOS CHARTS & CE SURVEYS)

SCALE: 1" = 4,000'



FIGURE NO. 5

(surface layer). After undergoing larval development in shelf waters, the post larval crabs pass through the study area on their way back into the Bay (figure 6).

48. For the most part, recent zooplankton studies off the Mid-Atlantic Bight are generally lacking. The few studies that have been performed show domination of the zooplankton community by a few major forms, particularly the holoplankters. Butt and Alden (1985) conducted a study designed to examine the spatial and temporal distribution of important meroplankton and icthyoplankton in the waters off Virginia Beach, Virginia, including the proposed Dam Neck Disposal Site. The study revealed blue crab, bay anchovy and sand shrimp larvae and Larvaceans as being the only species which are found in the area in significant numbers. Blue crab megalope were found in the neuston in the center of the study area but the zoeae were found in the greatest numbers offshore of Dam Neck Disposal Site. The particular area of Dam Neck, it was found, does not appear to represent a major larval transport route for any but the most common and commercially insignificant species (Butt and Alden, 1985).

49. A study performed by Birdsong (1985) investigated the seasonality and distribution of fishes in the vicinity of Dam Neck Disposal Site. It was found that fishes do make some use of the area during migrations, however, it did not appear that the area was used to any important extent for spawning by any of the commercial or sport species inhabiting it. These findings tend to confirm the meroplankton studies performed by Butt and Alden (1985).

50. A small conch fishery occurs along Virginia Beach from about 1.5 to 3 miles offshore (figure 7). There are no oyster reefs or other benthic molluscs abundant enough to be commercially important.

51. The only endangered or threatened species which would occur in the study area on more than an occasional or transient basis are marine turtles. The lower Chesapeake Bay is a summer foraging area for several populations of juvenile sea turtles. Evidence suggests that Chesapeake Bay is an important nursery for immature loggerheads (C. caretta) and Kemp's ridleys (L. kempii) turtles. The Virginia Institute of Marine Science (VIMS) has initiated a sighting program in which they have positively identified over 1,000 turtles. Other data accumulated indicates an estimated 3600 loggerheads and 270 kemp's ridleys moving into the Bay each summer to forage. Migration from wintering sites near Cape Hatteras, North Carolina and from as far south as Florida begins about the end of May, as water temperatures reach 20°C (Musick, et. al., 1984), Bottom temperatures at Dam Neck range from 8 to 10°C during the period of May through mid-June (Alden and Butt, 1985), the time period during which sea turtles are migrating north into the Bay.

(a) Disposal Impacts - The use of Dam Neck Disposal Site is not expected to impact migrating sea turtles for the following reasons:

(1) following a dump, water quality impacts, including suspended sediment are short-lived and spatially limited effects (see paragraphs 83-90). These short-lived and localized impacts could easily be avoided by the actively swimming sea turtles

(2) migrating sea turtles are following the 20°C isotherm and are not likely to venture into waters 8 - 10°C to feed or swim

(3) since sea turtles are opportunistic feeders it is likely that food could and would be found elsewhere. The area of bottom impact from a dump represents a miniscule portion of the total area over which the sea turtles are migrating and feeding (it has not been established for certain that sea turtles are feeding enroute to the Bay)

(b) Dredging Impacts - Sea turtles are not known to breed or nest within Chesapeake Bay, therefore, neither of these activities will be impacted by dredging within the limits of the Bay. The Chesapeake Bay is, however, an important nursery area for immature loggerheads (Caretta caretta) and Kemp's ridleys (Lepidochelys kempii). Benthic foraging by both species is likely to occur during their migrations into and out of the Bay, which occur during May-June and August-September, respectively.

If Thimble Shoal Channel is located within the migration route of the immature sea turtles, then dredging could physically damage or destroy some individuals during the migration periods. Dredging could also interfere with their migration due to such factors as night lighting, vibration, altered currents and increased turbidity. In addition, since sea turtles spend approximately 95% of their time near the bottom, except during migration, presumably feeding, destructive effects on the benthic fauna of the channel could then, in turn, affect the turtles.

Regardless of whether or not dredging activities are being conducted, Thimble Shoal Channel is a hazardous area for sea turtles. This channel is heavily used by commercial ships such as coal colliers, which are not fully loaded but are loaded as full as channel depths will allow. In order to gain maximum benefit from their capacities, these ships are very near bottom and their screws are generating tremendous turbulent forces. Fortunately, the distance between the Virginia Capes is great enough that turtles are not funneled into Thimble Shoal Channel as they enter or leave the Bay. The cross-sectional distance of Thimble Shoal Channel is less than 4% of the cross-sectional distance of the mouth of the Bay.

In order to gain further insight into potential for adverse effects on sea turtles, which could result from dredging in Thimble Shoal Channel, the Corps of Engineers has required that the Federal Highway Administration adhere to a program of conditions during their proposed dredging of this channel to obtain fill for construction of I-664. These conditions were proposed in lieu of "time of year" restrictions, and adherence is required only during the period of May 15 through June 30, as follows:

i. Use a routine dredging operation which maximizes efficiency in order to minimize dredging time.

ii. Install a device with 6 to 8 inch openings over the hopper overflows to trap any turtle parts drawn into the dredge.

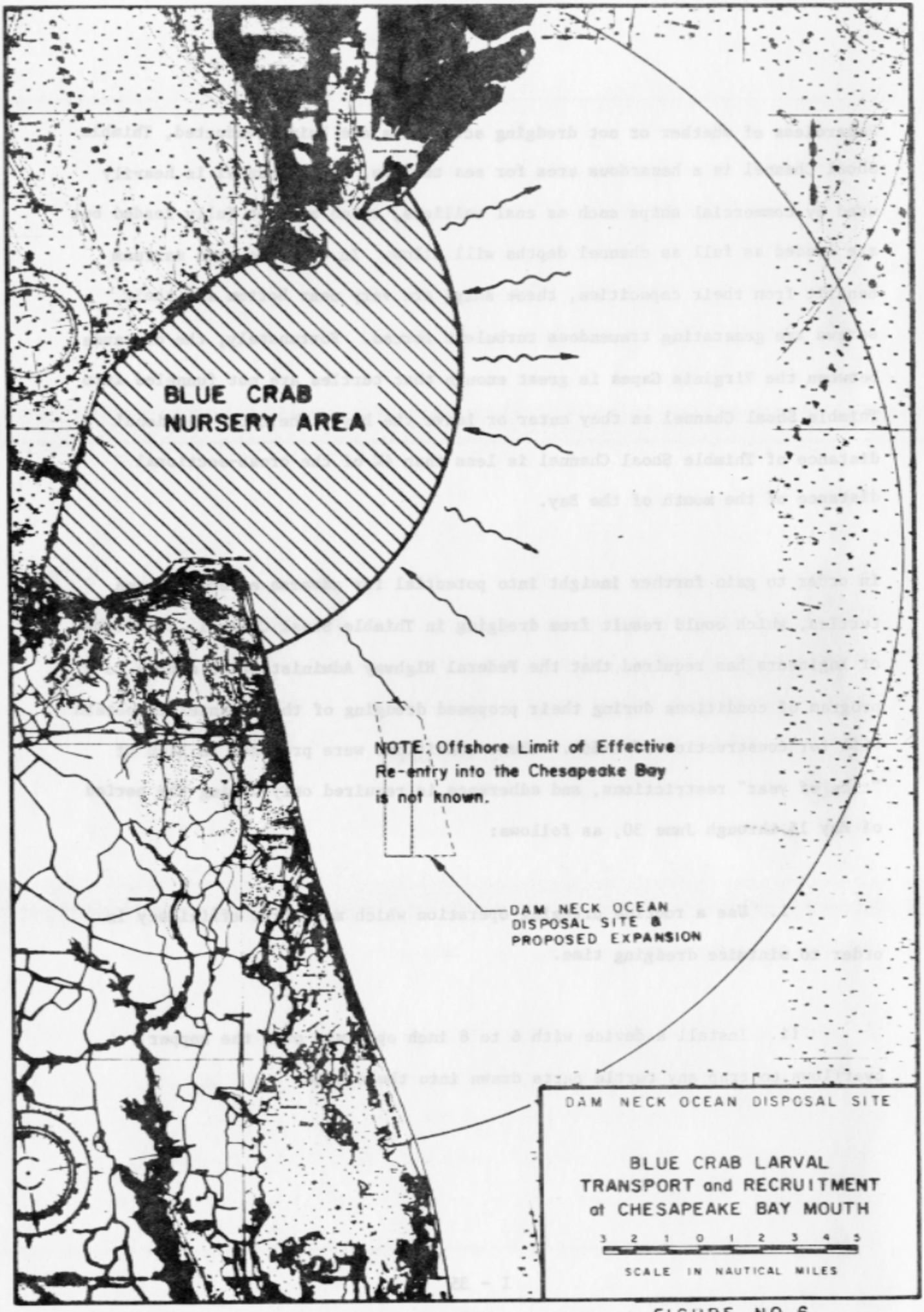

BLUE CRAB
NURSERY AREA
NOTE: Offshore Limit of Effective
Re-entry into the Chesapeake Bay
is not known.
DAM NECK OCEAN
DISPOSAL SITE &
PROPOSED EXPANSION
DAM NECK OCEAN DISPOSAL SITE
BLUE CRAB LARVAL
TRANSPORT and RECRUITMENT
at CHESAPEAKE BAY MOUTH
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES



FIGURE NO. 6

iii. Station trained personnel on the dredge full-time to unload and record the contents of the above device after each dredging cycle as well as record any unusual circumstances that might arise.

Information gained from this program will be used to determine future need for restrictions concerning dredging of Thimble Shoal Channel.

52. Distance from Beaches and Other Amenities - Dam Neck Disposal Site is located offshore of Virginia Beach. The 3.3 miles of coastline between Rudee Inlet and 49th Street (Virginia Beach) are a highly developed ocean resort area--the largest in Virginia. It includes many motels, hotels, restaurants, and amusement centers catering to a large tourist and summer resort trade. Private redevelopment is very active in this area, especially along the waterfront where the older hotels, rooming houses, and cottages are being razed to make way for modern motel-hotel accommodations with supporting restaurants and specialty shops. The dunes have been removed from the adjacent shoreline, and the inshore improvements are protected for the most part by a timber or concrete bulkhead. A public promenade extends about 2 miles between 2nd and 38th Streets. From 49th Street to the boundary of the Fort Story military reservation at Cape Henry is generally characterized by residential property and a line of sand dunes at the north end of this area.

53. South of Rudee Inlet to the Virginia-North Carolina line, the 20-mile shoreline is generally backed by sand dunes for the full length of beach. Residential development has occurred in the areas of Croatan Beach and Sandbridge Beach. Military installations occupy 4.1 miles of the shoreline, and a National Wildlife Refuge occupies an additional 4.3 miles. Virginia

Beach had developed a city park with 0.7 mile fronting the ocean, and the remaining 5.7-mile barrier strip to the North Carolina border has restricted access.

54. Virginia Beach has excellent beaches and the city attracts thousands of tourists and vacationers from the surrounding area as well as from all parts of the United States and Canada. Today, one may find the active, city beaches, as well as the contrasting near-seclusion offered at state part beaches, a wildlife refuge, and military reservations.

55. The Dam Neck Site is about 3 to 4 nautical miles offshore from the beaches of Virginia Beach. The center of the interim site is approximately 2 nautical miles seaward of the active zone with respect to the nearshore bottom profile. Material movement from the site by wave induced and tidal currents will be minimal. Thus little, if any, impact would occur in the littoral zone and all natural beach processes should continue in their normal fashion with continuing disposal at Dam Neck.

56. There are no public amenities in the vicinity of Dam Neck which are incompatible with continuing use of the disposal site. Recreational fishing is discussed in later sections of the report.

57. Based on studies of recent disposal operations, it is not anticipated that sediment will move from the site once deposited, and there is virtually no possibility of onshore movement of dredged material to Virginia Beach, 3-1/2 miles away.

58. Types and Quantities of Material to Be Disposed - The types of dredged material to be dumped at Dam Neck and method of release will be typical of previous dredging operations in the lower Chesapeake Bay channels that involved ocean disposal. The dredged materials will consist of uncontaminated sediments removed from the existing Thimble Shoal and Cape Henry Channels and the planned Atlantic Ocean Channel. (See Appendix B for further information on sediment quality.)

59. Thimble Shoal Channel is about 12 miles long and is maintained 45 feet deep and 1,000 feet wide. The channel extends between deep water just to the east of Hampton Roads and deep water at the Chesapeake Bay mouth. West of the Chesapeake Bay Bridge-Tunnel the channel sediments are are present clays and silts (50-75%), but fine to medium sands are present (75-90%), within the eastern end of the channel. In the absence of any port deepening projects, present maintenance practice will continue to generate, on intervals of 5 years, about 750,000 cubic yards of predominantly clays and silts with some fine sand (see Table 9). If the planned improvements are made to the channels serving Hampton Roads, about 23.5 million cubic yards of similar material must be dredged from Thimble Shoal Channel to provide a 55-foot-deep channel. The channel will be deepened in 4 increments, as shown on Table 10. The maintenance of the deepened Thimble Shoal Channel would increase and is expected to average about 900,000 cubic yards every 5 years (see Table 11).

60. Cape Henry Channel is about 2.5 miles long and is maintained 42 feet deep and 1,000 feet wide. The channel is at the Chesapeake Bay mouth and is the start of the route north to Baltimore. The channel sediments are predominantly fine sand (80-90%) with some of silt, clay and shell. Present maintenance dredging requirements average about 400,000 cubic yards every 4 years. Planned

improvements will require about 2.8 million cubic yards of predominantly fine sand to be dredged to provide the 50-foot-deep channel. With this deepened channel, the maintenance requirements are expected to increase to about 1,000,000 cubic yards every 4 years.

61. The Atlantic Ocean Channel will be constructed in the vicinity of the present southeast sealanes. Natural depths there are now adequate for vessels with drafts constrained by the existing dredged channels within the bay and inner harbors. The planned deepening of the channels serving Hampton Roads will require that the Atlantic Ocean Channel be dredged at least 57 feet deep over a width of 1,000 feet and length of about 12 miles. This channel will be constructed in 2 increments as shown on Table 10. The work will involve the dredging of about 10 million cubic yards of fine sand (80-90%) with silt, some clay, and some gravel. In addition to this new work, maintenance dredging requirements are predicted to be an average about 1,000,000 cubic yards of similar material every 5 years.

62. A summary of the dredging quantities requiring ocean disposal is given in table 8. The need for the Dam Neck Site evaluation is based on the premise that the ports of Baltimore and Hampton Roads will be deepened in the near future, during a 7 year construction period. Together, these projects will generate about 36 million cubic yards of dredged material that will require ocean disposal. The rates of ocean dumping for this new work will average about 5 million cubic yards per year, depending on funding and construction time. The three channells will result in the ocean dumping of uncontaminated materials similar to, and at rates on the same order of magnitude as, the quantities dumped as a result of port deepening projects in the 1960's to early 1970's. (See paragraphs 9, 62, and 63 for discussion of past ocean dumping.)

Table 8. DREDGED MATERIAL REQUIRING OCEAN DISPOSAL (MILLION CUBIC YARDS)

| Source | Existing Channels Maintenance (50 Years) | With Port Improvements New Work | With Port Improvements Additional Maintenance (50 Years) | Totals |
|---|---|---|---|---|
| Thimble Shoal Channel | 7.5 | 23.5 | 1.5 | 32.5 |
| Cape Henry Channel | 5.0 | 2.8 | 7.5 | 15.3 |
| Atlantic Ocean Channel | - | 10.0 | 10.0 | 20.0 |
| Totals | 12.5 mcy | 36.3 mcy | 19.0 mcy | 67.8 mcy |

63. The methods of dredging and release of the dredged material will be typical of past and present practices for these channels. It is expected that the sediments will be removed from the channels by self-propelled trailing suction hopper dredges and transported to the Dam Neck Ocean Disposal Site by these same seagoing vessels. The materials will be released at the site by bottom dumping. Split-hull hopper dredges accomplish this by opening the hull, whereas conventional hoppers dump by opening the bottom doors. Depending on the types of dredges, types of materials, and cohesiveness of these materials, the dredged material is released as a mass in a short period of time or is more dispersed by release over a period of minutes. These dredges have loaded drafts in the range of 20 to 30 feet. When the materials are bottom dumped, the vast majority descends rapidly through the short distance to the ocean floor, estimated to be from 5 to 20 feet depending on the type of hopper dredge and its location within the disposal site.

Table 9. PRESENT MAINTENANCE DREDGING SCHEDULE
FOR CHANNELS WITH DISPOSAL AT DAM NECK

| CHANNEL | CALENDAR YEAR 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thimble Shoal 45-foot channel | 818 | 428 | | | | | 750 | | | | | 750 |
| Cape Henry 42-foot channel | 28 | 426 | | | | 400 | | | | 400 | | |

*NOTE: Figures above are quantities in thousands of cubic yards.

TABLE 10. ESTIMATED CONSTRUCTION SCHEDULE
FOR CHANNELS WITH DISPOSAL AT DAM NECK

| ITEM | CONSTRUCTION TIME (MONTHS) 0 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| NORFOLK HARBOR & CHANNELS DEEPENING | | | | | | | | | |
| Thimble Shoal Channel | | | | | | | | | |
| 50 ft outbound lane | | 18 mo. 5.9 MCY | | | | | | | |
| 55 ft outbound lane | | | | 22 mo. 8.8 MCY | | | | | |
| 50 ft inbound lane | | | | | | 12 mo. 3.9 MCY | | | |
| 55 ft inbound lane | | | | | | | 14 mo. 4.9 MCY | | 23.5 MCY |
| Atlantic Ocean Channel | | | | | | | | | |
| 57 ft 800 ft. width | | | | 15 mo. 7.9 MCY | | | | | |
| 57 ft full width | | | | | | 6 mo. 2.1 MCY | | | 10.0 MCY |
| | | | | | | | SUBTOTAL | | 33.5 MCY |
| BALTIMORE HARBOR & CHANNELS DEEPENING | | | | | | | | | |
| Cape Henry Channel | | | | | | | | | |
| 50 ft full width | | | 6 mo. 2.8 MCY | | | | | | 2.8 MCY |
| | | | | | | | TOTAL NEW CONSTRUCTION WITH OCEAN DISPOSAL AT DAM NECK | | 36.3 MCY |

NOTE: MCY = million cubic yards.

TABLE 11. TYPICAL FUTURE MAINTENANCE SHCEDULE AFTER CHANNEL DEEPENING FOR CHANNELS WITH DISPOSAL AT DAM NECK

| CHANNEL | CALENDAR YEAR 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thimble Shoal 55 ft. channel | 900 | | | | | 900 | | | | | 900 | |
| Atlantic Ocean 57 ft. channel | | | | 1000 | | | | | 1000 | | | |
| Cape Henry 50 ft. channel | | 1000 | | | | 1000 | | | | 1000 | | |

NOTE: Figures are quantities in thousands of cubic yards.

64. Feasibility of Surveillance and Monitoring - The Dam Neck Site is accessible from Hampton Roads, Little Creek, Lynnhaven Inlet, and Rudee Inlet, and has conditions suitable for typical survey and oceanographic vessels. The site will not present problems to surveillance or monitoring activities, if required. The COE normally employs qualified personnel for contractor surveillance on the dredge. If surveillance or monitoring are required from separate survey or scientific vessels, these vessels could operate out of Rudee Inlet, as the COE survey vessels do now. Rudee Inlet provides a safe harbor only about 2 to 4 nautical miles from the Dam Neck Site. Monitoring vessels would not need to consume an excessive amount of time and fuel traveling to and from the disposal site. As with any offshore ocean site, Weather and sea conditions would at times limit or delay these activities. Several scientific and engineering investigations have previously been accomplished at or near the Dam Neck Site since its first use for ocean disposal in 1967. The continued use of the Dam Neck Site will not preclude any such activities.

65. Dispersal, Horizontal Transport, and Vertical Mixing Characteristics of the Area - The physical oceanographic characteristics of the Dam Neck Site are typical of the inner continental shelf seaward of the littoral zone. Appendix C describes these processes in more detail. The inner shelf circulation seaward of the 30-foot-depth contour is generally aligned with the bathymetric contours, with a negligible onshore-offshore component. The dispersal, horizontal transport, and vertical mixing characteristics of the Dam Neck Site are influenced by a net southward oceanic circulation rather than the nearshore littoral forces.

66. Immediate dispersal and horizontal transport of the dredged material are influenced primarily by the method of placement, type of dredged material, and depth of water at the disposal site. The material is expected to be released at Dam Neck by bottom-dumping hopper dredges at depths 20 to 30 feet below the water surface and would rapidly descend to the bottom at depths of about 30 to 50 feet. Non-cohesive materials such as sand and shell would descend as a high-density flow, whereas cohesive sediments would descend as more coherent masses of material. The sediments that would be deposited at the Dam Neck Site will be varying mixtures of cohesive and non-cohesive materialls. The length of the bottom impact zone depends on the speed of the dredge and time required to release its load, and will typically be less than 1,500 feet for a split-hull dredge and less than 3,000 feet for a conventional bottom door dredge. Deposition of the dredged material typically occurs no more than 500 feet laterally from the path of the hopper dredge. Field investigations have shown that the amount of dredged material lost to the ambient water during the dumping process is very small, and for most hopper dredging operations is typically less than 1 percent.

67. Long-term disposal and horizontal transport of dredged material are primarily influenced by prevailing currents. Analyses performed at the Dam Neck site indicate currents are insufficient to transport significant amounts of dredged material. Wave induced currents, though able to resuspend some fine-grained sediment, produce negligible sediment transport from the disposal site. Furthermore, numerous pre-dump and post-dump bathymetric surveys clearly illustrate the retention of virtually all dredged material disposal at Dam Neck (DeLoach, 1985).

Dredged material dumped and deposited at Dam Neck is not expected to be affected substantially by vertical mixing. The Dam Neck Site and surrounding area are a hydraulically stable environment with little potential for significant net movement of dumped dredged material.

68. Effects of Previous Disposals - The quantities of current and previous deposits of dredged material in the ocean have produced very limited detectable effects. Based on a number of studies performed in and around the Dam Neck Disposal Site (ODU, HRSD, EPA) there appears to be no significant difference in benthos, fisheries, water quality, and sediment quality (toxins) between the disposal site and adjacent areas which have not been disposed on. The lack of any significant difference between the disposal site and other "unaffected" areas tends to indicate that there have been little, if any, long term adverse impacts associated with disposal. Norfolk District dredging records indicate that no ocean dumping occurred prior to the 1950's. During the 1930's and 1940's, the material dredged from Thimble Shoal was deposited in established dumping grounds north and south of the channel, within Chesapeake Bay. The earliest records of ocean disposal in Thimble Shoal Channel and Cape Henry Channel are 1957 and 1964, respectively. During the period 1957 to about 1966, the materials dredged from Cape Henry and Thimble Shoal Channels were used for tunnel cover and beach restoration or were dumped in undelineated ocean areas varying from about 10 to 20 nautical miles east or northeast of Cape Henry.

69. The Norfolk District began using the Dam Neck Ocean Disposal Site during 1967, shortly after work began on deepening Thimble Shoal Channel to its present depth of 45 feet. The Dam Neck Site offered better operational control than the previously used areas. While transporting dredged material to the site, the Government hopper dredges GOETHALS and ESSAYONS were able to travel parallel to and within sight of identifiable land features. As additional aids to the disposal operation, under normal circumstances dump buoys were deployed in the Dam Neck Site for the duration of dredging. Since 1967, all new work and maintenance dredged material removed from Cape Henry and Thimble Shoal Channels, with limited exceptions, has been placed within the Dam Neck Ocean Disposal Site. Tables 12 and 13 show summaries of dredging and disposal quantities for these two channels.

Table 12. CAPE HENRY CHANNEL - PREVIOUS DISPOSAL

| Dates of Dredging | Quantities Deposited (cubic Yards) and Location/ | | |
|---|---|---|---|
| | Dam Neck | Other Ocean Sites | Miscellaneous |
| Apr - Jun 61 (deepening) | - | - | 1,251,000 (a) |
| Oct 64 (maint.) | - | 357,000 (b) | - |
| Dec 67 - Jan 68 (maint.) | 154,000 | - | - |
| Oct - Dec 69 (maint.) | 701,000 | - | - |
| Dec 71 - Feb 72 (maint.) | 452,000 | - | - |
| Dec 73 (maint.) | 93,000 | - | - |
| Jan 82 (maint.) | 28,000 | - | - |
| Aug - Nov 82 (maint.) | 426,000 | - | - |
| TOTALS TO DATE | 1,854,000 | 357,000 | 1,251,000 |

(a) Material used for cover on Chesapeake Bay Bridge Tunnel.
(b) About 20 nautical miles east of Cape Henry.

Table 13. THIMBLE SHOAL CHANNEL - PREVIOUS DISPOSAL

| Dates of Dredging | Quantities Deposited (cubic Yards) and Location | | |
|---|---|---|---|
| | Dam Neck | Other Ocean Sites | Miscellaneous |
| Feb - Jul 57 (widening) | - | 3,220,000 (a) | - |
| Apr 63 (maint.) | - | 566,000 (a) | - |
| Feb - Apr 64 (maint.) | - | 1,481,000 (a) | - |
| Jun - Jul 64 (maint.) | - | - | 70,000 (b) |
| Dec 65 - Jun 68 (deepening) | 3,000,000 | 5,294,000 (c) | - |
| Oct 69 - May 70 (deepening) | 11,568,000 (d) | - | - |
| Jun - Jul 70 (maint.) | 315,000 | - | - |
| Nov 70 - Jan 71 (maint.) | 468,000 | - | - |
| Jun - Nov 72 (maint.) | 1,161,000 | - | - |
| Oct - Dec 74 (maint.) | 819,000 | - | 711,000 (b)<br>635,000 (e) |
| Sep - Dec 81 (maint.) | 818,000 (f) | - | - |
| Aug - Nov 82 (maint.) | 428,000 | - | - |
| Totals to Date | 18,577,000 | 10,561,000 | 1,416,000 |

(a) Varied about 10 to 20 nautical miles east of Cape Henry.
(b) Material used for beach restoration.
(c) About 14 nautical miles east of Cape Henry.
(d) Less than 1% transported to other ocean site.
(e) Material removed by private contractor for use as landfill.
(f) Less than 5% transported about 18 nautical miles east of Cape Henry for test purposes.

70. The effects of present and previous dredged material disposal at the Dam Neck Site have been limited to physical effects. The materials placed at the site have been varying mixtures of uncontaminated fine sands, silts, and clays. The immediate effects of disposing these materials have been restricted to minor short-term increases in water column suspended solids, and the burial of limited bottom areas with a thin layer of dredged material. Neither of these effects have had any known lasting significance. Investigations by the U.S. Army Corps of Engineers Waterways Experiment Station (WES) have indicated that suspended solids levels typically return to ambient levels shortly after open water disposal operations are completed. WES studies have also indicated that bottom areas buried by dredged material are typically repopulated within several months. The cumulative effects of disposal at the Dam Neck Site are limited to bathymetric changes. Operational control of previous disposal and the relatively stable environment described in Paragraphs 65 to 67 have resulted in a measurable buildup of dredged material deposits in the northern end of the Dam Neck Interim Site. Evidence of this cumulative physical effect is the apparent disposal impression described in paragraph 45. Except for these bathymetric changes, there are no other known cumulative geophysical, biological, or chemical effects of previous disposal at the Dam Neck Site.

71. Interference With Other Uses of the Ocean

(a) Commercial Fishing - There is a small commercial fishery for conch (Busycon sp. and Strombus sp.) and blue crab along the coast off Virginia Beach. A purse seine fishery for menhaden is located at the mouth of the

Chesapeake Bay from May through October. A gill net fishery is located from just outside the breaker zone to about the 20-foot contour south of the mouth of the Chesapeake Bay down to the North Carolina state line. (figure 7).

Restrictions by the Navy limit fishing off Dam Neck. The primary species that are caught are bluefish (Pomatomus saltatrix), croaker, spot, and sea trout (Cynoscion regalis and C. nebulosus). The most important fishery in the vicinity of Dam Neck is the trawl fishery, which extends from 1/4 to 4 miles offshore, both north and south of the mouth of the Chesapeake Bay. The primary fishery, however, is south of Cape Henry. There is an intense flounder fishery (primarily summer flounder, Paralichthys dentatus) in the fall between October and December. According to the National Marine Fisheries Service (NMFS correspondence 5 June 1984) 96-98% of the total value of the landings from the Dam Neck Site area in 1982-1983 were derived from the harvest of two benthic species, the summer flounder and the Atlantic surf clam (Spisula solidissima). There is no evidence to suggest that surf clams inhabit the Dam Neck Disposal Site. ODU personnel sampled the benthos in and around Dam Neck during a 12-month period (1983 and 1984) using commercial equipment. Based upon three commercial clam dredge samples collected on 8 March 1984 and three rocking chair dredge samples collected on 8 May 1984, no commercially important benthic infaunal populations exist in the area of Dam Neck. On 2 July 1984, a commercial clam dredge sample taken at the Dam Neck Interim Site did not collect any individuals of commercially important benthic infaunal species. Historical data indicate that from the period 1971 to 1981, greater than 75% of all U.S. surf clam landings came from areas greater than 4.8 km (3 mi.) offshore. In 1980 and 1981, 92% and 81%, respectively, of the total landings came from the U.S. Fishery Conservation Zone (4.8 to 321.9 kms or 3

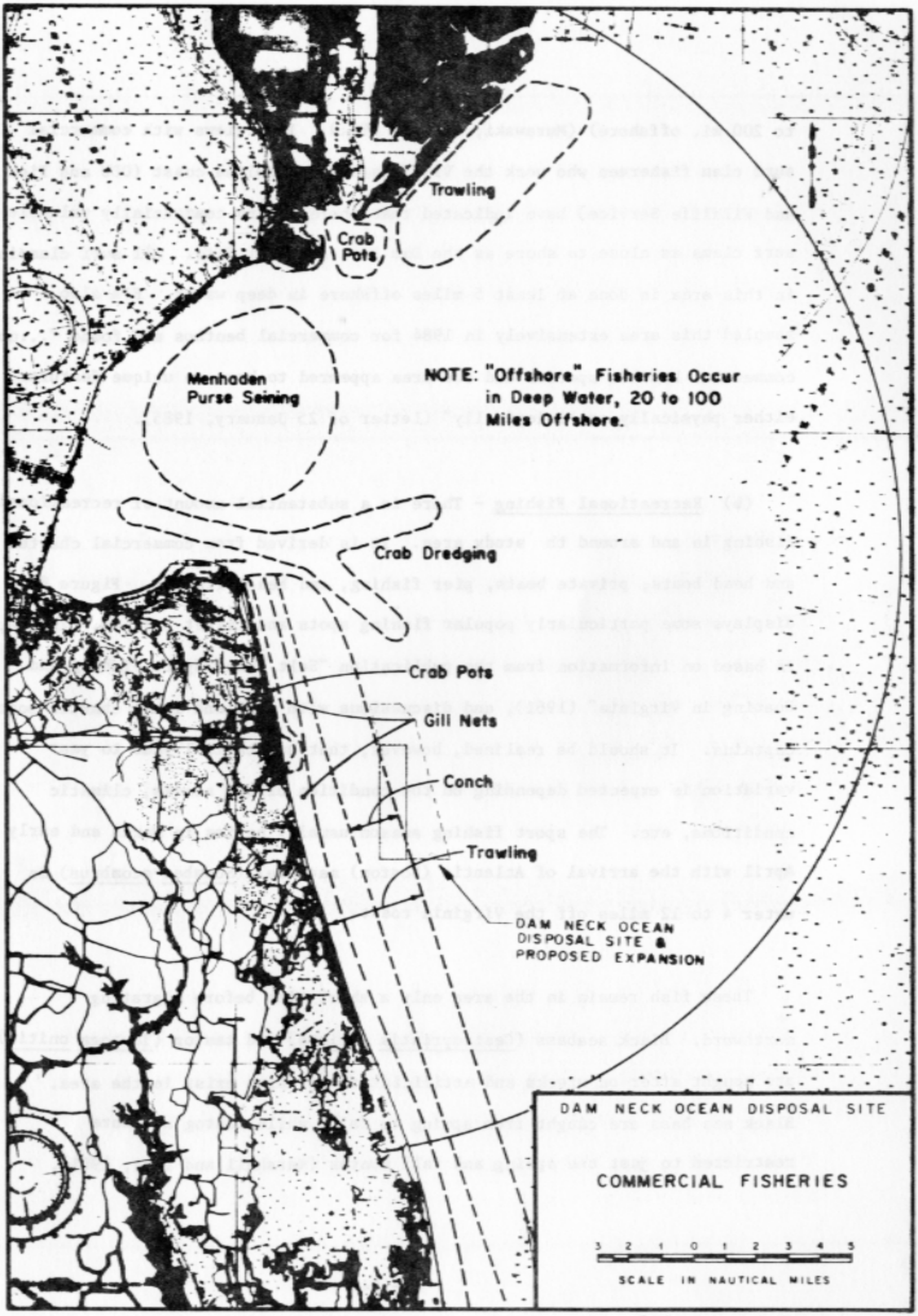
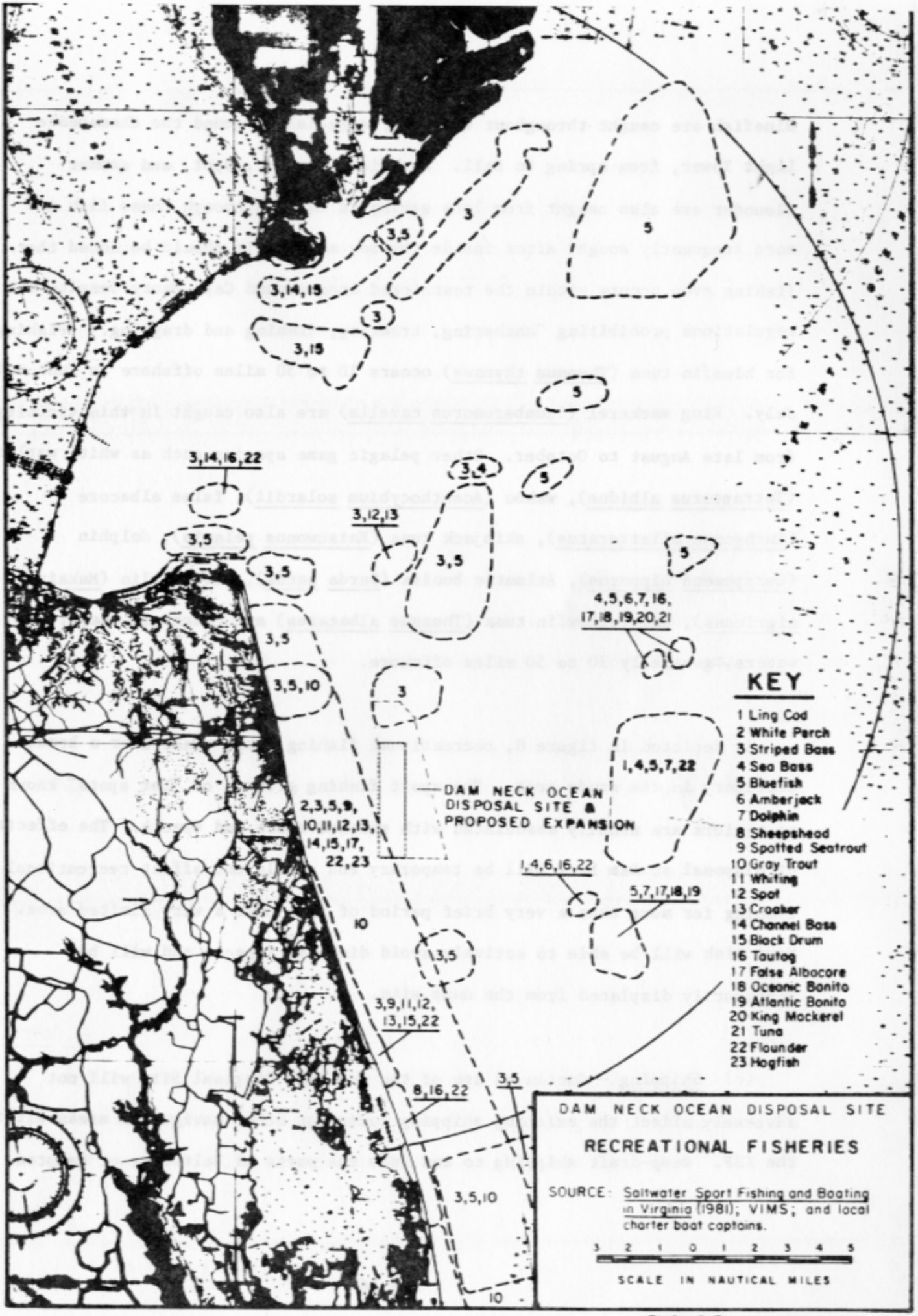

Trawling
Crab Pots
Menhaden Purse Seining
NOTE: "Offshore" Fisheries Occur in Deep Water, 20 to 100 Miles Offshore.
Crab Dredging
Crab Pots
Gill Nets
Conch
Trawling
DAM NECK OCEAN DISPOSAL SITE & PROPOSED EXPANSION
DAM NECK OCEAN DISPOSAL SITE
COMMERCIAL FISHERIES
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES

FIGURE NO. 7

to 200 mi. offshore) (Murawski, et al., 1981). Interviews with commercial surf clam fishermen who work the Virginia/North Carolina coast (ODU and Fish and Wildlife Service) have indicated that there are no commercially valuable surf clams as close to shore as the Dam Neck Disposal Site. All surf clamming in this area is done at least 5 miles offshore in deep water. EPA also sampled this area extensively in 1984 for commercial benthos and found "...no commercial benthic species and the area appeared to have no unique features, either physically or biologically" (letter of 25 January, 1985).

(b) Recreational Fishing - There is a substantial amount of recreational fishing in and around th study area. It is derived from commercial charter and head boats, private boats, pier fishing, and beach fishing. Figure 8 displays some particularly popular fishing spots and target species. The map is based on information from the publication "Salt Water Sport Fishing and Boating in Virginia" (1981), and discussions with VIMS and local charter boat captains. It should be realized, however, that substantial year to year variation is expected depending on the condition of the stocks, climatic conditions, etc. The sport fishing season usually begins in March and early April with the arrival of Atlantic (Boston) mackerel (Scomber scombrus) in water 4 to 12 miles off the Virginia coast.

These fish remain in the area only a short time before migrating northward. Black seabass (Centropristis striata) and tautog (Tautoga onitis) are sought after on wrecks and artificial reefs which exist in the area. Black sea bass are caught from spring to fall, while tautog are more restricted to just the spring and fall months (Marshall and Lucy, 1981).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4,5,6,7,16,
17,18,19,20,21
3,5,10
3
1,4,5,7,22
DAM NECK OCEAN
DISPOSAL SITE &
PROPOSED EXPANSION
2,3,5,9,
10,11,12,13,
14,15,17,
22,23
1,4,6,16,22
5,7,17,18,19
10
13,5
3,9,11,12,
13,15,22
8,16,22
3,5
3,5,10
10
KEY
1 Ling Cod
2 White Perch
3 Striped Bass
4 Sea Bass
5 Bluefish
6 Amberjack
7 Dolphin
8 Sheepshead
9 Spotted Seatrout
10 Gray Trout
11 Whiting
12 Spot
13 Croaker
14 Channel Bass
15 Black Drum
16 Tautog
17 False Albocore
18 Oceanic Bonito
19 Atlantic Bonito
20 King Mackerel
21 Tuna
22 Flounder
23 Hogfish
DAM NECK OCEAN DISPOSAL SITE
RECREATIONAL FISHERIES
SOURCE: Saltwater Sport Fishing and Boating in Virginia (1981); VIMS; and local charter boat captains.
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES



FIGURE NO. 8

Bluefish are caught throughout the area, especially around the Chesapeake Light Tower, from spring to fall. Weakfish, croaker, spot, and summer flounder are also caught from late spring to fall, although these fish are more frequently sought after inside the bay mouth. It should be noted that fishing even occurs within the restricted area around Cape Henry despite the regulations prohibiting "anchoring, trawling, fishing and dragging." Fishing for bluefin tuna (Thunnus thynnus) occurs 10 to 30 miles offshore in June and July. King mackerel (Scomberomorus cavella) are also caught in this vicinity from late August to October. Other pelagic game species such as white marlin (Totrapturus albidus), wahoo (Acanthocybium solardii), false albacore (Eurhynnus alletteratus), skipjack tuna (Katsuwonus pelamis), dolphin (Coryphaena hippurus), Atlantic bonita (Sarda sarda), blue marlin (Makaira nigricans), and yellowfin tuna (Thunnus albacares) are caught in deeper waters, generally 30 to 50 miles offshore.

As depicted in figure 8, recreational fishing takes place over a broad territory in the study area. The sport fishing grounds or "hot spots" known to anglers are usually associated with shoaled areas and wrecks. The effects of disposal at Dam Neck will be temporary and should not affect recreational fishing for more than a very brief period of time over a very limited area. Most fish will be able to actively avoid disposal impacts and will be temporarily displaced from the dump site.

(c) Shipping - Continued use of the Dam Neck Disposal Site will not adversely affect the existing shipping routes or other navigation areas within the ZSF. Deep-draft shipping to and from the ports of Baltimore or Hampton

Roads must comply with the Chesapeake Bay Traffic Separation Scheme to transit the ocean waters at the bay mouth. This scheme is comprised of the northeast sealanes, southeast sealanes, and the precautionary area centered on the "CBJ" Buoy at the mouth of Chesapeake Bay. The Dam Neck Disposal Site is well to the south of all features of the Traffic Separation Scheme. (See figure 9.) Thus, all deep-draft shipping routes are well outside the limits of the Dam Neck Site and will not be affected by disposal operations. Shallow-draft vessels such as trawlers and recreational boats may at times traverse the limits of the disposal site but will not be affected since their drafts are typically 15 feet or less.

(d) Mineral Extraction and Desalination - All considerations for mineral extraction in Virginia's offshore waters are in the exploratory stages. The Dam Neck Disposal Site is not expected to interfere with potential operations such as oil and natural gas drilling, as most exploration has occurred in the outer continental shelf region. Presently there are no desalination plants within the study area and no plans for desalination since more practical freshwater sources could be made available for future needs.

(e) Scientific - Dam Neck and vicinity has been studied over the years for a variety of reasons. The Hampton Roads Sanitation District (HRSD) presently monitors water quality and benthos at its Atlantic Plant Outfall discharge 2 miles offshore in the vicinity of Dam Neck. The Coastal Engineering Research Center (CERC) has maintained current meters in this area in connection with Norfolk District's study of current regimes at and near Dam Neck. There are presently no fixed stations in the vicinity which are being

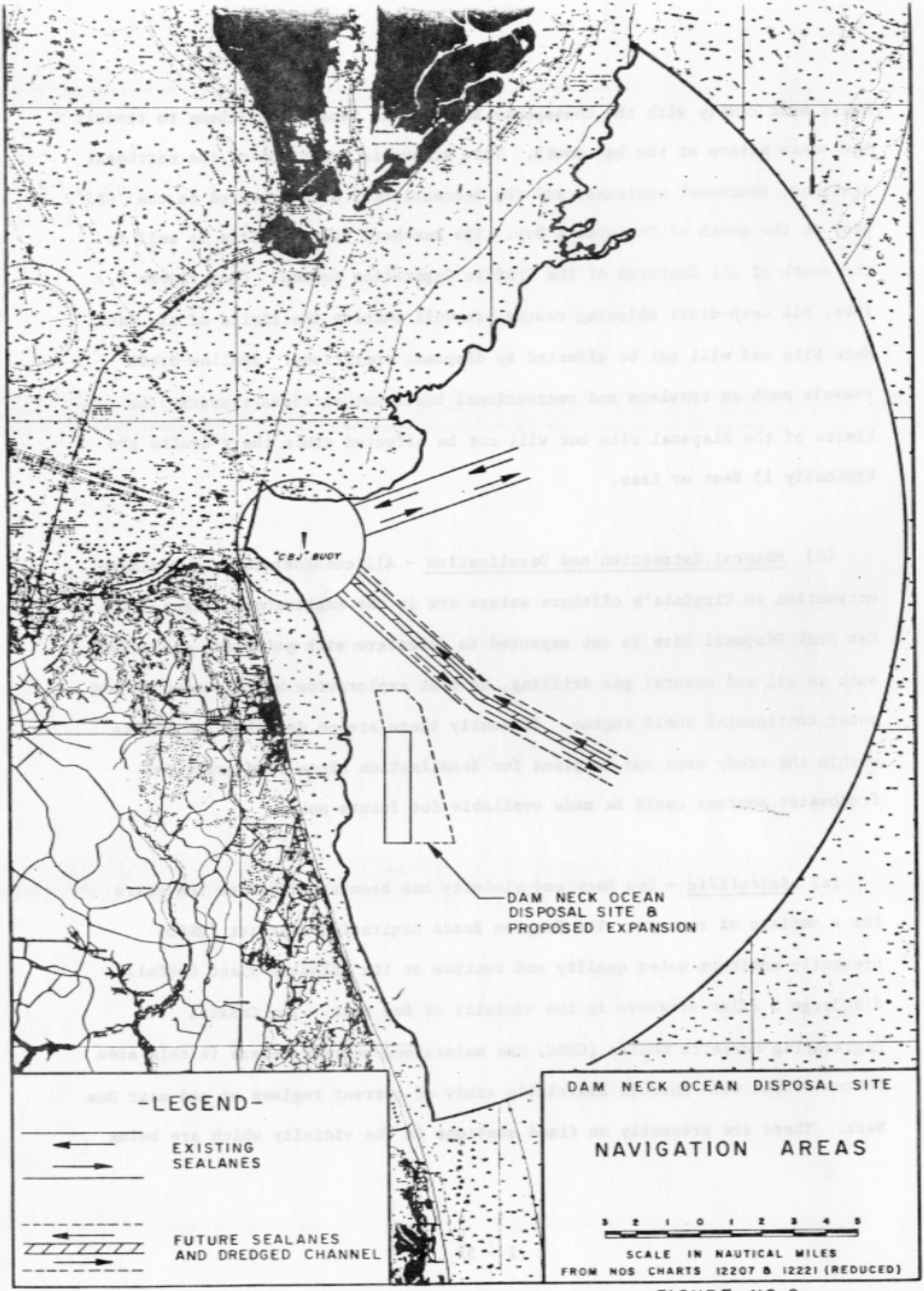

"CBJ" BUOY
DAM NECK OCEAN
DISPOSAL SITE &
PROPOSED EXPANSION
-LEGEND-
EXISTING
SEALANES
FUTURE SEALANES
AND DREDGED CHANNEL
DAM NECK OCEAN DISPOSAL SITE
NAVIGATION AREAS
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES
FROM NOS CHARTS 12207 & 12221 (REDUCED)



FIGURE NO. 9

monitored continuously by scientific instrumentation. ODU has been conducting finfish, benthic, plankton, and water quality investigations at and near Dam Neck between September 1983 and September 1984. These investigations are now completed and summarized in Appendices A and B and it is not anticipated that disposal would hamper any present or future scientific investigation either by the Corps or others.

(f) Recreation - Dam Neck Disposal Site is located offshore of Virginia Beach. Its northwest corner is located 3.6 miles east of Rudee Inlet. Virginia Beach has excellent beaches and the city attracts thousands of tourists and vacationers from the surrounding area and elsewhere in the U.S. and Canada. Rudee Inlet at Virginia Beach is a small craft harbor and entrance channel leading to the Atlantic Ocean. In October 1983, there were 235 permanently based recreational boats inside Rudee Inlet. In addition to these, another 16,250 boats are launched annually from the ramps on Lake Rudee. Rudee Inlet is also the base of operations for an active charter and party boat fleet. Its location not only provides these boats with quick access to ocean fishing grounds in and around the Dam Neck Disposal Site, but it is also adjacent to the active beach resort area of Virginia Beach. As of October 1983, there were 20 charter sport fishing boats and four party boats operating out of the inlet. Technically, restrictions by the Navy limit fishing off the Dam Neck area but it is suspected that these warnings often go unheeded.

The Virginia Beach shoreline generally has escaped the major environmental problems brought about by over-development or inadequate planning. Today, one may find the active city beaches, as well as the contrasting near-seclusion offered at state park beaches, a wildlife refuge, and military reservations, all within the 28 miles of shoreline along the Atlantic Ocean and the 10 miles along the Chesapeake Bay. Virginia Beach offers a great variety of recreational opportunities during all seasons. Activities include all kinds of fishing, camping, picnicking, bathing, beachcombing, boating, and hiking.

The recreational areas at Virginia Beach can be divided roughly into three areas. Between Cape Henry at the bay mouth and 49th Street, a distance of 2.7 miles, the beach is wide and, except for wooden bulkheads south of 57th Street, is fronted by sand dunes. Fort Story, a multiservice Army post, lies to the north and Seashore State Park bounds the post in this area. The 3.3 miles of coastline south of 49th Street to Rudee Inlet is a highly developed ocean resort area--the largest in Virginia. This area includes many motels, hotels, restaurants, and amusement centers catering to a large tourist and summer resort trade. South of Rudee Inlet to the Virginia-North Carolina line, the 20-mile shoreline is sparsely developed. Residences are concentrated at Croatan Beach and Sandbridge Beach. Military installations occupy 4 miles of the shoreline and a National Wildlife Refuge and adjoining State Park offers hiking, birdwatching, and limited camping at and near the oceanfront.

(g) Coastal Zone Management - The "Coastal Zone Management Act of 1969" was authorized by the Federal Government to encourage states to establish coastal authorities to manage coastal resources. The state of Virginia does

not currently have an approved Coastal Zone Management program and, therefore, this act is not applicable to dredging and disposal plans formulated for the Virginia coastal zone. The Virginia Council on the Environment is presently developing a CZM plan for Virginia, they were given opportunity to comment on the Draft SFEIS and Site Designation Document. In addition, North Carolina's Department of Natural Resources and Community Development, Division of Coastal Management has reviewed the Draft to determine consistency with North Carolina's CZM. Their letter of 19 February 1985 stated that the Dam Neck Ocean Disposal Site, as proposed, would not affect coastal resources in North Carolina.

Concern for the Chesapeake Bay and its tributaries prompted Congress to direct the U.S. Environmental Protection Agency to conduct a five-year study of the Bay's water quality and resources, and to develop management strategies to preserve the Bay's quality (P.L. 94-116). A technical program was set up in 1976 to identify and study the major environmental problems in Chesapeake Bay. In 1981, the technical program ended, and during 1982 and 1983 the Chesapeake Bay Program (CBP) analyzed and integrated their findings, leading to conclusions and recommendation for actions needed to preserve the environmental quality of the Bay. In 1984 Congress allocated $4.25 million to initiate a clean-up program. Three million dollars of the 1984 appropriation was set aside for state cost share grants. Coordination of state implementation programs has begun, and will continue in 1985 as the states (Maryland, Virginia, Pennsylvania and District of Columbia) begin to set goals and develop detailed plans for each tributary.

As evaluated in the EIS to which this document is an Appendix, the use of Dam Neck Ocean Disposal Site should in no way contribute to any further degradation of the environmental quality of the Bay. The goals of the CBP to restore the quality of the Bay include intensive investigation of the problems of nutrient enrichment, toxic substances, and the decline of submerged aquatic vegetation. The continued use of the Dam Neck Ocean Disposal Site will in no way inhibit the accomplishment of these goals as identified by Federal, state and CBP personnel, and major scientific research institutions.

(h) Wastewater Discharge - Since 1983, the HRSD has been using the ocean waters to the west of the Dam Neck Disposal Site for the discharge of treated wastewater. Continued disposal of dredged material at the Dam Neck Ocean Disposal Site is not expected to adversely affect HRSD's use of these waters for wastewater disposal. (See paragraph 86 for discussion on dissolved oxygen)

Wastewaters collected via a separate sanitary sewerage system are provided a minimum of secondary treatment through the activated sludge process at the HRSD Atlantic Treatment Plant. The treated wastewater is transported to the ocean floor through a single 66-inch-diameter outfall pipe and discharged into the ocean about 1-1/2 miles offshore at depths of about 32 feet. The Atlantic plant became operational in 1983 and is expected to treat average wastewater volumes of 35 million gallons per day (mgd) by the year 1990 and 65 mgd by 2010.

The terminal end of the Atlantic Treatment Plant outfall is within waters under state jurisdiction more than 6,400 feet to the west of the Dam Neck Disposal Site (see figure no. 10).

The effects of dredged material disposal at the Dam Neck Site are short term and are confined to relatively small areas within the site boundaries. Thus, continued dredged material disposal at Dam Neck will not interfere with HRSD's recently permitted use of the nearby ocean waters for wastewater disposal.

There are no other known wastewater outfalls within the ZSF. Stormwater outfalls discharge runoff from Virginia Beach into the ocean very near to shore, well outside the Zone of Siting Feasibility.

(i) Other Existing Uses of the Ocean - Other known uses of the ocean will not be affected by continued use of the Dam Neck Site. The ZSF encompasses parts of two military firing ranges, part of a naval restricted area, and a buoy testing area (see figure no. 10)

The buoy testing area is far enough away from any dredging and subsequent ocean disposal operations that its use will in no way be affected by continued use of the Dam Neck Site.

The firing ranges and the naval restricted area are designated by Corps of Engineers regulations codified under Title 33 of the Code of Federal Regulations. Hopper dredges in transit to the Dam Neck Disposal Site will pass through the naval restricted area (33 CFR 207.158) but will not affect the Navy's use of this area. The Dam Neck Rifle Impact Area (33 CFR 204.51a) and the Dam Neck Firing Area (33 CFR 204.52) are used for firing exercises conducted from shore at the U.S. Naval Fleet Combat Training Center. The Rifle Impact Area extends about 2-1/2 miles offshore and is to the west of the disposal site. The Firing Area is much larger and encompasses the Dam Neck

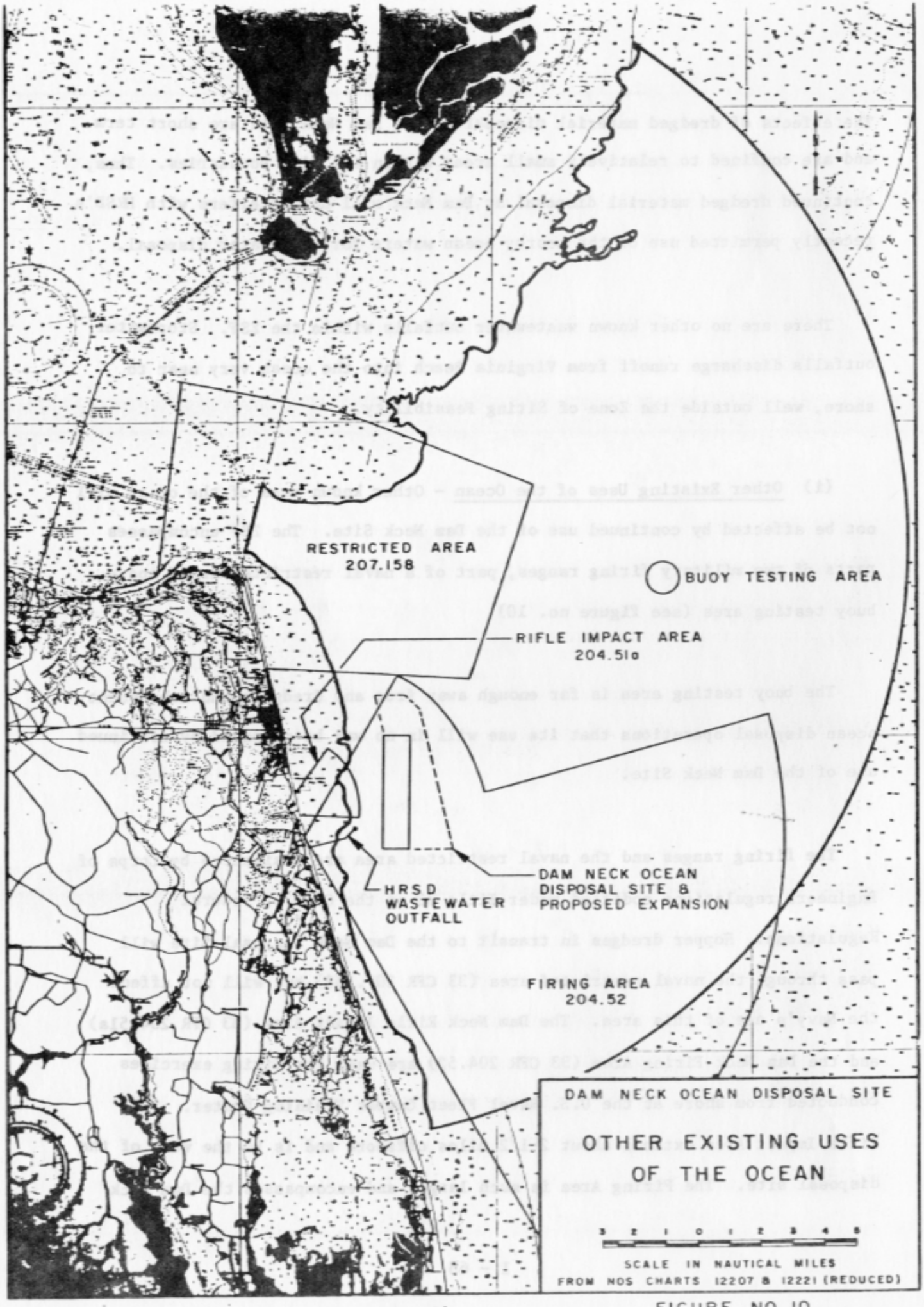

RESTRICTED AREA
207.158
BUOY TESTING AREA
RIFLE IMPACT AREA
204.51o
HRSD
WASTEWATER
OUTFALL
DAM NECK OCEAN
DISPOSAL SITE 8
PROPOSED EXPANSION
FIRING AREA
204.52
DAM NECK OCEAN DISPOSAL SITE
OTHER EXISTING USES
OF THE OCEAN
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES
FROM NOS CHARTS 12207 & 12221 (REDUCED)



FIGURE NO. 10

Disposal Site in its entirety. Since the disposal site is coincident with the Firing Area, the COE and its dredging contractor personnel coordinate with the Navy to schedule disposal operations. Firing exercises are conducted intermittently throughout the year, for periods of a few hours each week, and are publicized in the Coast Guard's Local Notice to Mariners (LNM). Contractor dredging and disposal operations are also listed in the LNM. This coordination, observance of applicable regulations by the contractor, and the Navy's strict adherence to safe firing procedures effectively prevent conflicts with the use of the Dam Neck Disposal Site.

Other military exercises, such as underwater explosive ordnance disposal training, are conducted in offshore areas within the ZSF. Similarly, these other activities are infrequent and effectively coordinated and scheduled to prevent conflicts.

72. Existing Water Quality and Ecology - The Virginia State Water Control Board has classified the Atlantic Ocean and its tidal tributaries from Cape Henry Light east to the 3-mile limit and south to the North Carolina state line as Class I-B-a. A more detailed discussion of this classification, the operation of the HRSD Atlantic Plant Outfall, and water quality studies performed by ODU are included in Appendix B of this report. In addition, a monitoring plan for dissolved oxygen is discussed in paragraph 112, section (f) of this report.

73. The ecology of the study area is greatly influenced by its position adjacent to the mouth of the Chesapeake Bay. The outflow from the Bay enhances primary production by contributing nutrients and detrital material to the inner continental shelf region. Phytoplankton cell concentrations in the

Bay plume water are significantly higher than in shelf waters outside the plume (Marshall, 1981). Marshall (1985) observed the seasonal changes in phytoplankton composition which he related, at least in part, to the Bay plume changes in composition, quantity of flow, temperature, and salinity. He also indicated the trophic relevance of various size categories of the phytoplankton to faunal components of the region.

74. Butt and Alden (1985), in a study mentioned previously (paragraphs 43-44), found the meroplankton in the study area of Dam Neck dominated by blue crab, bay anchovy and sand shrimp larvae and Larvaceans. The blue crab megalope were found in the center of the study area but the zoea were found in greatest numbers offshore. It was concluded by Butt and Alden (1985) that Dam Neck does not appear to represent a major larval transport route for any but the most common and commercially insignificant species (the only exception being blue crab megalope). Birdsong (1985) found commercial and sport fishes to use the study area during migrations but to no important extent for spawning. The benthos of the area has been investigated by the U.S. Fish and Wildlife Service (June 1982) and the HRSD (Hydroscience Inc. report, 1974). Based on these studies, it appears that the study area supports a productive benthic faunal population which is typical of benthos of the mid-Atlantic inner continental shelf. A planning aid report entitled "A Review of the Aquatic Biological Resources of the Atlantic Coastal Area off Virginia Beach, Virginia" has been prepared for Norfolk District by U.S. Fish and Wildlife Service. This report appears in Appendix A and describes the ecology of the area in detail as taken from the literature.

75. Ranasinghe et al. (1985) have sampled the commercial and non-commercial benthos in the area of the Dam Neck Disposal Site. Non-commercial benthos were sampled quarterly at four Dam Neck stations to the north of the interim site in 1983-84 and once at five Dam Neck interim stations in July 1984. Commercial benthos were sampled seasonally on two occasions by three commercial dredge hauls at the northern site and once at the interim site. The commercial benthos abundances were found to be low and only species of marginal commercial importance were collected. The Environmental Protection Agency also has sampled this area quite intensively and found "...no commercial benthic species and the area appeared to have no unique features, either physically or biologically" (letter to Norfolk District COE, 25 January, 1985). The non-commercial benthic macroinfaunal community was found by Ranasinghe et al. (1985) to be a typical sandy substrate assemblage. Species restricted to sandy substrates, or known to prefer them, such as Spiophanes bombyx, Pseudunciola obliquua, Tellina agilis, Amastigos caperatus, Apoprionospio pygmaea, Pectinaria gouldi and Asabellides oculata occurred with greater consistency and abundance than habitat generalists such as Mediomastus ambiseta and Polydora ligni. The authors speculate that this may indicate an environment under low natural and anthropogenic stress.

76. Potential For Recruitment of Nuisance Species - Dredged material has been placed in the Dam Neck Site since the mid-1960's. The sediments which have been placed in the Dam Neck Site have been, and will continue to be, dredged material which meets ocean disposal criteria as specified by the Corps and EPA. On the basis of unpublished studies conducted by the HRSD (Steve Hawthorne, HRSD, personal communication) and the published Ranasinghe et al.

(1985) report, there is no indication of recruitment of nuisance species at Dam Neck or in the surrounding areas.

Benthic organisms in and around the site are typical of benthic faunal populations of the mid-Atlantic inner continental shelf (Ruddy and Mayne, 1984) The open ocean conditions of the DNDS (low bottom temperatures, high salinities and coarse grained dredged materials with low organic content) do not favor microbial activity or proliferation and they are not expected to develop as a nuisance species. Nuisance species for the purposes of this analysis are considered as any organism not previously existing at the disposal site and either transported to or recruited there because of the disposal of dredged materials and capable of establishing themselves there.

77. Existence of Significant Natural or Cultural Features - The area extending from Assateague Island to Fisherman's Island and offshore for 10 miles is on the National Oceanographic and Atmospheric Administration's (NOAA) site evaluation list for consideration as a marine sanctuary. This does not confer any specific statutory protection on the area, but merely indicates that the site is included within a pool of 39 nationwide sites from which individual sites can be chosen for study when funds become available. Most of Fisherman's Island, located on the north side of the bay mouth, is a National Wildlife Refuge known for having a wide variety of birds which are particularly abundant during seasonal migratory periods. The Back Bay National Wildlife Refuge and False Cape State Park are located to the south of the study area (paragraph taken from Appendix A page 6, Fish and Wildlife Service Coordination Act Report, February 1984). Also in the study area is Seashore State Park, a

2, 80-acre state-owned facility that is a naturally preserved setting with a wide variety of plants and many miles of hiking trails.

78. The Virginia Historic Landmarks Commission's (VHLC) Research Center for Archaeology was contacted about cultural resources in the project area of Virginia Beach and offshore in reference to a beach erosion control study at Virginia Beach. Their letter of response, dated November 10, 1981, stated that a review of their underwater archaeological site records indicated 17 known historic vessels that have been lost in the vicinity of the project (landward of the 25-foot contour). Within the proposed area of the enlarged Dam Neck Disposal Site there are no known wrecks or obstructions. The nearest known wreck is located about 1/4 n.m. east of the proposed eastern boundary and has been tentatively identified as a 500-ton vessel called Kingston Celonite which sank in June 1942. Another obstruction has been located about 3/4 n.m. north-northwest of the proposed northwest corner of the site and is listed as a wreck, name unknown. The Dam Neck Disposal Site designation was discussed in detail with Mr. John Broadwater of the VHLC/VRCA and, as proposed, the disposal of dredged material would not likely adversely disturb or otherwise impact marine archaeological resources.

GENERAL CRITERIA (228.5)

79. General - An evaluation of an Ocean Dredged Material Disposal Site is based on the 11 specific factors in 40 CFR 228.6 of the ocean dumping regulations and criteria. The next step is to utilize the 11 specific factors to discuss requirements of the General Criteria (40 CFR 228.5).

80. Interference with Other Activities - The first of the five criteria require that a determination be made as to whether the site will minimize interference of the proposed disposal operations with other uses of the marine environment. This determination will be made by overlaying several individual maps presented in the technical appendices onto a base map, giving bathymetry and location of the interim disposal site and ZSF. Particular attention is given to areas of existing fisheries or shellfisheries and regions of heavy commercial or recreational navigation. The following figures were selected to be included in evaluation of this criteria.

| | |
|---|---|
| Blue Crab Larval Transport | Figure 6 |
| Commercial Fishing | Figure 7 |
| Recreational Fishing | Figure 8 |
| Navigation Areas | Figure 9 |
| Sediment and Water Quality | Figure B-1 |

81. Use of the Dam Neck Site would not interfere with shipping, mineral extraction, desalination, fish and shellfish culture, or areas of special scientific importance. However, recreational and commercial fishing activities are known to occur in the area.

82. The commercial trawl fishery is the most important fishery within the ZSF. This fishery extends from 1/4 to 4 miles offshore, both north and south of the Chesapeake Bay mouth. The fishery is depicted on figure 6. This fishery is not considered a resource of limited distribution. Disposal operations have taken place in Dam Neck consistently since the early 1960's,

and during this time to the present there have been no observable conflicts between fishermen and disposal operations. The same is true for recreational fishing, which in the long run is probably enhanced by the changes in bottom configurations which occur as a result of dumping. Most fish will be able to actively avoid disposal impacts and will be temporarily displaced from the dump site. Since finfish are, for the most part, highly opportunistic feeders, they should easily be able to locate food supplies outside the relatively small area of disposal.

83. Changes in Water Quality - The second of the five general criteria requires that . . . "Location and boundaries of disposal sites will be so chosen that temporary perturbation in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery."

84. The effects that suspended solids have on water quality (and the environment as a whole) are dependent upon composition, sorbed minerals or toxins, as well as the concentration of the suspension. In bioassay tests conducted under laboratory conditions, dissolved oxygen concentration usually decreases upon the addition of the solid phase to the test water (Shuba, et al., 1978).

85. Schubel et al., (1978) showed that the effect that oxygen-demanding material has on the water column is a function of the length of time the material resides in the water and the amount of water available for dilution. Only a small fraction of the oxidizable components in dredged material are reactive before the majority of the discharged particulate matter settles to the bottom. Reduced elements present in interstitial water appear to be the most reactive, and are the only components which place a rapid oxygen demand on the water column. The oxidizable particulates simply settle on the seafloor before imposing any oxygen demand (ibid.). The study concluded that the apparent oxygen demand of fine-grained estuarine sediments removed by pipeline dredge, with water contents of 80%, is approximately 0.4 mg $O_2$/g of sediment dredged.

86. As mentioned previously, depressions in dissolved oxygen concentrations have been observed in bottom waters in the Dam Neck area during the summer months when stratification is greatest. A one year study was performed by Old Dominion University to investigate the physical characteristics of the water column in the nearshore area off Virginia Beach, Virginia. An important aspect of this study was to determine whether dissolved oxygen patterns are significantly influenced by the HRSD Atlantic Sewage Treatment Plant (STP) diffuser or the Dam Neck Disposal Site. Alden and Butt (1985) concluded that (based on historical records and the 1984 field investigations) neither the diffuser outfall nor the deposition of dredged material at Dam Neck Disposal Site were significantly associated with the oxygen patterns of the region.

The study pointed, rather, to the Chesapeake Bay plume (debris, organic-rich fine sediments and sewage-associated particulates flushing out of the Bay) as the major non-point source of oxygen demand.

87. Overall most impacts associated with disposal of dredged material seem to be relatively short term. The condition of the water column associated with disposal generally returns to ambient within minutes to hours. Chemical changes in the sediment persist for days to weeks (where they occur at all), while physical changes often last for several months (Wright, 1978). An exception to this would be with highly persistent chemicals which are expected to reside in the sediment at detectable levels long after disposal operations have been completed. In the case of Dam Neck Site, only material which meets Corps/EPA Ocean Disposal Criteria (chemical and biochemical analysis) would be deposited in the site (the majority of material placed here would be sand of various grain sizes).

88. During October 1981, the Corps, NOAA, and EPA jointly conducted a series of test dumps in the Atlantic Ocean off Chesapeake Bay in order to directly evaluate water quality changes associated with disposal operations. The NOAA Underway Towed Pumping System (UTPS) (Taylor, 1980) was employed to collect continuous water samples and physical measurements, while an acoustic profiling system (Proni and Newman, 1977) was used to determine plume location and dispersion patterns. Dredged material for these test dumps came from the inner portion of the Thimble Shoal Channel in the Chesapeake Bay.

89. Water quality data were tested by several multivariate statistical models to determine whether there were significant changes in water quality. No statistically significant changes due to the disposal operations could be detected, even for composites taken within a plume of fine sands. Physical parameters changed only slightly following the dump, and trends appeared to reflect an entrainment of surface water in the plume as it sank: temperatures rose 0.1°; salinities decreased 0.4 ppt; and oxygen increased 0.1 ppm. The values returned to ambient levels when the UTPS emerged from the plume. Acoustic profiles showed that the dumped material is largely confined to within a 300-meter radius, and the bulk of the material settled quickly to the bottom. Bottom surges of material decayed rapidly within 6 to 10 minutes and little if any material was still in suspension 1 hour after a dump.

90. The sediments from the Thimble Shoal Channel have been found by laboratory studies to be similar to those found in many areas of the outer harbor, so the lack of even short-term water quality effects may have important implications to the feasibility of open ocean disposal (Alden, et al., 1982). A monitoring plan for dissolved oxygen to look at possible synergistic effects is discussed in paragraph 112, section (f) of this report.

91. A technical report prepared by for EPA by JRB Associates (Devonald and Ausubel) in 1984 entitled "An Assessment of the Potential Impacts on Zooplankton and Fish of Ocean Dredged Material Disposal at the Norfolk Disposal Site" states that " . . . the lowest suspended sediment concentration for which any harmful effect has been reported to occur on a planktonic organism is 40 mg/l, at which concentration Stern and Stickle (1978) found that feeding rates of the copepod Acartia tonsa were substantially

decreased." The JRB/EPA report also confirms that " . . . in general, fish eggs and larvae have been found to be extremely tolerant of uncontaminated suspended sediment. Substantial mortality is probably rare even in extremely turbid environments . . ." Hatching success of fish eggs (striped bass and white perch were species tested) exposed to continuous concentrations of fine-grained (clay or silt) suspended sediment ranging from 20 to 5,250 mg/1 was generally unaffected at levels below 1000 mg/1 . . . Shubel et al. (1977) emphasize that eggs of the species tested can tolerate extremely high suspended sediment levels for many hours, and estimate 500 mg/1 is a conservative maximum limit to which striped bass and white perch eggs may be subjected over the entire incubation period." The conclusion of a one year field study at Dam Neck by Birdsong (1985) states that " . . . the study area (Dam Neck) does not appear to be used to any important extent for spawning by any of the commercial or sport (fish) species inhabiting it." Butt and Alden (1985) characterized the mero - and icthyoplankton communities within the Chesapeake Bay plume during a one year study in and surrounding the Dam Neck Disposal Site. The conclusion of their study states that " . . . The only species which apparently move through the study area in ecologically significant numbers are the blue crab larvae, the Bay anchovy larvae, and the sand shrimp larvae . . . this particular area does not appear to represent a major larval transport route for any but the most common and commercially insignificant species . . . even the blue crab zoeae tend to be found in greatest numbers offshore of DNDS . . . the only possible exception would be blue crab megalopae found in the neuston in the center of the study area."

92. The JRB/EPA report presents a "worst-case" scenario of impact on blue crab populations. Based on literature review and communication with various experts, blue crab larvae of all stages were calculated to inhabit a total area of roughly 5000 to 6000 $km^2$ at the Bay mouth and offshore. Megalopae are reported by McConaugha and Johnson (1982) to inhabit a portion of this area, an area in the size range of 1000 $km^2$. The worst-case impact area of a single dump (expected to contain dredged material concentrations in excess of 40mg/1) was calculated at 6.25 $km^2$. Thus, based on the JRB/EPA study, the expected "worst-case" impact area is an area of about 6:6000 or 0.1% as large as the principal blue crab larval distribution area and about 6:1000, or approximately 0.6% as large as the principal blue crab megalopal distribution area.

93. In the real world, test dumps at the Norfolk Disposal Site documented by Darby, et al (1981) measured suspended sediment concentrations of up to 9 mg/1. Suspended solids were confined to within a 300-meter radius, or a total area of approximately o.28 $km^2$ and little if any material was still in suspension one hour after a dump. Based on these figures ("real world" test dumps) and the larval distribution described previously, the principal blue crab larval distribution area of impact is 0.28:6000 or .005% and about 0.28:1000 or approximately .03% for the principal blue crab megalopal distribution area. Actual test dumps in the ocean reflect neither the suspended solid loads or extended area of impact that the hypothetical "worst-case" scenarios describe. The conclusion that no significant impact would occur to larval blue crabs, therefore, is based on the following:

(1) suspended solids are well below levels which would be lethal to larval forms of indigenous species

(2) total area of impact relative to total distribution area of larvae is miniscule

(3) conditions return to ambient rapidly, less than one hour after a dump

(4) most of the blue crab larvae are concentrated in the neuston (surface) layer, above the 20-30 foot depth at which hopper dredges release their loads.

94. Interim Site Meets Criteria - This site evaluation study indicates the Dam Neck Ocean Disposal Site meets the criteria set forth in 40 CFR 228.5 and 228.6 and thus is suitable for continued use for disposal of the types and quantities of dredged material as described in this report.

95. Determination of Site Size and Configuration - The General Criteria (228.5 (d.)) require the determination of site size, configuration, and location as part of the disposal site evaluation. These criteria also require that ocean disposal sites be limited in size to localize the immediate impacts of disposal and permit effective surveillance.

96. Since this study is an evaluation of an existing EPA interim designated site, the location has previously been determined by the EPA and COE. The remaining variables to determine for final designation of the Dam Neck Site

are the size and configuration. The evaluation of these variables is based on a systematic technical approach, contained in Appendix D, Disposal Site Design Evaluation.

97. The goals of the design evaluation can be stated as follows:

(1) The site must accommodate estimated dredged material volumes of 36 million cubic yards of new construction from channel deepening, and 32 million cubic yards from 50 years of channel maintenance, or a total capacity of 68 million cubic yards.

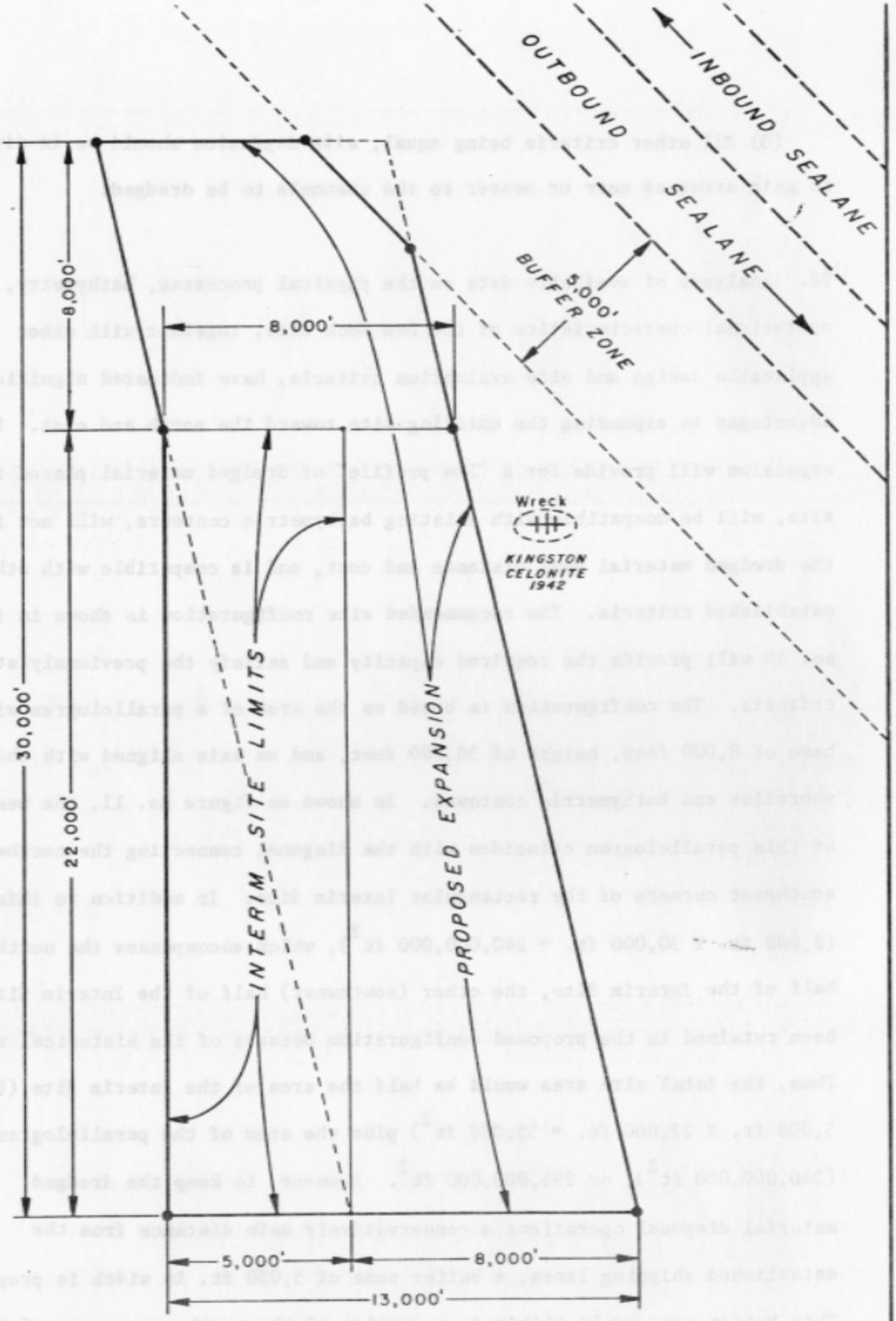
(2) The site should be designed with a "low profile." That is, the site design profile should be kept to a level such that the anticipated hydraulic forces will not significantly affect the dredged material placed at the site. This will also serve to reduce the chance of significant hydraulic changes at the site vicinity.

(3) The site should be designed with the smallest bottom surface area practicable, while still satisfying other design criteria. This will localize the immediate impacts and enable effective surveillance and monitoring.

(4) If the evaluation indicates that expansion or modification of the existing site are required, any such reconfiguration should take advantage of the site bathymetry to maximize the capacity gained. Expansion into bottom areas shallower than the existing site will gain less effective capacity than expansion into areas with equal or greater depth.

(5) All other criteria being equal, site expansion should be in directions to gain areas as near or nearer to the channels to be dredged.

98. Analyses of available data on the physical processes, bathymetry, and operational characteristics of the Dam Neck Site, together with other applicable design and site evaluation criteria, have indicated significant advantages in expanding the existing site toward the north and east. Such an expansion will provide for a "low profile" of dredged material placed in the site, will be compatible with existing bathymetric contours, will not increase the dredged material haul distance and cost, and is compatible with other established criteria. The recommended site configuration is shown in figure no. 10 will provide the required capacity and satisfy the previously stated criteria. The configuration is based on the area of a parallelogram with a base of 8,000 feet, height of 30,000 feet, and an axis aligned with the shoreline and bathymetric contours. As shown on figure no. 11, the west side of this parallelogram coincides with the diagonal connecting the northwest and southeast corners of the rectangular Interim Site. In addition to this area (8,000 ft. X 30,000 ft. = 240,000,000 $ft^2$), which encompasses the northeast half of the Interim Site, the other (southwest) half of the Interim Site has been retained in the proposed configuration because of its historical use. Thus, the total site area would be half the area of the Interim Site (0.5 X 5,000 ft. X 22,000 ft. = 55,000 $ft^2$) plus the area of the parallelogram (240,000,000 $ft^2$), or 295,000,000 $ft^2$. However, to keep the dredged material disposal operations a conservatively safe distance from the established shipping lanes, a buffer zone of 5,000 ft. in width is proposed. This buffer zone would eliminate a portion of the northeast corner of the




DAM NECK OCEAN DISPOSAL SITE
PROPOSED CONFIGURATION

SCALE: 1" = 4,000'



FIGURE NO. II

proposed site configuration, reducing the area by less than 5,000,000 $ft^2$ and leaving a total site area of 290,000,000 $ft^2$ or about 10.4 statute $mi^2$. A comparison of the existing interim designated site configuration and the configuration recommended for final site designation is shown in table 14.

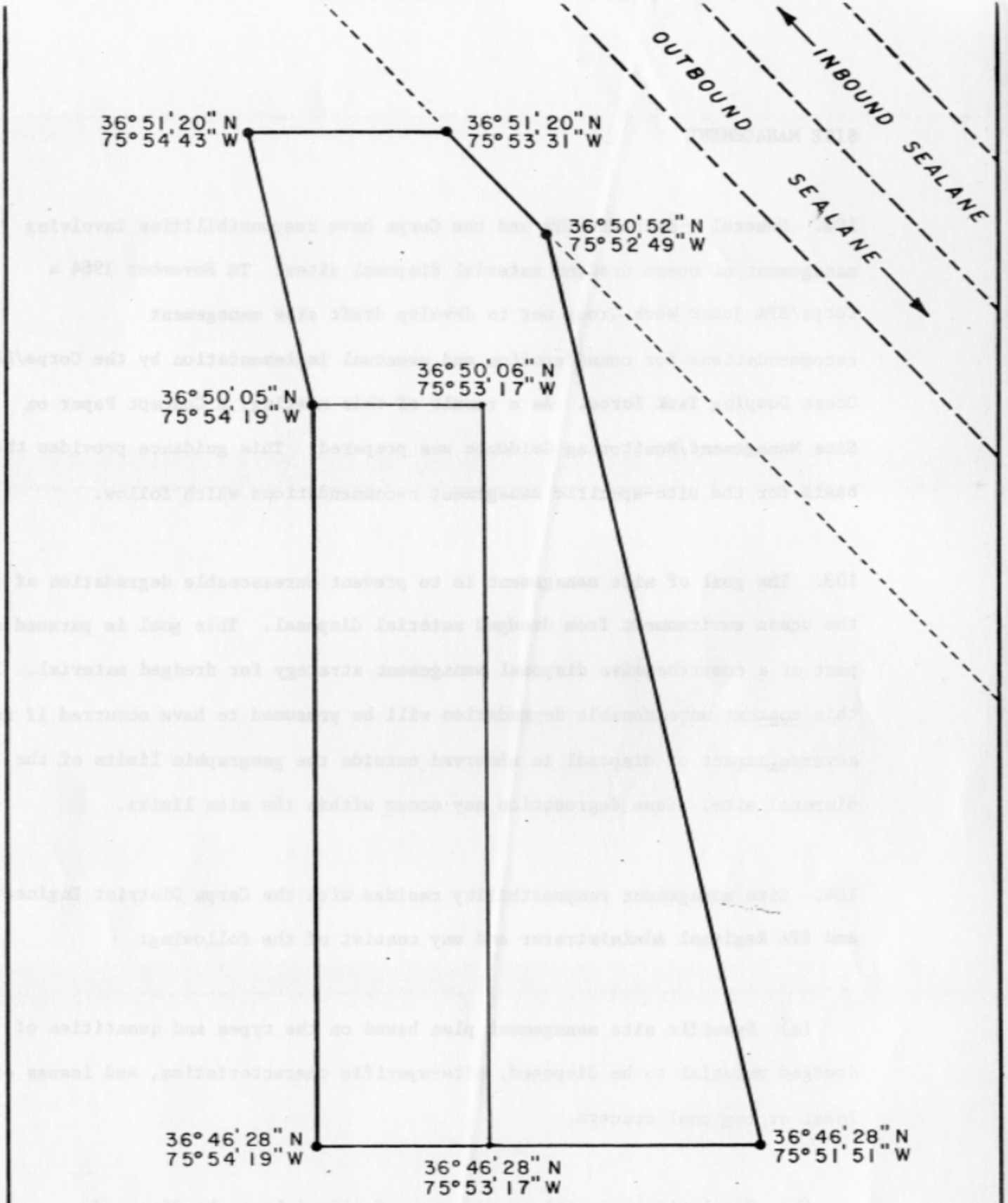
Table 14. COMPARISON OF EXISTING AND RECOMMENDED DISPOSAL SITE CONFIGURATIONS

| Item | Dam Neck Interim Site | Dam Neck Final Site Designation |
|---|---|---|
| Length | 22,000 ft | 30,000 ft |
| Width | 5,000 ft | 6,000 to 13,000 ft |
| Bottom Area | 110 X $10^6$ $ft^2$ (4 $mi^2$) | 290 X $10^6$ $ft^2$ (10 $mi^2$) |
| Present Depth (average) | 38 ft | 42 ft |
| Design Depth (68 mcy capacity) | 21 ft | 35 ft |
| Orientation (NNW - SSE) | North - South | Parallel to Coast |
| Distance Offshore (centerline) | 3.5 mi | 4 mi |

99. Approximate corner coordinates for this recommended site configuration are shown on Figure 12. The exact geographic coordinates for final designation of the Dam Neck Ocean Disposal Site will be determined following completion of public review of this document.

100. Sites Off the Continental Shelf - Any possible disposal sites off the Virginia continental shelf are at least 70 nautical miles offshore, while the established ZSF extends almost 19 nautical miles from shore (See figure 3). Theoretically, seagoing hopper dredges can transport dredged material to the limits of their fuel supply, including locations at or beyond the continental shelf.

101. However, the possibility of utilizing a continental slope disposal site is operationally, environmentally, and economically prohibitive. Utilizing the continental slope region would increase the distance between the dredging areas and the disposal site, extending the transportation frequency and period. Adverse meteorologic and oceanic conditions during construction would produce operationally prohibitive circumstances. Lengthening the transportation distance requires greater fuel expenditures, resulting in the depletion of non-replaceable resources and increased air pollution. Since fuel cost is the primary component of dredging, increasing the distance to the disposal site would significantly increase the time of construction and raise the total cost of the project. The operational, environmental, and economic circumstances involved in utilizing a continental slope disposal site could make the Norfolk Harbor and Channels Deepening project infeasible.




## DAM NECK OCEAN DISPOSAL SITE

CORNER POINT COORDINATES

SCALE: 1" = 4,000'



FIGURE NO. 12

SITE MANAGEMENT

102. General - Both the EPA and the Corps have responsibilities involving management of ocean dredged material disposal sites. In November 1984 a Corps/EPA joint Work Group met to develop draft site management recommendations for consideration and eventual implementation by the Corps/EPA Ocean Dumping Task Force. As a result of this meeting, a Concept Paper on Site Management/Monitoring Guidance was prepared. This guidance provides the basis for the site-specific management recommendations which follow.

103. The goal of site management is to prevent unreasonable degradation of the ocean environment from dredged material disposal. This goal is pursued as part of a comprehensive disposal management strategy for dredged material. In this context unreasonable degradation will be presumed to have occurred if any adverse impact of disposal is observed outside the geographic limits of the disposal site. Some degradation may occur within the site limits.

104. Site management responsibility resides with the Corps District Engineer and EPA Regional Administrator and may consist of the following:

(a) Specific site management plan based on the types and quantities of dredged material to be disposed, site-specific characteristics, and issues of local or regional concern.

(b) Regulating quantities and types of materials to be disposed.

(c) Regulating times, rates, and methods of disposal as needed.

(d) An effective and appropriate ambient monitoring program.

(e) Modifications to site use based on experience in use and results of monitoring or other data.

105. Factors to be considered in development of a site management plan should include information on critical resources and their proximity to the disposal site; physical processes at the site which influenced the choice of site limits and configuration (e.g. sediment retention characteristics and wave energy); sediment management strategies; and operational considerations. For management to be effective, the plan must be practical and implementable.

106. Site monitoring may involve specific studies undertaken as part of the management plan to demonstrate that important resources or amenities outside the site have not been degraded. Monitoring has two basic purposes:

(a) To verify predictions related to site designation.

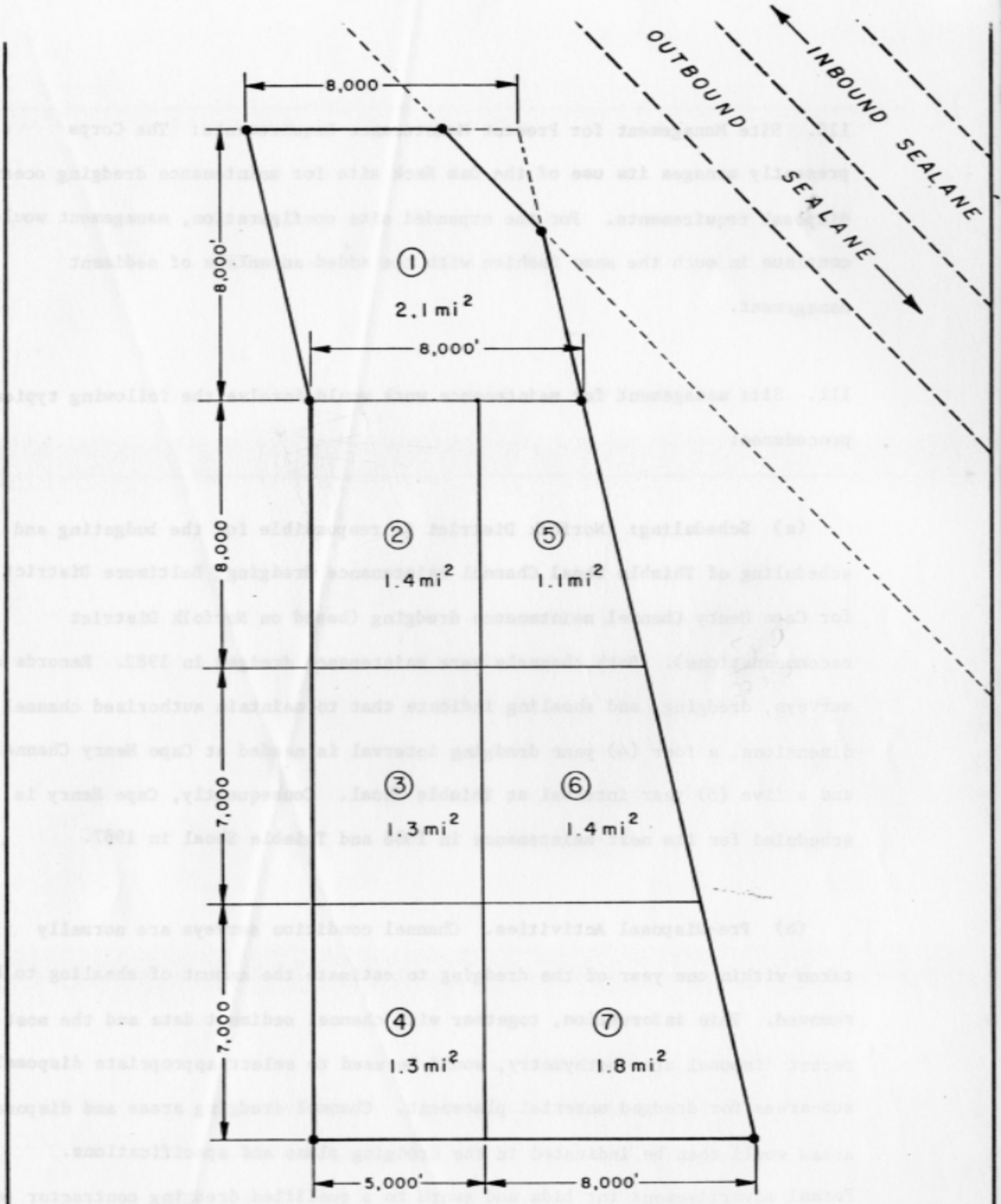
(b) to insure compliance with the site management plan.

107. Monitoring can be an effective management tool, but is not appropriate in many cases. Monitoring should be applied only if the results can clearly be used in the site management decision-making process. Factors to be considered in monitoring plans include issues of substantial public interest

or concern; hypothesis formulation and testing of presumed cause and effect relationships; identification of legitimate concerns that cannot readily be dealt with by hypothesis testing; sampling and analytical considerations; and the evaluation of dredged material disposal impacts.

108. Implementation of site management for the Dam Neck Site will be done through the Corps dredging contracts for the Federal navigation channels. Although presently unforeseen, the management of site use for private dredging work would be implemented through the permit program. Monitoring plans that are specific to particular site use requirements for Federal projects will be implemented by the Corps because of its extensive hydrographic surveying, floating plant, and contracting capabilities. EPA remains the principle party in this joint relationship responsible for ensuring the environmental acceptability of site management activities, and may conduct broader scope impacts assessment monitoring.

109. Dam Neck Site Management Sub-Areas: By dividing the Dam Neck Site into sub-areas, site use can be better managed. Figure no. 13 shows the proposed management areas for the expanded configuration. These seven (7) areas range in size from 1.1 square miles to 2.1 square miles. Areas of this size can be more readily surveyed than the site as a whole. Site use can be specified at limited areas or points within these sub-areas. In addition, sub-areas enable a sediment management strategy to be employed. The more granular materials, suitable for beach nourishment or other purposes, could be placed separately from dredged materials that are predominantly fine-grained. Alternatively, for certain materials resulting from unforeseen dredging and ocean disposal requirements, it may be advantageous to place these materials separately from the relatively uncontaminated outer channel dredged sediments.




DAM NECK OCEAN DISPOSAL SITE

PROPOSED MANAGEMENT AREAS

TOTAL AREA = 10.4 st. mi²

SCALE: 1" = 4,000'



FIGURE NO. 13

110. Site Management for Present Maintenance Requirements: The Corps presently manages its use of the Dam Neck site for maintenance dredging ocean disposal requirements. For the expanded site configuration, management would continue in much the same fashion with the added advantage of sediment management.

111. Site management for maintenance work would involve the following typical procedures:

(a) Scheduling: Norfolk District is responsible for the budgeting and scheduling of Thimble Shoal Channel maintenance dredging; Baltimore District for Cape Henry Channel maintenance dredging (based on Norfolk District recommendations). Both channels were maintenance dredged in 1982. Records of surveys, dredging, and shoaling indicate that to maintain authorized channel dimensions, a four (4) year dredging interval is needed at Cape Henry Channel and a five (5) year interval at Thimble Shoal. Consequently, Cape Henry is scheduled for its next maintenance in 1986 and Thimble Shoal in 1987.

(b) Pre-Disposal Activities. Channel condition surveys are normally taken within one year of the dredging to estimate the amount of shoaling to be removed. This information, together with channel sediment data and the most recent disposal area bathymetry, would be used to select appropriate disposal sub-areas for dredged material placement. Channel dredging areas and disposal areas would then be indicated in the dredging plans and specifications. Formal advertisement for bids and award to a qualified dredging contractor (or on limited occasions, Government dredge) would immediately follow. During

this period the Corps also makes arrangements with the Coast Guard to deploy dump buoys. Immediately before-dredging channel surveys are performed to verify the dredging quantities. In addition, it may be advantageous to perform pre-dump disposal surveys in some cases to provide up-to-date disposal bathymetry.

(c) Sediment Management. Effective sediment management is accomplished by requiring the dredging contractor to place the dredged material within a specific disposal sub-area, depending on which channel reach is being maintenance dredged. For the purposes of final acceptance of dredging work, dredging plans normally have the channel broken into acceptance sections. The width and length of the acceptance sections are tailored to the location of the shoaling and the type of dredge, which in this case is trailing suction hopper. Generally the character of material within each channel section is known based on knowledge of previous sediment sampling. Neither Cape Henry Channel nor Thimble Shoal Channel have significant quantities of beach-quality sand that are removed during maintenance. Cape Henry maintenance dredged material is predominantly very fine sand with some silt, clay, and shell. Thimble Shoal maintenance dredged material is predominantly a silt-clay mixture with some fine sand. All maintenance dredged materials from both channels that were disposed at Dam Neck during the past several maintenance dredgings have been placed within management area no. 2. During the most recent maintenance dredging a specific attempt was made to deposit the materials at a precise location within this area, and proved to be quite successful. Using detailed bathymetric surveys the Corps has monitored and will continue to monitor the stability of these materials. It is proposed to

continue to manage the placement of present quantities of maintenance dredged materials by uniform deposit in management area 5 and the deeper (seaward) portions of area 2. Additional materials would not be placed within the portion of area 2 already shallower than 30 feet. This plan would not affect present ocean disposal costs and would reserve suitable areas for future new work disposal requirements.

(d) Regulating Disposal Quantities, Time and Rates. The quantities and types of materials will be managed, but presently there is not a need for regulating the times, rates, and methods of ocean disposal. Maintenance dredging is infrequent and results in relatively small quantities of uncontaminated materials.

(e) Surveillance and Monitoring. Contractor surveillance now includes routine inspection by qualified Corps representatives, and a contractor quality control plan which requires daily reporting. Corps survey parties perform channel acceptance section surveys to monitor the progress of dredging and provide the basis for payment estimates. These procedures adequately assure that the contractor dredges and disposes the material in accordance with contract plans. The channel progress surveys and after dredging acceptance section surveys also determine the total quantities removed from the channel, and thus provide a record of the quantities of material deposited at the disposal site. If warranted the Corps may on occasion perform progress surveys at the disposal site to monitor the progress of dumping. There are no other significant monitoring requirements for the present level of use of the

Dam Neck site. Maintenance dredging and ocean disposal scheduled in the near future could provide the opportunity to conduct studies applicable to site management for the new work disposal requirements.

(f) Post-Disposal Activities. Upon completion of disposal operations the Coast Guard removes any dump buoys that were deployed for the project. As soon as weather and scheduling permit, the Corps performs a post-disposal survey of the dump site to provide up to date bathymetry. These surveys are then used to analyze the performance of the disposal management plan and provide the basis for planning the next ocean disposal requirement.

112. Site Management for New Work Requirements. Management will be particularly important during use of the Dam Neck site for new work ocean disposal requirements. It is expected that present management practices with respect to maintenance dredging will continue with the initiation of channel deepening projects. In addition there may be more emphasis or sediment management and monitoring of large quantities of new work dredged material disposal.

(a) Schedule. The presently estimated schedule for channel deepening, as shown on Table 10, is based on incremental construction of the channel segments. This schedule is optimal in that it will expeditiously make the project navigation benefits available for 50 feet and 55 feet increments, and assumes no regulation of dredging and disposal times and rates.

(b) Pre-Disposal Activities. The procedures for maintenance dredging would continue in much the same fashion with the larger-magnitude new work contracts. During the interim period between dissemination of this document and initiation of construction, Norfolk District will be completing the engineering and design studies and prepare a General Design Memorandum for the Norfolk Harbor and Channels deepening project. These studies may include additional physical analyses of initial, interim, and final disposal profiles that will help guide the management of dredged material placement. Thus the site management plan, given here in concept, will be made final concurrently with engineering and design studies that will lead directly into dredging contract plans and specifications for the first increment of channel deepening.

(c) Sediment Management. In concept, sediment management at Dam Neck would involve targetting specific areas within the disposal site to receive specific materials or a range of materials. Increments of channel deepening, and the materials dredged from each increment, must be considered with regard to location of placement within the site. Consideration should also be given to minimizing the area used at any given time and to reserving suitable locations within the site for future maintenance dredging requirements. The following general recommendations are applicable to sediment management for new work dredging:

(1) Thimble Shoal 50 Ft. Outbound (5.9 MCY) - This material is expected to be predominantly clay and silt, but as much as a third may be suitable beach material. If not used directly, separable beach quality material would be placed in sub-area 1 and the balance in areas 2 and 5.

(2) Thimble Shoal 55 Ft. Outbound (8.8 MCY) - This material is also expected to be predominantly clay and silt, and contains a higher proportion of good quality sand than the first increment. Separable beach quality material not used directly would continue to be placed in area 1, and the balance uniformly placed in areas 2 and 5. Area 2 will reach its capacity.

(3) Cape Henry 50 Ft. Full Channel (2.8 MCY) - This material is expected to be predominantly fine sand, suitable, but not ideal for beach nourishment. All material would be placed in area 1.

(4) Atlantic Ocean 57 Ft. 800 Ft. Width (7.9 MCY) - This material is expected to be predominantly fine sand, suitable for beach nourishment, but possibly not ideal for that purpose. Most of this material would be placed in area 1 until capacity is reached, and the balance placed in area 3. Area 1 would then contain up to 15 MCY of material suitable for future beach nourishment.

(5) Thimble Shoal 50 Ft. Inbound (4.9 MCY) - This material is expected to be predominantly clay and silt, which would be placed in area 5. Separable portions of good quality sand would be placed at area 3.

(6) Thimble Shoal 55 Ft. Inbound (4.9 MCY) - This material is also expected to be predominantly clay and silt, which would be placed at area 5 until filled to capacity then at area 6. Separable portions of good quality beach material would be placed at area 3 until filled to capacity then at area 4.

(7) Atlantic Ocean 57 Ft. Full Width (2.1 MCY) - This material is expected to be predominantly sand, suitable but not ideal for beach nourishment. All material would be placed in area 4, which together with the materials in area 3 would form a stockpile of sand of up to 7 MCY. Areas 6 and 7 would remain for future maintenance.

A general plan of this type would result in less than a third of the total disposal site area being used at any one time. The plan should be kept sufficiently flexible to enable adjustments which may be indicated by further engineering and design studies or monitoring studies.

(d) Regulating Disposal Times and Rates. This evaluation study of the Dam Neck site has addressed each of the criteria for continued use of the site, and there does not appear to be any critical resources that would at this time warrant a decision to regulate the times and rates of disposal for new work dredging. It should be noted that channel deepening is planned on a construction schedule of about 7 years, and that restrictions on times and rates of disposal would have the effect of increasing the project duration and cost. If monitoring and surveillance activities indicate that impacts are occurring beyond the site boundaries, it would be appropriate at that time to consider this type of regulation.

(e) Surveillance. Contractor surveillance would continue during new work dredging with the same procedures now used with maintenance dredging. Surveillance activities would increase in proportion to the number of contractors or dredges employed during each increment of channel deepening.

(f) Monitoring the Disposal Site. Plans for monitoring each increment of new work disposal will be developed by determining appropriate monitoring parameters based on a heirarchical approach, taking into account the cumulative volumes disposed, locations, and the rates of disposal. The primary purpose of the monitoring program would be to assess the performance of the site management plan, and to determine whether disposal at the site is significantly affecting areas outside the site. Certain monitoring efforts may involve control sites and areas which are likely to be affected (as indicated by environmental factors, such as prevailing currents). The results of adequate surveys will provide early indications of potential significant adverse effects outside the site.

Guidelines for the Monitoring Plan. The following sections outline the recommended monitoring of new work ocean disposal. The monitoring plans will be subject to potential revision when sampling data are analyzed and reviewed with respect to the overall site management plan. Changes in the plan may be made after this review.

The requirements for monitoring a particular site use may be determined by applying the considerations outlined below.

(1) Dredged Material Movement. Based on the physical studies documented in the Site Evaluation Study, it is not anticipated that dumped sediments will be transported in significant amounts beyond the site limits. Periodic detailed bathymetric surveys would be performed to continue to assure that significant transport of dredged material is not occurring. Using a

heirarchical approach, if a series of bathymetric surveys show that material is leaving the site, this may trigger plans to take samples and make measurements that would determine the quantities and directions of movement.

(2) Water Quality. Measurable changes in water quality due to dredged material disposal are not likely to occur, or to be detectable, because of:

- Limited release to the water column of contaminants (as analyzed, the sediments destined for DNDS have only trace to non-detectable levels of contaminants), as well as large dilution factors;

- Transient nature of ocean water masses;

- High natural variability in water column chemical parameters and biota;

- The short-lived water column changes attributable to open ocean disposal of dredged material as observed in test dumps.

For these reasons, monitoring the water column for long-term chronic changes is not likely to produce useful results, and is therefore not proposed.

Based on what is known about the dissolved oxygen patterns of the region and the effects of intermittent dredged material disposal, the use of the Dam Neck Site should not significantly effect dissolved oxygen concentrations.

Concerns have been expressed with regard to the short-term and synergistic effects on dissolved oxygen which could potentially be caused by dredged material disposal, the Chesapeake Bay plume, and simultaneous use by the HRSD Atlantic Sewage Treatment Plant. Dissolved oxygen should be monitored prior to disposal (background) and during disposal to determine if induced changes of significance have occurred during the first increment of new work disposal.

(3) Benthic Biota. According to Dauer et. al. (1985) the benthos of DNDS are typical of those found offshore in the region. The previous deposition of dredged material has apparently not altered the benthic biological makeup to any great degree nor has it introduced any "nuisance species" at the site. Should the bathymetric surveys recommended previously indicate that material is leaving the site in substantial quantities, further monitoring may be required to indicate any biotic changes or impacts beyond the boundaries of the site.

113. Site Management for Future Maintenance Requirements. On completion of new work disposal operations, the Dam Neck site management would revert to a mode similar to present procedures for maintenance dredging and disposal. Under the proposed concept plan, capacity would be reserved in sub-areas 6 and 7 to accommodate 50 years of future ocean disposal requirements, now estimated at about 32 MCY.

114. Site Management for Private Permit Requirements. The Dam Neck site will be available for ocean disposal requirements resulting from non-Federal

dredging approved under the permit program. Presently there are no known requirements of this type. Work approved under the permit program would be managed on a case by case basis, depending on the volumes and types of material and the capacities available in the various management sub-areas.

## CONCLUSIONS

115. This study has addressed the 11 specific criteria and the 5 general criteria for ocean disposal site evaluation, as they relate to the Dam Neck Ocean Disposal Site. For each criteria, no significant conflicts or problems with continued use of the Dam Neck Site have been identified.

116. The study made use of all known sources of information pertinent to the channels requiring ocean disposal of dredged material, and pertinent to the ZSF established for this evaluation. The types and quantities of dredged material expected from present channel maintenance requirements, future channel deepening projects, and future channel maintenance, can be accommodated at the Dam Neck Site with appropriate management. An examination of site sizing and configuration requirements determined that expansion of the existing Dam Neck Interim Site toward the north and east would be advantageous, and result in no conflicts with the applicable criteria. Expansion of the interim site would enable the dredged material to be placed in a low profile, with little likelihood of adverse physical or ecological effects.

## RECOMMENDATIONS

117. The conclusions of this site evaluation study are that the Dam Neck Ocean Disposal Site, expanded and reconfigured as described in the text, is suitable for continued use. Continued use of the site, as presently proposed, would amount to the disposal of up to 68 million cubic yards of uncontaminated sediments from Cape Henry Channel, Thimble Shoal Channel, and the planned Atlantic Ocean Channel. The Norfolk District, Corps of Engineers recommends that the Dam Neck Interim Site be given final site designation, with an expanded configuration as proposed. Final designation will assure that an environmentally suitable, operationally efficient disposal site is available for maintenance dredging and new channel deepening/ construction requirements.

118. Management of the Dam Neck site for future new work and maintenance dredging ocean disposal requirements will include a sediment management strategy, and appropriate surveillance and monitoring. As well as dredged materials from the identified Federal channels, it is recommended that the Dam Neck site be given a final designation status that would allow the placement, within the expanded site, of any dredged material meeting the ocean disposal criteria.

## COORDINATION

119. Final designation of the Dam Neck Ocean Disposal Site has been discussed at length with both state and Federal environmental agencies throughout the

development of this study. The original concept of creating a bar at Dam Neck was presented to the agencies at a joint meeting on 15 September 1983. A variety of concerns were expressed at this meeting from which a basic format for field and literature examination was developed. On 9 November 1983, the District met with the Federal agencies to develop a plan of study for the proposed bar concept. Because of possible hydrologic modifications, the bar concept was dropped in favor of an expanded Dam Neck Site that would have the potential for only minor system changes.

120. The expanded Interim Site concept and Site Evaluation Study format were presented to a meeting of Federal agencies on 9 May 1984. The agencies were briefed on the proposed technique as described in the EPA/Corps "Technical Guidance for the Designation of Ocean Dredged Material Disposal Sites." The stepwise process of arriving at the Dam Neck Site was then described using narrative and overlay maps to represent the biological and physical resources within the ZSF. There was ample opportunity for the exchange of questions, concerns, and ideas which were integrated into this document.

121. The following state and Federal agencies have been involved throughout the study:

U.S. Environmental Protection Agency

U.S. Fish and Wildlife Service

National Marine Fisheries Service

Va. State Water Control Board

Va. Marine Resources Commission

Va. Institute of Marine Science

Old Dominion University

City of Virginia Beach

Va. Beach Erosion Commission

The Draft Supplement describing the use and proposed final designation of the Dam Neck Site was filed with EPA on 14 December, 1984. The document received wide distribution to a mailing list and comments were solicited by Norfolk District. Comments received as a result of this coordination, and responses provided by Norfolk District are found in the Appendix II. Public comment on the Final Supplement will be open for 30 days following the filing date with EPA.

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# APPENDIX A

# LIVING RESOURCES

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Planning Aid Report prepared by the U.S. Fish and Wildlife Service for Norfolk District entitled "A Review of the Aquatic Biological Resources of the Atlantic Coastal Area Off Virginia Beach, Virginia"


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# A REVIEW

# OF

# THE AQUATIC BIOLOGICAL RESOURCES OF

# THE ATLANTIC COASTAL AREA

# OFF VIRGINIA BEACH, VIRGINIA

Planning Aid Report by the
U.S. Fish and Wildlife Service
Under Provisions of the
Fish and Wildlife Coordination Act
For a Proposed Ocean Dredged Material Disposal Site
by the Norfolk District,
U.S. Army Corps of Engineers

February, 1984

Prepared by: George Ruddy
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Feb 28, 1984
Date

Approved:

Glenn Kinser
Supervisor
Annapolis Field Office

This report will provide planning aid information for the Norfolk Harbor Deepening Study. Consideration is currently being given to establishing a new dredged material disposal site further inshore from the previously proposed site, located approximately 17 miles east of the Bay mouth. We understand that although no firm alternative site has been selected for study, one alternative being considered is deposition of disposal material north of the previously utilized Dam Neck disposal site in a manner to create an off-shore bar.

This report will attempt to describe the baseline biological conditions in the study area. Because of the short time frame, absence of project specifics, and broad scope of this report, the level of detail of our treatment of this ecologically complex area will necessarily be limited. As the project requirements become better defined, we will be able to provide more detailed information on particular areas of concern.

For the purposes of this report we are considering the study area to be the area bounded by 37 degrees 10' latitude on the north, 36 degrees 40' latitude on the south, 75 degrees 40' longitude on the east and the shoreline and Bay mouth on the west (Figure 1). The ecology of this area is extremely dynamic. As is typical of mid-Atlantic coastal areas, the biological make-up changes dramatically on a seasonal basis. However, it is the proximity of the Chesapeake Bay, the largest estuary on the east coast, which primarily adds to the complexity and importance of this area.

## Phytoplankton

Phytoplankton in the study area are dominated by lower Chesapeake Bay species which are transported eastward from the mouth of the Bay and then southward along the Virginia coast by the Chesapeake Bay plume. Species composition fluctuates seasonally. Diatoms are typically dominant in the fall, winter and spring, while in the summer there is a mixture of diatoms, phytoflagellates and nannoplankters. Moving away from the Bay mouth and out over the continental shelf, the phytoplankton composition changes to reflect an increase in shelf species and a decrease in concentration. Marshall (1980) investigated the phytoplankton within the Bay plume and adjacent shelf waters. Based on his sampling (Figure 2) he identified phytoplankton assemblages within the Bay plume and adjacent shelf water for March, June and October (Table 1). His findings also show that phytoplankton cell concentrations in the Bay plume water are significantly higher than in shelf waters outside the plume (Figure 3). Similarly, an examination of respiration rates in the Bay plume (Robertson and Thomas, 1981) indicated that the plume supports a higher level of biological activity than adjacent non-affected shelf waters.

## Zooplankton

The zooplankton forms a vital part of the ecological picture in the study area. Not only does it provide an important trophic link between the primary production of the phytoplankton and higher animal forms, but it

also includes the planktonic larval stages of many marine and estuarine invertebrates and fish. Unfortunately, detailed comprehensive zooplankton studies in the study area are lacking. Researchers from Old Dominion University have been sampling zooplankton in the area regularly for two years, but their collections have not yet been analyzed. There are, however, a few studies available from which information on the zooplankton composition in the study area can be inferred. Focusing only on molluscs, decapods and fish, the U.S. Fish and Wildlife Service (1981) made six meroplankton collections in and around Rudee Inlet. Species and abundance from two of their stations at the mouth of Rudee Inlet are shown in Table 2. Grant and Olney (1979 and 1983) studied zooplankton in the lower Chesapeake Bay. Their sampling stations closest to the study area were in the vicinity of the Bay Bridge Tunnel. A list of species which they found at these stations is shown in Table 3. Grant (1979) surveyed zooplankton on a seasonal basis in the Middle Atlantic Bight. A list of species from his LI station, located approximately 20 miles offshore of Wachapreague is shown in Table 4. The locations of the zooplankton collections made in the above mentioned studies are shown in Figure 4. The zooplankton composition in the study area is likely to include a mixture of the species identified in these studies; that is to say, there will be a mixture of estuarine species from the Bay and continental shelf species. The relative composition of these species assemblages will vary with changes in the Bay discharge and meterological conditions. Other complicating factors include tremendous seasonal shifts in species composition, diurnal vertical migrations which can bias sampling efforts, and substantial natural year to year variation. For these reasons it seems likely that the study area would include a large number of species which do not appear in any of the surveys we have reported.

The zooplankton includes many important species from higher trophic levels which are present during their developmental stages, mainly eggs and larvae. Of the species which were identified in the three studies mentioned above, there were a total of 32 species of molluscs, 38 species of decapods and 41 species of fish present in the zooplankton. The eggs and larvae of many decapods and fish were particularly prevalent in the late spring and summer, and were frequently concentrated in the surface layers.

Although there are several commercially and recreationally important fish species which will occur in the zooplankton in the study area, the blue crab (Callinectes sapidus) may be the most important species to regularly occur in high concentrations. Chesapeake Bay blue crabs spawn in the lower Bay during the summer months. Recent studies indicate that after hatching the larvae move into the neuston (surface layer) and are transported out of the Bay (Provenzano et al., 1982). Larval development occurs in offshore waters in the neuston (Smyth, 1980; McConaugha et al., 1983). Larval development to the megalopa stage has been estimated to take 30 to 40 days (McConaugha et al., 1983). Since the Chesapeake Bay plume moves southward toward Cape Hatteras, it is not clear how the crab larvae avoid being trapped in this flow and lost from the Chesapeake Bay system. However, since the larvae occupy the surface layer, wind driven surface currents may play a major role in determining their distribution. Johnson et al. (1983) have postulated that the southerly winds common in this area in the summer could retaiin the

larvae in the offshore waters near the Bay mouth, thereby facilitating their recruitment back into Chesapeake Bay. The dimensions of this nearshore "nursery area" have not as yet been determined.

## Benthic Fauna

There have been several studies on benthic fauna at various locations within the study area. Our office conducted a one time survey of benthic infauna at 8 stations and epifauna at 3 additional stations approximately 3 miles offshore from Virginia Beach (Figure 5) in June of 1982. The results from this study were submitted to your office in a planning aid report for the Virginia Beach Hurricane Protection Study (USFWS, 1982). In this report we also reviewed other benthic studies conducted on the mid-Atlantic continental shelf. Species lists from this study are shown in Tables 5 and 6. The Hampton Roads Sanitation District has been conducting benthic surveys in the vicinity of their Virginia Beach sewage treatment plant discharge pipe for several years. Although these data are not presently available, a species inventory from an earlier study done for them by Hydroscience, Inc. (1974) is shown in Table 7 and Figure 6. Based on these studies it appears that the study area supports a productive benthic faunal population which in general character is typical of the mid-Atlantic inner continental shelf.

## Finfish

The fishery resources in the study area are rich and varied. A species list compiled from National Marine Fisheries Service groundfish trawl surveys between 1977 and 1980 is given in Table 8. The surveys identified 76 species, but this is far from a complete list of the species that use the area. As is typical for the mid-Atlantic region, most species undergo seasonal migrations. The species composition in the study area is also strongly influenced by the large number of species which migrate in and out of the Chesapeake Bay. Of the 209 marine and estuarine fish species known to occur in Chesapeake Bay, 180 species migrate in and out of the Bay (Musick, 1972). Spring and fall are the peak migration periods. It is of particular interest that many species migrate through the area during their more vulnerable larval or early juvenile stages on their way to nursery areas within Chesapeake Bay. These would include species of commercial and recreational importance such as menhaden (Brevoortia tyrannus), weakfish (Cynoscion regalis), croaker (Micropogon undulatus), spot (Leiostomus xanthurus) and summer flounder (Paralichthys dentatus) (Gosselein and Azarovitz, 1982). Weakfish spawn in the lower Bay and coastal waters in the summer. Their larvae are planktonic until the later stages of development when they become demersal (Mercer, 1983). In a survey of lower Chesapeake Bay ichthyoplankton, Olney (1983) found early stage weakfish larvae at densities up to 966/100 $m^2$ near the Bay mouth. Menhaden, croaker, spot and summer flounder spawn in offshore waters. Their larval and postlarval stages appear to follow inshore bottom currents into Chesapeake Bay (U.S. Dept of the Interior, 1970).

## Commercial Fisheries

The commercial fisheries in the Atlantic Ocean off Virginia Beach are found in two general areas. The "offshore" fishery occurs in deep water from 20 to 100 miles or more off the coast and consists of oceanic species such as the surf clam, scallop, and lobster, and deep water finfish such as tuna, dolphin and bonito. The "inshore" fishery occurs in the nearshore area from just outside the breaker zone to about 3 to 4 miles offshore. This fishery mainly harvests the finfish that migrate along the Atlantic coast and into and out of the Chesapeake Bay. The following is a brief discussion of the major inshore fisheries, which is accompanied by a map that shows the locations of these fisheries. It is based on discussions with the Virginia Institute of Marine Science, the Virginia Marine Resources Commission, and local watermen and seafood dealers.

There is a small fishery for blue crabs in the area, which is incidental to the major blue crab fishery within the Chesapeake Bay. A summer crab pot fishery exists from Cape Henry south to below Rudee Inlet, immediately east of the breaker zone and in Smith Inlet on the Eastern Shore. The crab pot fishery has been restricted within the mouth of the Chesapeake Bay by the State of Virginia because the lower Chesapeake Bay is the blue crab spawning and nursery area. Although the Virginia Beach pot fishery is outside of the restricted zone, most of the crabs that are caught in this area are also the spawning females. A winter crab dredge fishery exists along the flanks of the Chesapeake Bay entrance channels. This area is only fished during good weather conditions. The majority of the winter fishery occurs inside the mouth of the Chesapeake Bay.

A small conch fishery (Busycon sp. and Strombus sp.) occurs along Virginia Beach from about 1.5 to 3 miles offshore. This fishery takes place year round but is usually incidental to the more important finfisheries. The abundance of conch appears to vary from year to year, which may be related to fishing pressure.

A purse seine fishery for menhaden is located at the mouth of the Chesapeake Bay from late May through October. Purse seining may also occur in the nearshore area of the Atlantic Ocean during this period if spotter planes locate large concentrations of fish.

A gill net fishery is located from just outside the breaker zone to about the 20-foot contour south of the mouth of the Chesapeake Bay down to the North Carolina state line. Restrictions by the Navy limit fishing off the Dam Neck area. A shad fishery (Alosa sp.), utilizing floating gill nets, occurs during the spring run of shad into the Chesapeake Bay from March through April. Anchored gill nets are fished in the area between April and September, with the largest catches during the spring and fall migrational periods. The primary species which are caught are bluefish (Pomatomus saltatrix), croaker, spot and sea trout (Cynoscion regalis and C. nebulosus).

The most important fishery in the study area is the trawl fishery, which extends from 1/4 to 4 miles offshore, both north and south of the mouth of the Chesapeake Bay. The primary fishery, however, is south of Cape Henry.

There is an intense flounder fishery (primarily summer flounder, (Paralichthys dentatus) in the fall between about October and December. Other major species which are caught during the spring and fall migrations into and out of the Chesapeake Bay include spot, croaker, sea trout and bluefish. Striped bass (Morone saxatilis) were previously caught during the winter; however, the decline of the striped bass stocks in recent years has eliminated this fishery.

It is difficult to determine the size and economic value of the commercial fisheries in the study area. The methods that have been used by the National Marine Fisheries Service and the Virginia Marine Resources Commission to compile the statistics on the annual landings of commercial species from the Atlantic Ocean will not allow a breakdown of the catches on a small scale. Therefore, catch data for the study area includes a large area that extends from the shoreline to 75 degrees longitude and from 36 degrees to 37 degrees latitude. Catch data from the period of 1972 to 1981 have previously been compiled for the Norfolk Harbor Deepening Study and can be provided in draft form if necessary.

One of the unanswered questions regarding the commercial fisheries is whether the location of the fisheries adequately reflects the actual limits of the resources. For example, it is known that blue crabs extend much further offshore than what the extent of the crab pot fishery would indicate. However, fishermen find that it is both uneconomical and impractical to set their pots in offshore areas. This may also be the case with the finfisheries. Several watermen have indicated that they do not trawl further offshore than 4 miles because the bottom is bad, there are many obstructions, and because of the shipping lanes. Therefore, while it is speculated that the major concentrations of finfish occur within the 3 mile zone, it is possible that these fish are also found further offshore, but in lesser numbers. Of course, the location of migrating fish along the Virginia coast can vary greatly from year to year, depending on such variables as weather conditions, water temperatures, current patterns and food sources.

## Recreational Fisheries

There is a substantial amount of recreational fishing in and around the study area. It is derived from commercial charter and head boats, private boats, pier fishing and beach fishing. The accompanying map displays some particularly popular fishing spots and target species. The map is based on information from the publication Saltwater Sport Fishing and Boating in Virginia (1981), and discussions with VIMS and local charter boat captains. It should be realized, however, that substantial year to year variation is expected depending on the condition of the stocks, climatic conditions, etc. The sport fishing season usually begins in March and early April with the arrival of Atlantic (Boston) mackerel (Scomber scombrus) in water 4 to 12 miles off the Virginia coast. These fish remain in the area only a short time before migrating northward. Black sea bass (Centropristis striata) and tautog (Tautoga onitis) are sought after on wrecks and artificial reefs which exist in the area. Black sea bass are caught from

spring to fall, while tautog are more restricted to just the spring and fall months (Marshall and Lucy, 1981). Bluefish are caught throughout the area, especially around the Chesapeake Light Tower, from spring to fall. Weakfish, croaker, spot and summer flounder are also caught from late spring to fall, although these fish are more frequently sought after inside the Bay mouth. It should be noted that fishing even occurs within the restricted area around Cape Henry despite the regulations prohibiting "anchoring, trawling, fishing and dragging." Fishing for bluefin tuna (Thunnus thynnus) occurs 10 to 30 miles offshore in June and July. King mackerel (Scomberomorus cavella) are also caught in this vicinity from late August to October. Other pelagic game species such as white marlin (Totrapturus albidus), wahoo (Acanthocybium solardii), false albacore (Euthynnus alletteratus), skipjack tuna (Katsuwonus pelamis), dolphin (Coryphaena hippurus), Atlantic bonita (Sarda sarda), blue marlin (Makaira nigricans), and yellowfin tuna (Thunnus albacares) are caught in deeper waters, generally 30 to 50 miles offshore.

## Endangered Species

The only endangered or threatened species which would occur in the study area on more than an occasional or transient basis are marine turtles. The loggerhead turtle (Caretta caretta), which is Federally listed as threatened, and the leatherback (Dermochelys coriacea) and Atlantic ridley (Lepidochelys kempis) turtles, which are Federally listed as endangered, are known to frequently occur in the study area from May through October (Richard Byles, VIMS, personal communication). Leatherbacks occur around the Bay mouth where they often feed on jellyfish. Loggerheads and ridleys, especially the juveniles, have more of a tendency to penetrate further up the Bay. Both these species spend a good deal of time on the bottom feeding on epifaunal invertebrates. All three species are under the jurisdiction of the National Marine Fisheries Service (except when nesting) and further information can be obtained by contacting Doug Beach, NMFS, Gloucester, Massachusetts, at (617) 281-3600.

## Miscellaneous Resource Considerations

The area extending from Assateague to Fisherman's Island and offshore for 10 miles is on the NOAA site evaluation list for consideration as a marine sanctuary. This does not confer any specific statutory protection on the area, but merely indicates that the site is included within a pool of 39 nationwide sites from which individual sites can be chosen for study when funds become available. Most of Fisherman's Island, located on the north side of the Bay mouth, is a National Wildlife Refuge known for having a wide variety of bird life which are particularly abundant during seasonal migratory periods. The Back Bay National Wildlife Refuge and False Cape State Park are located to the south of the study area.

## Summary

The dominant factor influencing the biological make-up of the study area is its position adjacent to the mouth of the Chesapeake Bay. The Bay, which is the largest estuary on the east coast, exerts a tremendous influence. As the Bay plume sweeps over this portion of the inner continental shelf, it contributes nutrients and other materials, resulting in enhanced primary production compared to adjacent shelf waters. A critical period in the life cycle of the Chesapeake Bay blue crab occurs in this area when, after spawning in the lower Bay, the crab larvae enter the surface waters and are transported out of the Bay. After undergoing larval development in shelf waters, the post-larval crabs must pass through the area on their way back into the Bay.

The proximity of the Bay mouth also dictates that there will be extensive fish migrations through the study area. This would also include the vulnerable larval and juvenile stages of many ocean spawning species passing through the area on their way to estuarine nursery grounds.

Detailed information on the nearshore spawning and nursery areas and migratory routes of most of the finfish species and blue crabs is not available. Since the study area comprises one of the most biologically unique and important areas along the Atlantic Coast, and is vital to the maintenance of the Chesapeake Bay resources, it is imperative that any proposal to modify this area must accurately define the impacts of such a project. Unless it can be reasonably determined that there will be no adverse impacts associated with dredged material disposal, this area should not be used for a permanent, long-term disposal site.

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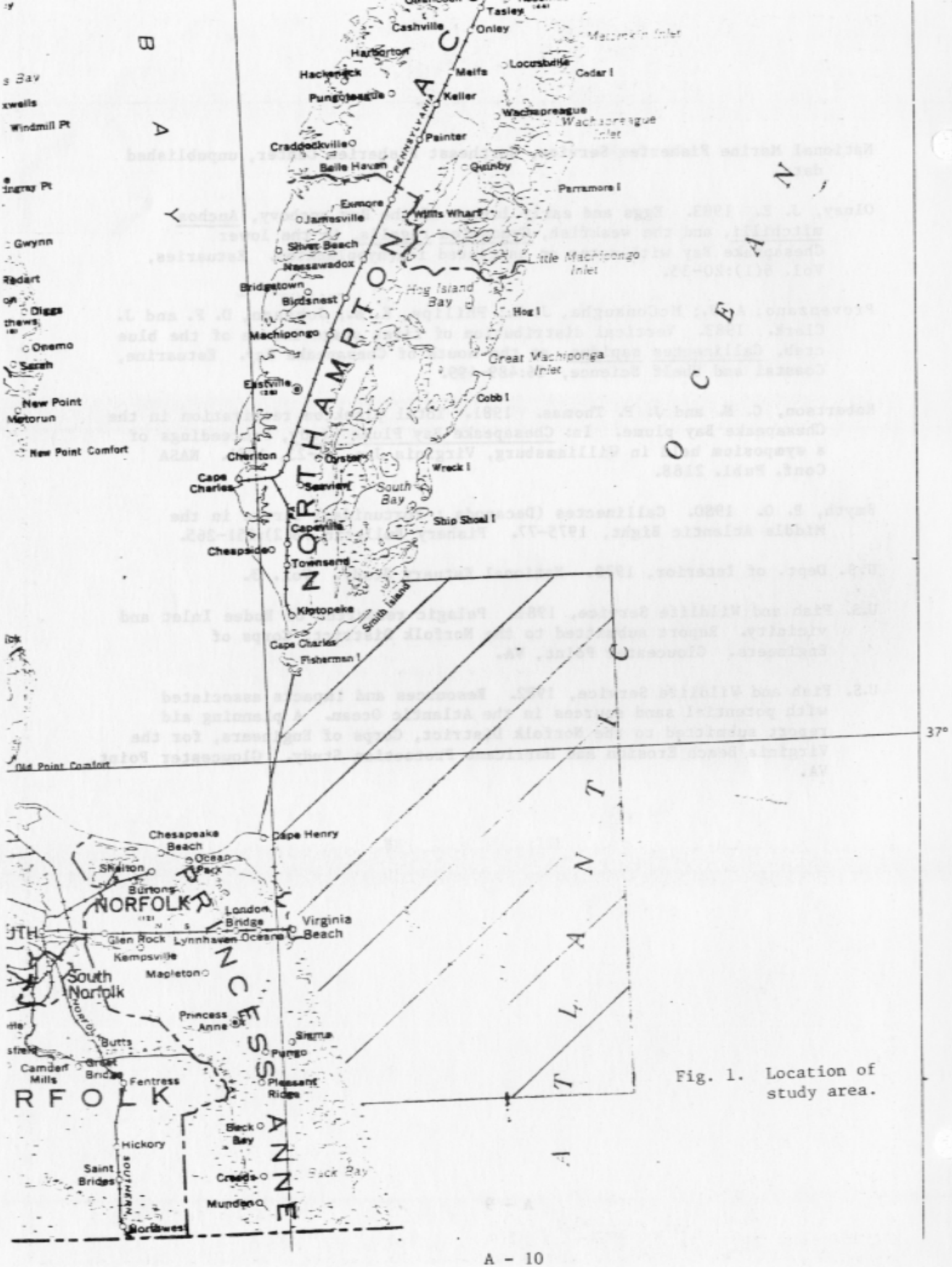
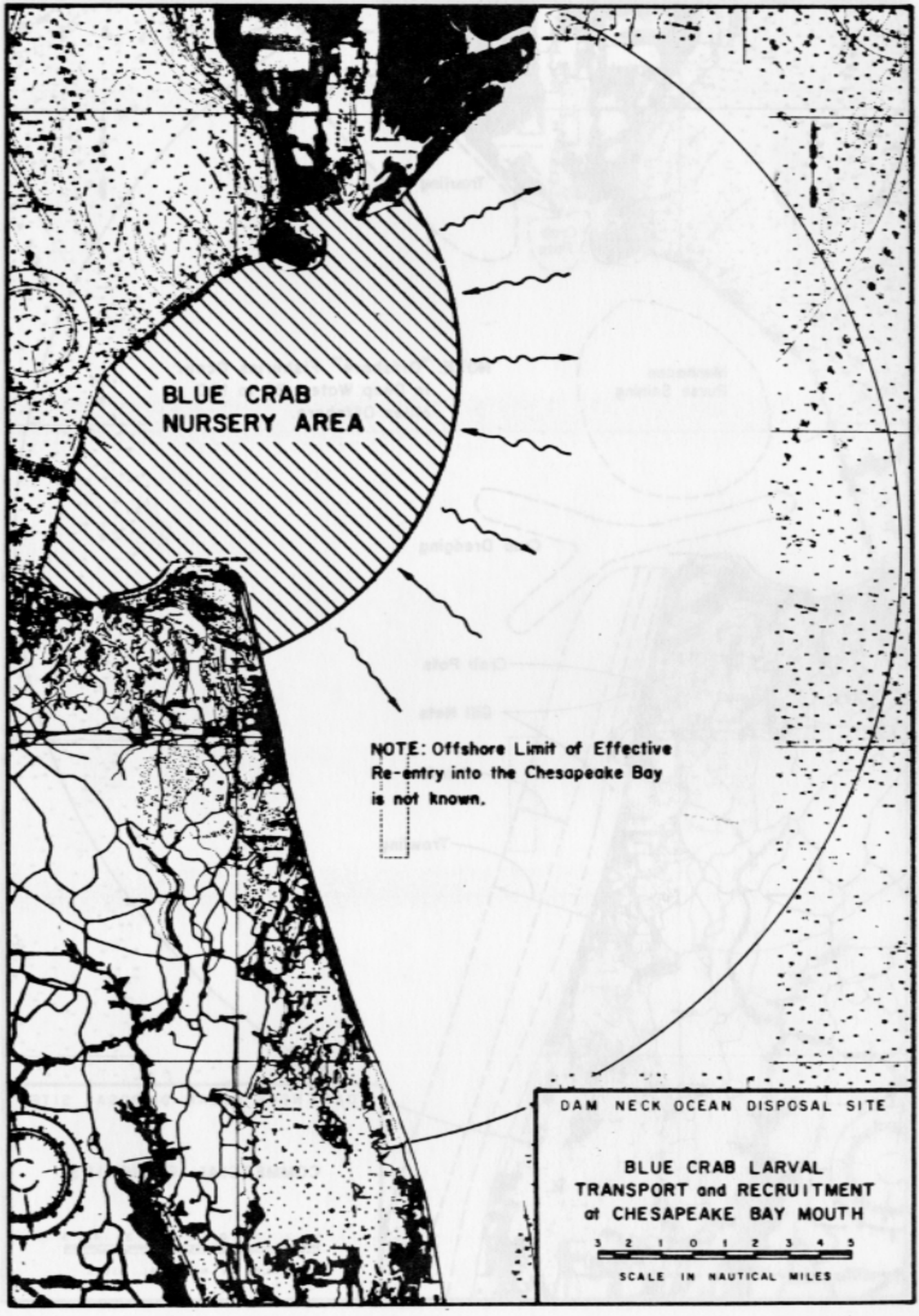
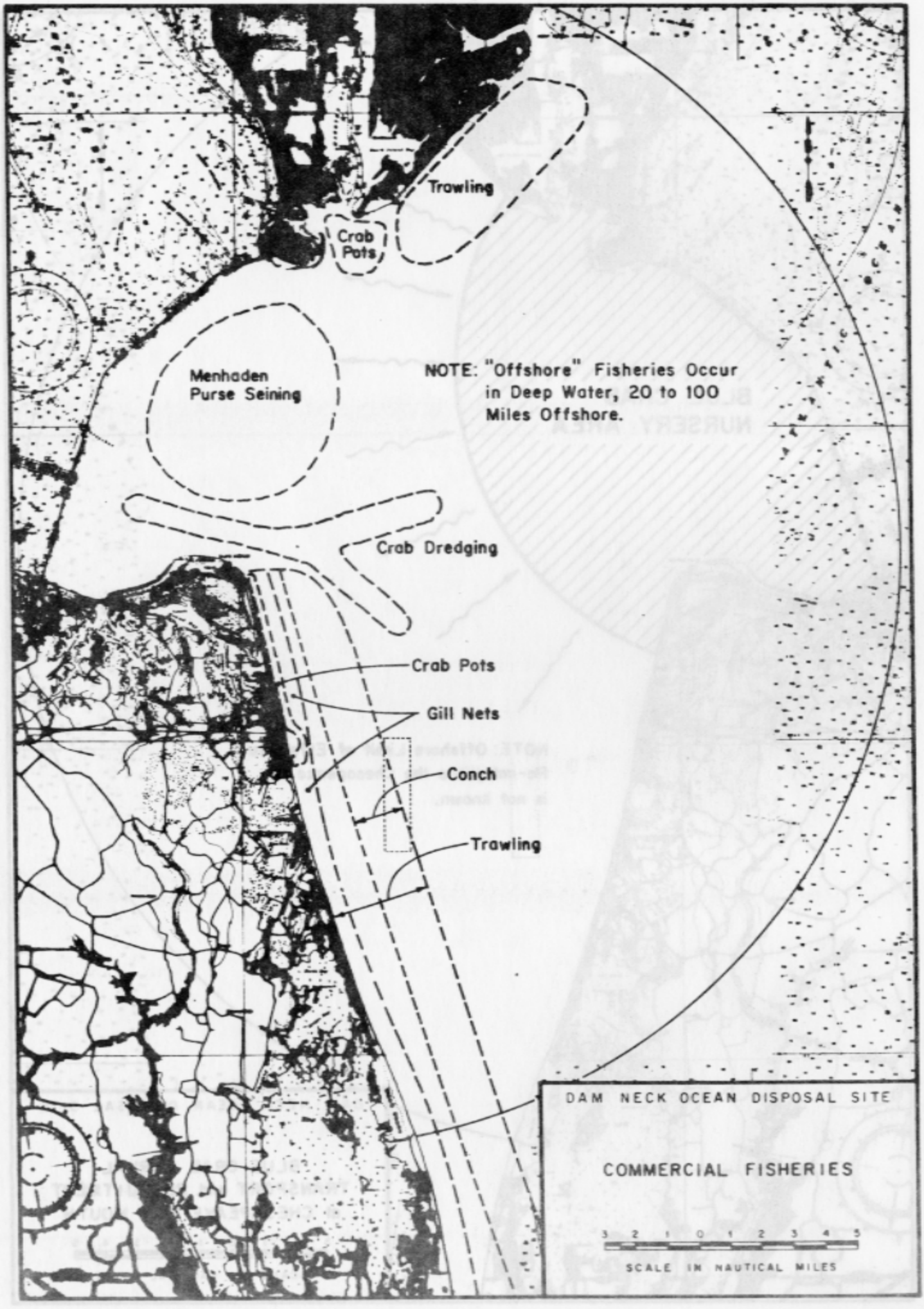



Fig. 1. Location of study area.


BLUE CRAB
NURSERY AREA
NOTE: Offshore Limit of Effective Re-entry into the Chesapeake Bay is not known.
DAM NECK OCEAN DISPOSAL SITE
BLUE CRAB LARVAL TRANSPORT and RECRUITMENT at CHESAPEAKE BAY MOUTH
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES


Trawling
Crab Pots
Menhaden Purse Seining
NOTE: "Offshore" Fisheries Occur in Deep Water, 20 to 100 Miles Offshore.
Crab Dredging
Crab Pots
Gill Nets
Conch
Trawling
DAM NECK OCEAN DISPOSAL SITE
COMMERCIAL FISHERIES
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES

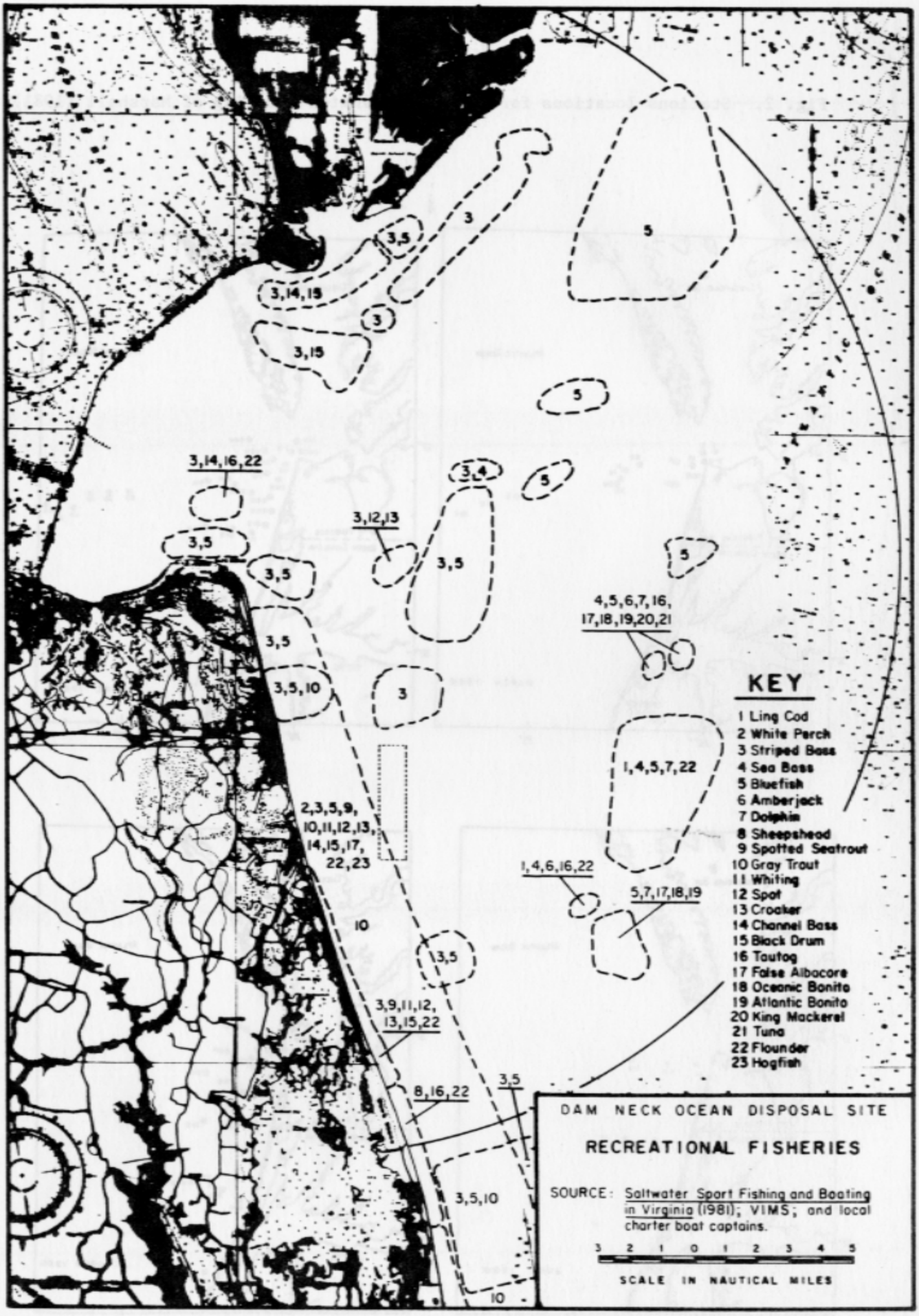

3,5
3
5
3,14,15
3
3,15
5
3,14,16,22
3,4
5
3,12,13
3,5
3,5
3,5
5
4,5,6,7,16,
17,18,19,20,21
3,5
3,5,10
3
1,4,5,7,22
2,3,5,9,
10,11,12,13,
14,15,17,
22,23
1,4,6,16,22
5,7,17,18,19
10
3,5
3,9,11,12,
13,15,22
8,16,22
3,5
3,5,10
10
KEY
1 Ling Cod
2 White Perch
3 Striped Bass
4 Sea Bass
5 Bluefish
6 Amberjack
7 Dolphin
8 Sheepshead
9 Spotted Seatrout
10 Gray Trout
11 Whiting
12 Spot
13 Croaker
14 Channel Bass
15 Black Drum
16 Tautog
17 False Albacore
18 Oceanic Bonito
19 Atlantic Bonito
20 King Mackerel
21 Tuna
22 Flounder
23 Hogfish
DAM NECK OCEAN DISPOSAL SITE
RECREATIONAL FISHERIES
SOURCE: Saltwater Sport Fishing and Boating in Virginia (1981); VIMS; and local charter boat captains.
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES

Fig. 2. Stations locations for the phytoplankton sampling of Marshall (1981).

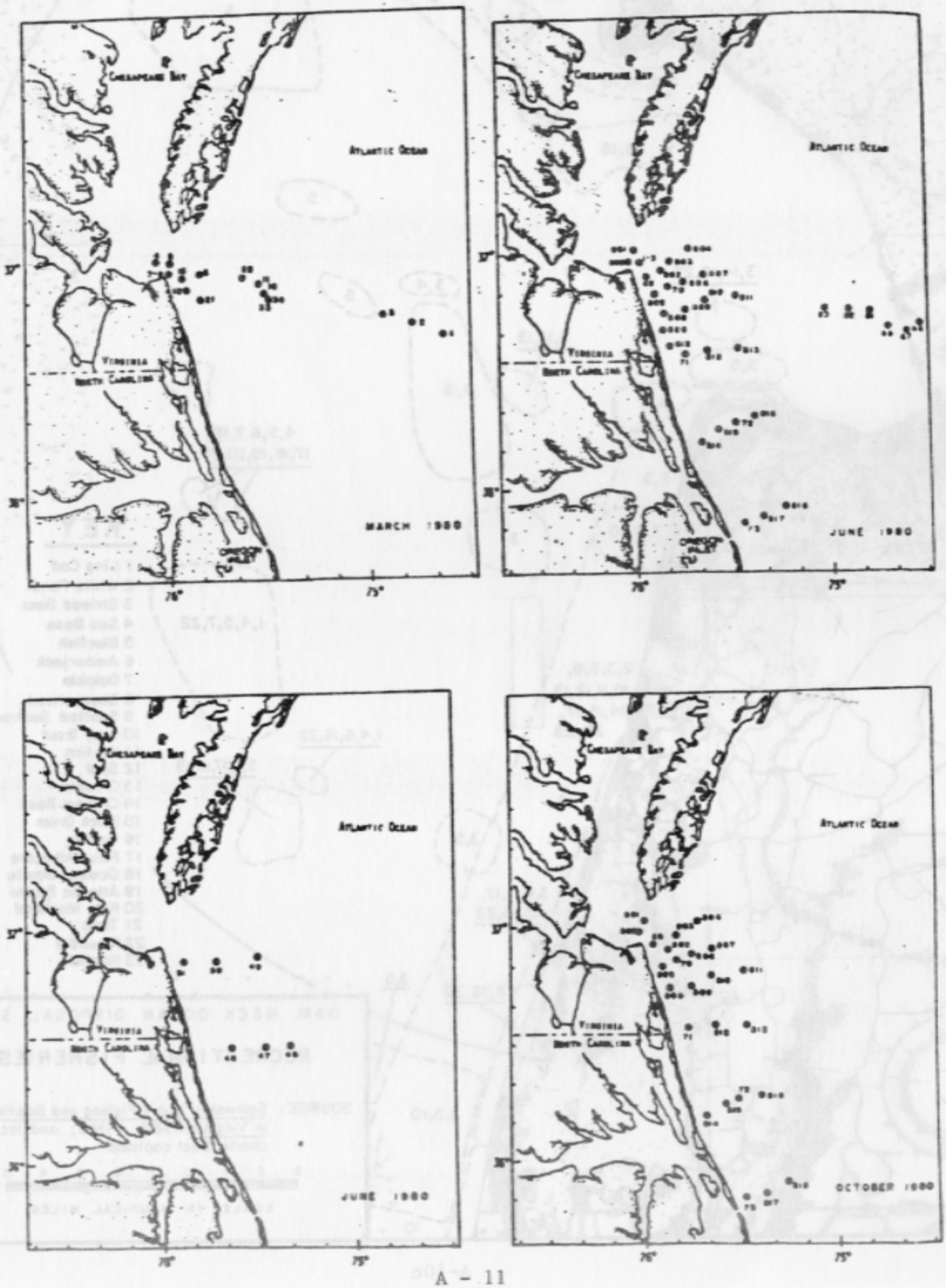


Fig. 3. Phytoplankton cell concentrations from Marshall (1981) within the Chesapeake Bay plum and adjacent shelf waters for March, June, and October 1980.

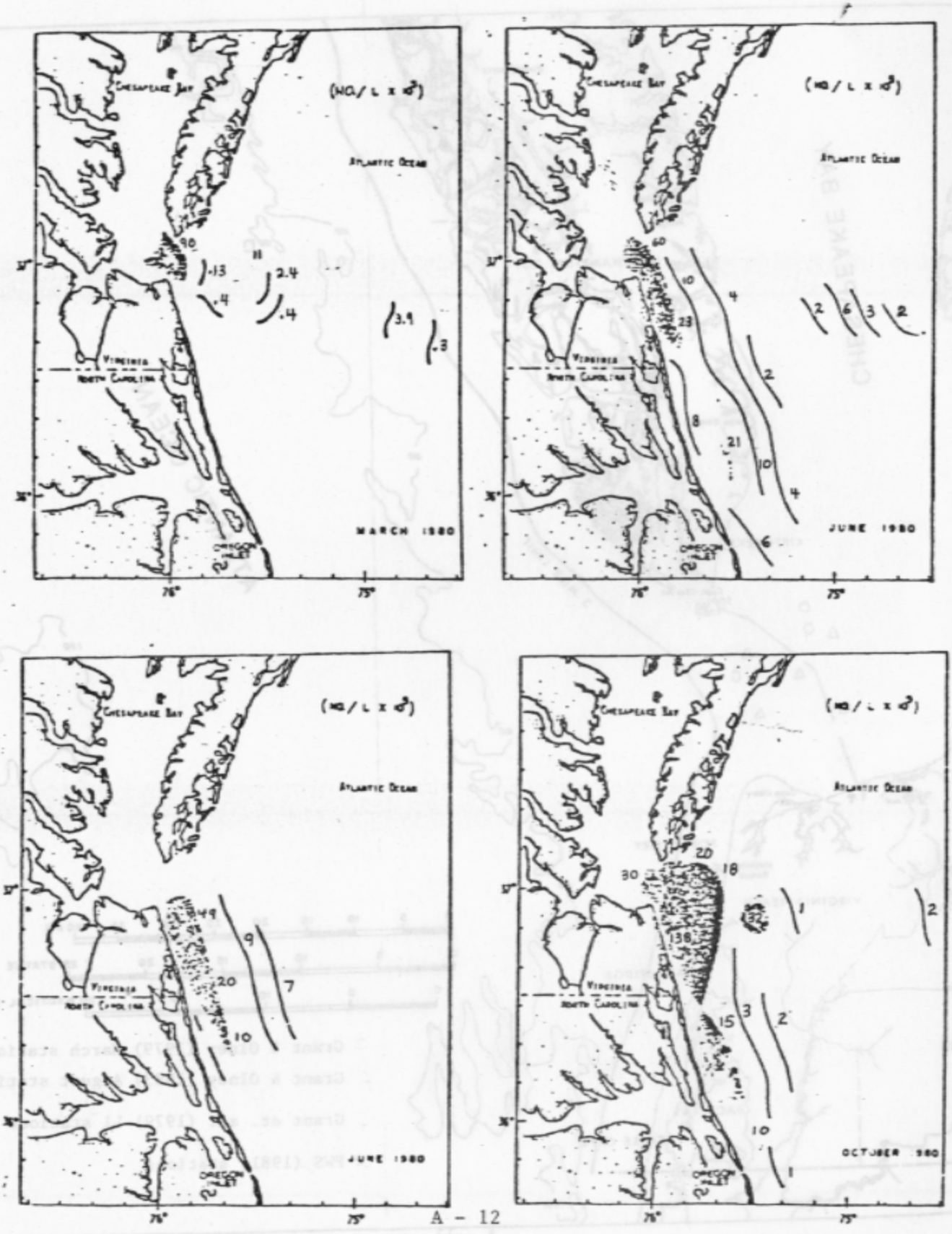


Fig. 4. Station locations for zooplankton collections.

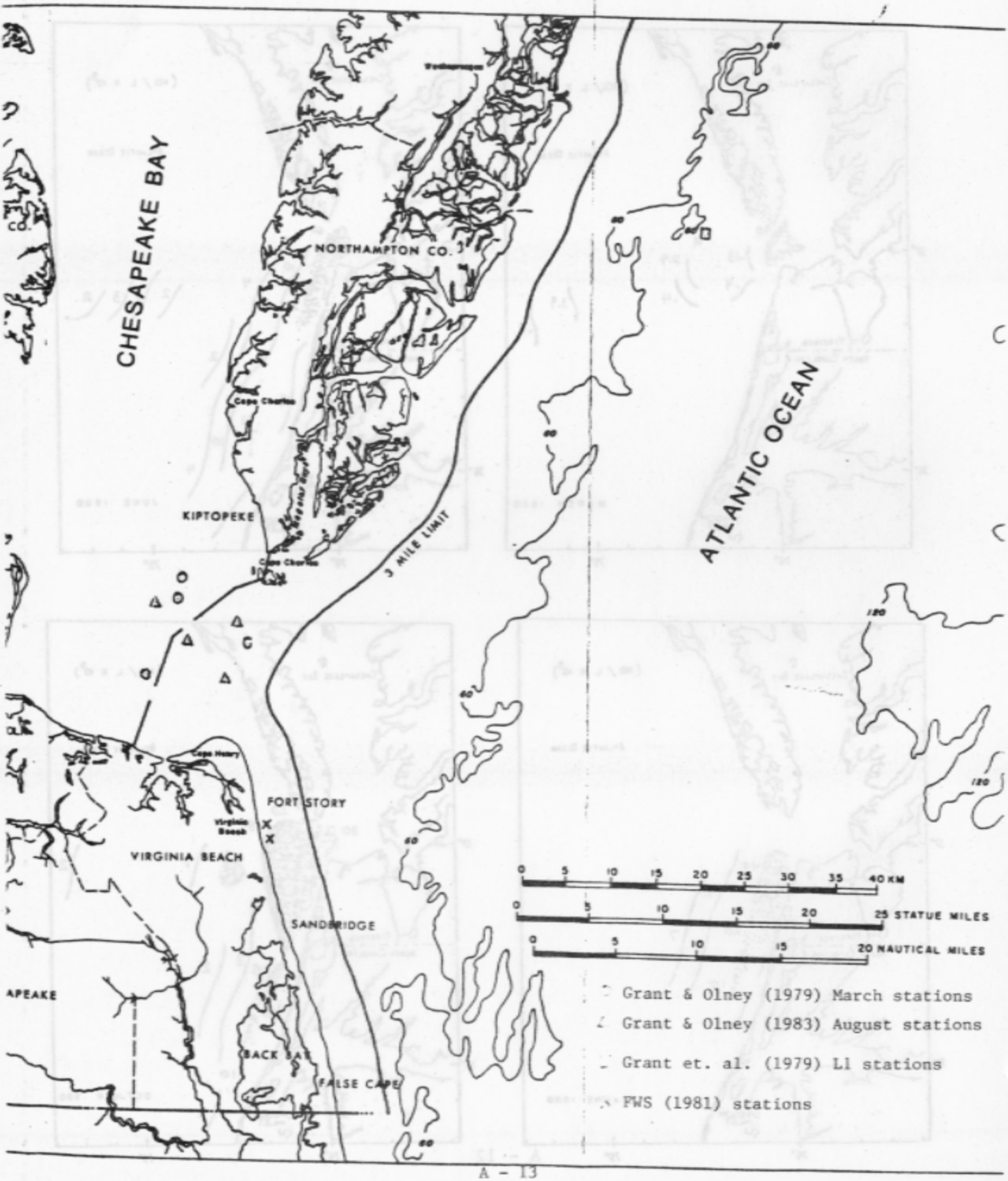
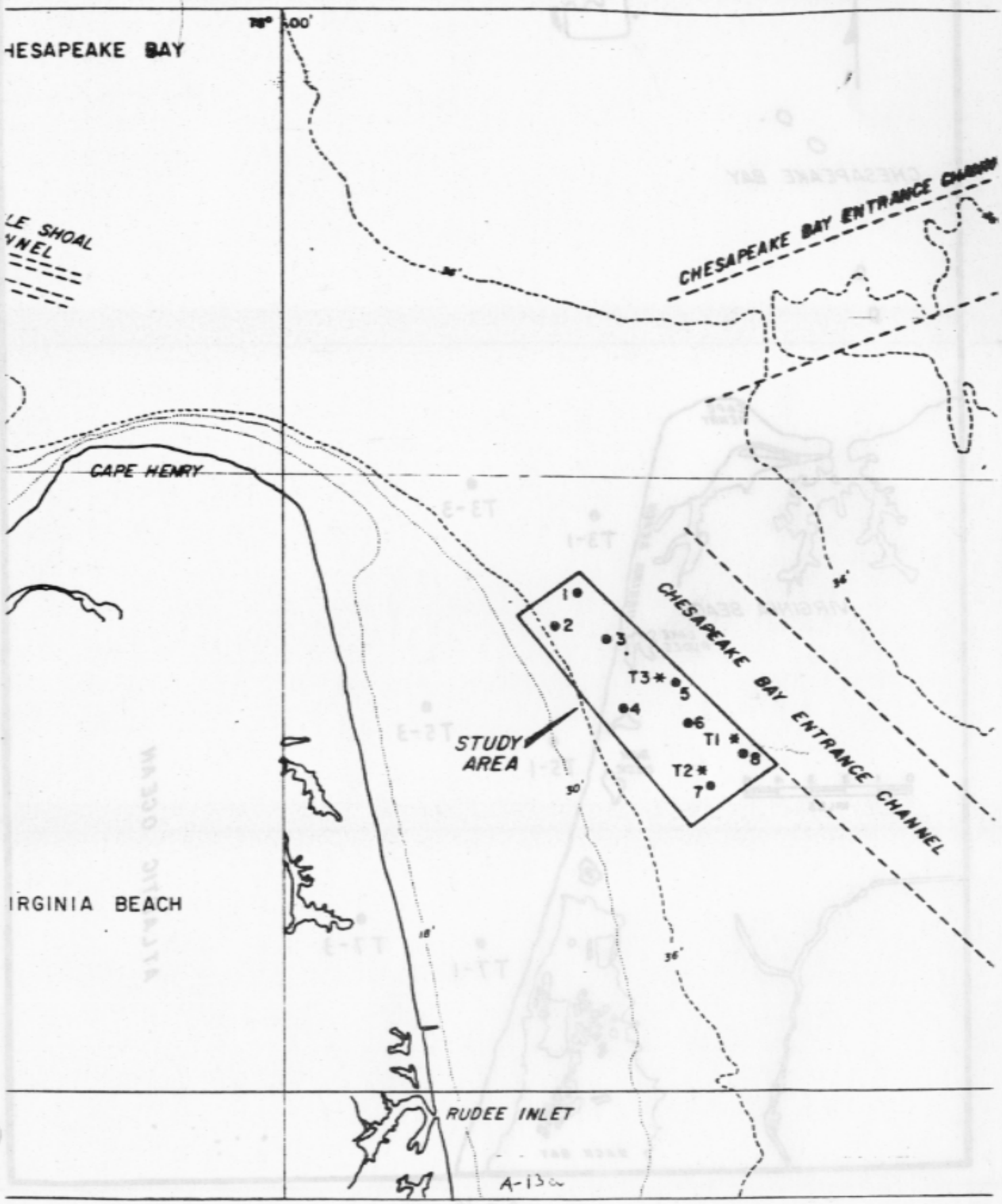


Fig. 5. Locations of benthic grab stations (●) and epifaunal trawl stations (✱) sampled by USFWS (1982).



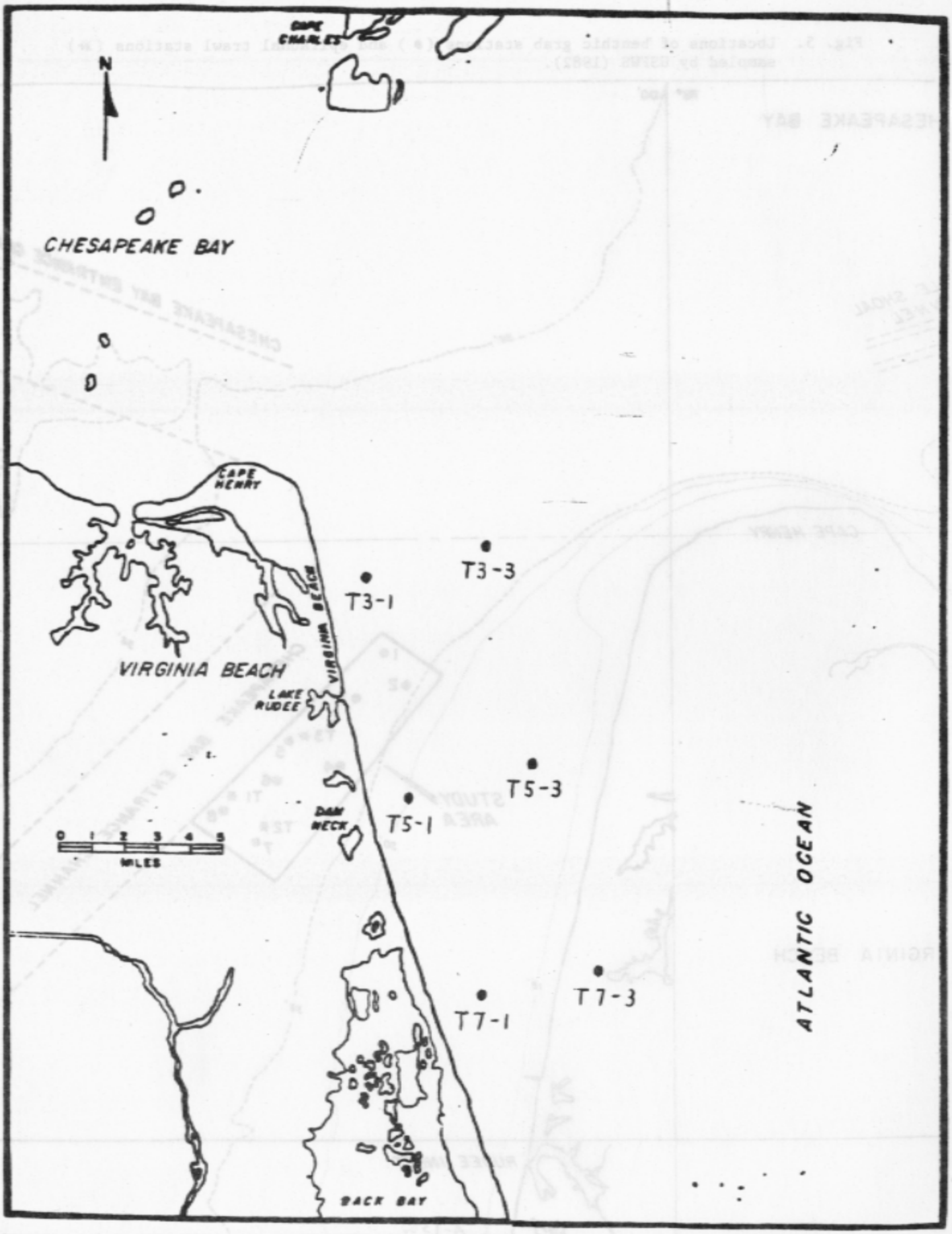

CAPE CHARLES
N
CHESAPEAKE BAY
CAPE HENRY
VIRGINIA BEACH
VIRGINIA BEACH
LAKE RUDEE
DAM NECK
0 1 2 3 4 5
MILES
T3-1
T3-3
T5-1
T5-3
T7-1
T7-3
ATLANTIC OCEAN
BACK BAY

Table 1. Phytoplankton assemblages found by Marshall (1981) within the Chesapeake Bay plume and adjacent shelf waters for March, June, and October 1980. Numerical dominance is indicated for each collection period.

| | Bay Entrance - Plume | Shelf |
|---|---|---|
| March | Asterionella glacialis | Bacteriastrum hyalinum |
| | Cyclotella sp. | Chaetoceros costatum |
| | Guinardia flaccida | Nitzschia longissima |
| | Leptocylindurs danicus | Rhizosolenia delicatula |
| | Leptocylindrus minimus | Thalassiosira nordenskioldii |
| | Nitzschia pungens | Thalassiorsira rotula |
| | Paralia sulcata | *Emiliania huxleyi |
| | Rhizosolenia delicatula | Green cells 5-10 microns |
| | Rhizosolenia fragilissima | |
| | *Skeletonema costatum | |
| | Thalassiosira nordenskioldi | |
| | Gomphosphaeria aponina | |
| | Nostoc commune | |
| | *Prorocentrum minimum | |
| | *Green cells <3 microns | |
| | *Green cells 3-5 microns | |
| June | Chaetoceros spp. | Rhizosolenia alata |
| | Cylindrotheca closterium | *Emiliania huxleyi |
| | Leptocylindrus danicus | Pontosphaera sp. |
| | Nitzschia pungens | Rhabdosphaera sp. |
| | Rhizosolenia delicatula | Syracosphaera pulchra |
| | *Skeletonema costatum | |
| | Green cells 3-5 microns | |
| October | *Asterionella glacialis | Nitzschia pungens |
| | Cerataulina pelagica | Rhizosolenia delicatula |
| | Cylindrotheca closterium | Rhizosolenia fragilissima |
| | Lauderia borealis | Skeletonema costatum |
| | Leptocylindrus danicus | *Emiliania huxleyi |
| | Nitzschia pungens | *Green cells <3 microns |
| | Rhizosolenia delicatula | *Green cells 3-5 microns |
| | *Skeletonema costatum | Mixed phytoflagellates |
| | *Emiliania hyxleyi | |
| | *Green cells <3 microns | |
| | *Green cells 3-5 microns | |
| | Anacystis sp. | |
| | Cryptomonas sp. | |

*Dominant phytoplankters

Table 2. Species and abundance of fish, decapods, and molluscs collected by U.S. Fish and Wildlife Service (1981) using oblique daylight plankton tows at two stations near the mouth of Rudee Inlet (Fig. 4).

| | Number/100m$^2$ | | | | | |
|---|---|---|---|---|---|---|
| | May | June | July | Aug | Oct | Jan |
| FISH | | | | | | |
| Ammodytes sp. | | | | | | 2 |
| Anchoa hepsetus eggs | | | | 42 | | |
| Anchoa mitchilli eggs | 11 | 1549 | 199 | 23 | | |
| Anchoa mitchilli | | 12 | 593 | | | |
| Anchoa sp. | | | | 3261 | | |
| Cynoscion regalis | | | | 204 | | |
| Etropus microstomus | | | 3 | | | |
| Gobiesox strumosus | | | | 2 | | |
| Gobiosoma sp. | | | | 4 | | |
| Leiostomus xanthurus | 2 | | | | | |
| Membras martinica | | 3 | | | | |
| Morone americanus | | 2 | | 31 | | |
| Peprilus sp. eggs | | | 77 | 106 | | |
| Pogonias cromis (?) | 30 | | | | | |
| Tautoga omitis eggs | 11 | | | | | |
| Trinectes maculatus eggs | | 16 | | 68 | | |
| Trinectes maculatus | | | 8 | | | |
| unid. Sciaenidae | | | 10 | | | |
| unid. Sciaenidae eggs | 6 | 199 | 63 | 142 | | |
| DECAPODS | | | | | | |
| Callianassa atlantica | | | 55 | 837 | 2 | |
| Callinectes sapidus | | 289 | 15 | 1973 | | |
| Cancer irrorata | 4 | 4 | | | | |
| Crangon septemspinosa | 15 | | | | | 10 |
| Emerita talpoida | | 5 | 6 | 5 | 1 | |
| Lucifer faxoni | | | | 20 | 52 | |
| Naushonia crangonoides | | | 5 | | | |
| Neopanope sayi | | 20 | 35 | 46 | | |
| Ogyrides limicola | | | | | 20 | |
| Ovalipes ocellatus | | | | | 2 | |
| Pagurus longicarpus | | | 3 | 33 | | |
| Palaemonetes sp. | 1 | 3 | | | | |
| Pinnixa sp. | | 3 | 185 | 134 | 2 | |
| Pinnotheres maculatus | | | 6 | | | |
| P. ostreum | | | | 5 | 38 | |
| Rhithropanopeus harrissi | | | | 284 | | |
| Sesarma sp. | | | 18 | 155 | | |
| Uca sp. | | 15 | 27 | 10 | | |
| Upogebia affinis | | 4 | 130 | 3476 | 5 | |

Table 2. (Cont.)

| | Number/100m$^2$ | | | | | |
|---|---|---|---|---|---|---|
| | May | June | July | Aug | Oct | Jan |
| MOLLUSCS | | | | | | |
| Acteon punctostriatus | | 28 | 1602 | 2 | | |
| Cerithiopsis (?) | | | | | 6 | |
| Littorina sp. | 6 | | | | | |
| Mulinia lateralis | | | | 7 | | |
| Mytilus edulis | 1 | | | | | |
| Nassarius vibex | | | 3 | 2 | | |
| Petricola pholadiformis | | | | 5 | | |
| Solen viridis | | | | 7 | | |
| Spiratella trochiformis | | | | 2 | | |
| unid. Turridae | | | 2 | | | |

Table 3. List of zooplankton identified by Grant and Olney (1979, 1983) from bongo (oblique) and neuston (surface) tows conducted during day and night periods at stations in the vicinity of the Bay Bridge Tunnel (Fig. 4).

| | March '79 | August '79 |
|---|---|---|
| COELENTERATA | | |
| Bougainvillea sp. | | x |
| Chrysaoura quinquecirrha | | x |
| Cunina octonoria | | x |
| Cyanea capillata | x | |
| Hydrocodon prolifer | x | |
| Liriope tetraphylla | | x |
| Muggiaea kochei | | x |
| Nemopsis bachei | | x |
| Obelia sp. | x | x |
| Ruthkea octopunctata | x | |
| CTENOPHORA | | |
| Pleurobrachia pileus | x | |
| NEMATODA | | |
| unid. nemotodes | x | |
| POLYCHAETA | | |
| Autolytus sp. | x | |
| Glycera dibranchiata | x | |
| Gyptis vittata | | x |
| Harmathoe sp. | x | x |
| Hesionidae | | x |
| Nereis succinea | | x |
| Paranaitis speciosa | x | |
| Paraprionospio pinnata | | x |
| Phyllodocidae | | x |
| Polydora sp. | x | x |
| Polynoidae | | x |
| Pseudeurythoe ambigua | | x |
| Spionidae larvae | x | x |
| Syllidae | | x |
| Terebellidae | | x |
| Tomopteris helgolandica | x | x |
| MOLLUSCA | | |
| Cerithiopsis sp. | | x |
| Crassostrea virginica | | x |
| Crepidula sp. | | x |
| Ensis directus | x | |
| Epitonium sp. | | x |
| Laevicardium mortoni | x | |
| Lilliguncula brevis | | x |

Table 3. (Cont.)

| | March '79 | August '79 |
|---|---|---|
| MOLLUSCA (cont.) | | |
| Limacina retroversa | x | |
| Littorina irrorata | x | x |
| Loligo pealeii | | x |
| Lyonsia hyalina | x | |
| Macoma balthica | x | |
| Mulina lateralis | x | x |
| Mytilus edulis | x | |
| Nassarius obsoletus | | x |
| N. vibex | | x |
| Naticidae | | x |
| Pholadidae | | x |
| Tellina agilis | x | x |
| MEROSTOMATA | | |
| Limulus polyphemus | | x |
| MYSIPACEA | | |
| Metamysidopsis mexicana | | x |
| Mysidopsis bigelowi | x | x |
| Neomysis americana | x | x |
| CUMACEA | | |
| Leptocuma minor | x | |
| Mancocuma sp. | x | x |
| Oxyurostylis smithi | x | x |
| ISAPODA | | |
| Aegathea medialis | | x |
| A. oculata | | x |
| Edotea triloba | x | |
| AMPHIPODA | | |
| Ampelisca abdita | x | x |
| A. agassizi | | x |
| A. vadorum | | x |
| Ampithoe longimana | | x |
| Atylus minidoi | | x |
| Batea catharinensis | | x |
| Caprella equilibra | x | |
| Corophium insidiosum | x | |
| C. lacustre | | x |
| Gammarus mucronatus | x | x |
| Idunella sp. | | x |
| Jassa falacata | x | x |
| Lestrigonus bengalensis | | x |
| Melita sp. | | x |
| Microprotopus raneyi | x | x |
| Monoculodes edwardsi | x | |

Table 3. (Cont.)

| | March '79 | August '79 |
|---|---|---|
| AMPHIPODA (cont.) | | |
| Paraplentes aestuarius | | x |
| Phoxocephalus spinosus | | x |
| Unciola irrorata | x | |
| CLADOCERA | | |
| Evadne nordmani | x | x |
| Penilia avirostris | | x |
| Podon polyphemoides | x | |
| COPEPODA | | |
| Acartia clausi | x | |
| A. tonsa | x | x |
| Caligus chelifer | | x |
| Centropages hamatus | x | x |
| C. typicus | x | x |
| C. velificatus | | x |
| Corycaeus speciosus | | x |
| Eucalanus crassus | | x |
| E. pileatus | x | x |
| Eurytemora affinis | x | |
| Hemicyclops sp. | x | |
| Labidocera aestiva | | x |
| Oithona sp. | x | x |
| Paracalanus crassirostris | x | x |
| P. indicus | | x |
| P. quosimoda | | x |
| Pseudocalanus sp. | x | |
| Pseudodiaptomus coronatus | | x |
| Temora longicornis | x | |
| CIRRIPEDIA | | |
| Balanus balanoides (?) | x | |
| Lepus sp. | x | |
| unid. barnacle larvae | | x |
| STOMATOPODA | | |
| Squilla empusa | | x |
| DECAPODA | | |
| Alpheus normanni | | x |
| Callianassa atlantica | | x |
| C. biformis | | x |
| Callinectes sp. | | x |
| Crangon septemspinosa | x | x |
| Euceramus praelongus | | x |
| Hexapanopeus angustifons | | x |
| Libinia emarginata | | x |
| L. dubia | | x |

Table 3. (Cont.)

| | March '79 | August '79 |
|---|---|---|
| DECAPODA (cont.) | | |
| Lucifer faxoni | | x |
| Naushonia crangonoides | | x |
| Neopanope sayi | | x |
| Ogyrides limicola | | x |
| Ovalipes occellatus | | x |
| O. stephensoni | | x |
| Pagurus longicarpus | | x |
| Palaemonetes sp. | | x |
| Panopeus herbstii | | x |
| Pinnixa chaetopterana | | x |
| P. cylindrica | | x |
| P. sayana | | x |
| Pinnotheres maculatus | | x |
| P. ostreum | | x |
| Portunus sp. | | |
| Uca sp. | | x |
| Upogebia affinis | | x |
| PHORONIDA | | |
| unid. phoronid larvae | x | |
| CHAETOGNATHA | | |
| Sagitta elegans | x | |
| S. enflata | | x |
| S. hispida | | x |
| S. tenuis | | x |
| TUNICATA | | |
| Oikopleura sp. | | x |
| PISCES | | |
| Ammodytes hexapterus | x | |
| Anchoa hepsetus | | x |
| A. mitchilli | x | |
| Anguilla rostrata | x | |
| Atherinidae | x | x |
| Centropristis striata | | x |
| Cynoscion nebulosus | | x |
| C. regalis | | x |
| Etropis microstomus | | x |
| Gadus morhua | x | |
| Gobiosoma sp. | | x |
| Hypsoblennius hentzi | | x |
| Menticirrhus sp. | | x |
| Peprilus paru | | x |
| P. trincanthus | | x |
| Prionotus sp. | | x |

Table 3. (Cont.)

| | March '79 | August '79 |
|---|---|---|
| PISCES (cont.) | | |
| Pseudopleuronectes americanus | x | |
| Rissola marginata | | x |
| Symphurus plagiusa | | x |
| Syngnathus fuscus | x | |
| Trinectes maculatus | | x |
| unid. ophidiid | | x |
| unid. pleuronectiform | | x |

Table 4. List of zooplankton identified by Grant et al (1979) from oblique and surface tows conducted during day and night periods at a coastal station off the eastern shore of Virginia (Fig. 4).

| | Fall '76 | Winter '77 | Spring '77 | Summer '77 |
|---|---|---|---|---|
| CNIDARIA | | | | |
| Abylopsis eschscholtzii | x | | | |
| Abylopsis tetragona | x | | | |
| Aequorea sp. | | | | x |
| Agalma elegans | x | | | |
| Bassia bassensis | x | | | |
| Catablema vesicarium | | | | x |
| Diphyes chamissoni | x | | | |
| Diphyes dispar | x | | | |
| Diphyopsis campanulifer | x | | | |
| Liriope sp. | x | | | x |
| Liriope tetraphylla | x | | | |
| Muggiaea kochei | x | | | |
| Obelia sp. | | | | x |
| Pelagia noctiluca | x | | | |
| Rhacostoma atlanticum | | | | x |
| unid. anthozoans | x | | | |
| unid. hydrozoans | | | | x |
| TURBELLARIA | | | | |
| unid. flatworms | x | | | x |
| ANNELIDA | | | | |
| Tomopteris helgolandica | | | | x |
| unid. polychaetes | x | x | x | x |
| MOLLUSCA | | | | |
| Atlanta peroni | x | | | x |
| Cavolina longirostris | x | | | |
| Cerastoderma pinnulatum | | x | | x |
| Creseis virgula | x | | | x |
| Ensis directus | | x | x | |
| Hyalocyclis striata | | | | x |
| Lima tenera | x | | | |
| Limacina retroversa | | | x | |
| Limacina trochiformis | x | | | x |
| Loligo pealii | x | | x | x |
| Lunatia triseriata | | | x | |
| Macoma balthica | | x | x | |
| Paedoclione doliiformis | | | x | x |
| Rossia tenera | | | | x |
| Spisula solidissima | x | x | x | |
| unid. gastropods | | | | x |

Table 4. (Cont.)

| | Fall '76 | Winter '77 | Spring '77 | Summer '77 |
|---|---|---|---|---|
| CLADOCERA | | | | |
| Evadne nordmanni | | | x | x |
| E. spinifera | | | | x |
| E. tergestina | x | | | x |
| Penilia avirostris | x | | | x |
| Podon sp. | | | | x |
| Podon leuckartii | | | x | |
| OSTRACODA | | | | |
| Conchoecia bispinosa | | x | | |
| Euconchoecia chierchine | x | | | |
| COPEPODA | | | | |
| Acartia sp. | | | | x |
| A. clausi | | | | x |
| A. danae | x | | | |
| A. tonsa | | | | x |
| Anomalocera sp. | | | x | |
| A. ornata | x | | x | |
| A. patersonii | | | x | |
| Calanus finmarchicus | | x | x | x |
| Candacia armata | x | | | x |
| Caligus chelifer | | | | x |
| Centropages furcatus | x | | | x |
| C. hamatus | | x | x | x |
| C. typicus | x | x | x | x |
| C. violacens | x | | | |
| Clausocalanus arevicornis | | x | | |
| Copilia mirabilis | | | | x |
| Corycaens sp. | x | x | x | x |
| C. lautus | | | | x |
| C. speciosus | x | | | x |
| Eucalanus sp. | x | x | | |
| E. crassus | x | | | x |
| E. pileatus | x | | | x |
| Euchaeta marina | | x | | |
| Eurytemora sp. | | | | x |
| E. americana | x | | | |
| Labidocera sp. | x | | | x |
| L. aestiva | x | | | x |
| Mecynocera clausi | x | | | |
| Metridia lecens | x | x | | |
| Nannocalanus minor | x | | | x |
| Oithona sp. | x | | x | x |
| Oncaea conifera | x | | | |
| O. mediterranea | x | | | |
| O. venusta | x | | | |
| Paracalanus sp. | x | x | x | |

Table 4. (Cont.)

| | Fall '76 | Winter '77 | Spring '77 | Summer '77 |
|---|---|---|---|---|
| COPEPODA (cont.) | | | | |
| P. parvus | x | | | |
| Pleuromamma gracilis | x | x | | |
| Pontella sp. | x | | | x |
| P. meadii | x | | | x |
| Pontellopsis villosa | x | | | |
| Pseudocalanus sp. | | | x | x |
| Rhincalanus nasutus | x | x | | |
| Sapphirina sp. | x | | x | |
| S. nigromaculata | x | | | x |
| Scolecithrix danae | x | | | |
| Temora sp. | | | x | |
| T. longicornis | | | x | x |
| T. stylifera | x | | | x |
| T. turbinata | x | | x | |
| Tortanus discaudatus | | | x | x |
| Undinula vulgaris | x | | | |
| CIRRIPEDIA | | | | |
| Chthamalus fragilis | | x | | x |
| unid. barnacle larvae | | | x | x |
| STOMATOPODA | | | | |
| unid. stomatopod larvae | x | | x | x |
| MYSIDACEA | | | | |
| Bowmaniella sp. | x | | | x |
| Heteromysis formosa | | x | x | |
| Mysidopsis bigelowi | x | x | x | |
| Neomysis americana | | x | | |
| Promysis atlantica | x | | | |
| CUMACEA | | | | |
| Cyclaspis sp. | | | x | x |
| Leptocuma minor | | x | x | x |
| Leucon americanus | x | | x | x |
| Oxyurostylis smithi | x | | x | x |
| ISOPODA | | | | |
| Chiridotea tuftsi | | | x | x |
| Edotea triloba | | | | x |
| Idotea balthica | | | | x |
| I. metallica | x | | x | |

Table 4. (Cont.)

| | Fall '76 | Winter '77 | Spring '77 | Summer '77 |
|---|---|---|---|---|
| AMPHIPODA | | | | |
| Acanthostepheia sp. | | | x | |
| Ampelisca agassizi | | | x | |
| A. verrilli | | | | x |
| Ampithoe longimana | | | | x |
| Argissa hamatipes | | | x | x |
| Byblis serrata | | | x | |
| Corophium acheruscium | | | x | |
| Gammarus sp. | | | x | |
| Lestrigonus sp. | | | | x |
| L. bengalensis | x | | | x |
| Lycaea sp. | | | | x |
| Lycaeopsis neglecta | x | | | |
| Microprotopus raneyi | | | | x |
| Monoculodes sp. | | x | x | |
| Parametopella cypris | | | x | |
| Parathemisto gandichandii | x | x | | |
| Protohaustorius wigleyi | | | x | |
| Syncholidium americanum | | | | x |
| Themistella fusca | x | | | x |
| Trichophoxus epistomus | | | | x |
| Unciola irrorata | | | | x |
| unid. gammarids | | x | | |
| unid. caprellids | x | | | |
| unid. hyperiids | | | | x |
| EUPHAUSIACEA | | | | |
| Euphausia sp. | x | | | |
| Thysanoessa sp. | x | x | | |
| unid. euphausiids | x | x | | |
| DECAPODA | | | | |
| Arenaens sp. | | | | x |
| Callianassa sp. | x | | | |
| Callinectes sp. | x | | | x |
| Cancer sp. | x | | x | |
| Crangon septemspinosa | x | x | x | x |
| Dichelopandalus leptocerus | | | x | |
| Dromida antillensis | x | | | |
| Emerita sp. | | | | x |
| Hexapanopeus augustifrons | | | | x |
| Homarus americanus | | | x | |
| Leptochela sp. | x | | | |
| Libinia sp. | x | | | |
| Lucifer faxoni | x | | | x |
| Naushonia crangonoides | | | | x |
| Ocypode quadrata | | | | x |
| Ovalipes sp. | x | | | |

Table 4. (Cont.)

| | Fall '76 | Winter '77 | Spring '77 | Summer '77 |
|---|---|---|---|---|
| DECAPODA (cont.) | | | | |
| Portunus sp. | x | | | x |
| Processa sp. | x | | | |
| Sergestes sp. | x | | | |
| Uca sp. | | | | x |
| Upogebia affinis | | | | x |
| unid. calappids | | | x | |
| unid. hippolytids | | | | x |
| unid. leucosiids | x | | | |
| unid. pagurids | x | | | x |
| unid. palaemonids | | | | x |
| unid. penaeids | | | | x |
| unid. xanthids | x | | | |
| ECHINODERMATA | | | | |
| unid. asteroids | x | | | |
| unid. ophinroids | x | | | |
| CHAETOGNATHA | | | | |
| Sagitta elegans | | x | x | x |
| S. enflata | x | | | x |
| S. helenae | x | | | |
| S. hispida | x | | | x |
| S. minima | x | | | |
| S. serratodentata | x | | | |
| S. tasnanica | x | x | | |
| S. tenuis | x | | | x |
| TUNICATA | | | | |
| Doliolum sp. | | | | x |
| D. nationalis | x | | | x |
| Oikopleura sp. | x | | | x |
| PISCES | | | | |
| Ammodytes sp. | | x | x | |
| Anchoa sp. | x | | | x |
| Astroscopus guttatus | x | | | x |
| Bothus sp. | x | | | |
| Citharichthys arctifrons | | | | x |
| Conger oceanicus | | | x | |
| Cynoscion regalis | x | | | |
| Enchelyopus cimbrius | | | x | |
| Etropus microstomus | | | | x |
| Gasterosteus aculeatus | | | x | |
| Gobiosoma ginsburgi | x | | x | x |
| Hypsoblennius hentzi | | | | x |
| Limanda ferruginea | | | x | |
| Lophius americanus | | | x | |

Table 4. (Cont.)

| | Fall '76 | Winter '77 | Spring '77 | Summer '77 |
|---|---|---|---|---|
| PISCES (cont.) | | | | |
| Menidia minidia | | x | | |
| Merluccius sp. | x | | | |
| Paralichthys dentatus | x | | | x |
| Peprilus triacanthus | | | | x |
| Pomatomus saltatrix | | | x | x |
| Scophthalmus aquosus | x | | x | x |
| Symphurus sp. | | | | x |
| Tylosurus acus | | | | x |
| Urophycis sp. | x | | x | |
| unid. engraulids | x | | | |
| unid. ophidiids | | | | x |
| unid. scorpaenids | | | | x |

**Table 5.** Macrobenthic species sampled with Shipek grab by FWS (1982) and the stations (see Fig. 4) at which they occurred.

| Taxa | Common Name | Stations Where Collected |
|---|---|---|
| CNIDARIA | | |
| Anthozoa (unidentified) | anemone | 1 2 6 |
| PLATYHELMINTHES | | |
| Turbellaria (unidentified) | flatworm | 8 |
| NEMERTEA | | |
| unidentified Nemertean | nemertean worm | 1 2 3 4 5 6 7 8 |
| PHORONIDA | | |
| Phoronis sp. | phoronid worm | 2 3 4 7 8 |
| MOLLUSCA | | |
| Gastropoda | | |
| Crepidula fornicata | slipper shell | 5 8 |
| Mitrella lunata | lunar mitrella | 1 2 4 |
| Nassarius trivittatus | mud snail | 1 3 8 |
| Natica pusilla | moon shell | 3 |
| Retusa candea | lathe shell | 2 |
| Turbonilla interrupta | pyramid shell | 2 4 5 7 |
| Pelecypoda | | |
| Anadara transversa | transverse ark shell | 1 |
| Ensis directus | razor clam | 1 2 3 4 5 6 7 8 |
| Gemma gemma | gem shell | 8 |
| Lyonsia hyalina | transparent lyonsia | 7 8 |
| Mulinia lateralis | little surf clam | 2 |
| Mytilus edulis | blue mussel | 1 2 3 4 5 6 |
| Nucula proxima | nut shell | 2 5 6 8 |
| Siliqua costata | ribbed pod shell | 7 |
| Spisula solidissima | surf clam | 1 4 5 6 7 8 |
| Tellina agilis | tellin shell | 1 2 3 4 5 6 7 8 |
| Yoldia limatula | | 2 3 4 |
| ANNELIDA | | |
| Polychaeta | | |
| Ampharete acutifrons | | 1 2 3 4 5 6 7 8 |
| Amparete americana | | 2 3 5 6 8 |
| Ampharetidae sp. (juvenile) | | 1 2 3 4 5 |
| Amastigos caperatus | | 1 2 3 4 5 6 7 8 |
| Ancistrosyllis hartmanae | | 1 5 6 8 |
| Aproprionospio pygmaea | | 7 8 |
| Aricidia catherinae | | 1 5 6 7 8 |
| Aricidia wassi | | 5 7 |
| Asabellides oculata | | 6 |
| Capitella capitata | | 1 2 3 4 |
| Capitella sp. (juvenile) | | |
| Cirratulidae spp. | | 1 2 3 4 5 6 7 8 |

Table 5. (Cont.)

| Taxa | Common Name | Stations Where Collected |
|---|---|---|
| ANNELIDA, cont'd. | | |
| Polychaeta | | |
| Cirrophorus furcatus | | 1 2 4 5 6 8 |
| Clymenella torquata | bamboo worm | 3 4 7 8 |
| Diopatra cuprea | | 1 2 |
| Dorvilleidae sp. (juvenile) | | 6 7 |
| Eteone heteropoda | | 1 2 6 |
| Eteone lactea | | 1 5 6 7 8 |
| Eumida sanguinea | | 4 |
| Glycera americana | bloodworm | 1 2 3 4 5 6 7 8 |
| Glycera dibranchiata. | bloodworm | 1 3 4 5 6 7 8 |
| Glycera sp. (juvenile) | bloodworm | 1 2 3 4 6 7 |
| Goniadella gracilis | | 2 3 |
| Harmothoe extenuata | | 1 2 3 4 8 |
| Hemipodus roseus | | 8 |
| Linopherus ambigua | | 6 |
| Lumbrineris tenuis | | 5 6 8 |
| Macroclymene zonalis | | 4 5 6 8 |
| Magelona sp. | | 1 2 3 4 5 6 7 8 |
| Maldanidae sp. (juvenile) | | 1 4 7 8 |
| Mediomastus ambiseta | | 1 2 3 4 5 6 7 8 |
| Microphthalmus sczelkowii | | 6 |
| Nephtys picta | | 2 3 4 5 6 7 |
| Nereidae sp. (juvenile) | clam worm | 1 |
| Nereis succinea | clam worm | 1 |
| Notomastus hemipodus | | 4 7 8 |
| Ophelia sp. | | 6 |
| Owenia fusiformis | | 8 |
| Paleonotus heteroseta | | 3 |
| Paranaitis speciosa | | 3 4 8 |
| Phyllodoce arenae | paddle worm | 2 3 4 5 6 7 8 |
| Phyllodoce sp. (juvenile) | paddle worm | 7 |
| Phyllodocidiae sp. (juvenile) | paddle worm | 3 |
| Pista cristata | | 2 |
| Polydora websteri | | 2 4 8 |
| Polydora sp. (juvenile) | | 1 2 3 4 5 7 |
| Polygordius sp. | | 1 2 3 4 5 6 7 8 |
| Protodorvillae kefersteini | | 1 4 5 6 |
| Sabellaria vulgaris | sand builder worm | 1 |
| Scalibregma inflatum | | 6 8 |
| Schistomeringos caeca | | 1 4 5 6 7 8 |
| Schistomeringos rudolfi | | 1 5 6 |
| Scolelepis sp. | | 4 7 |
| Scoloplos robustus | | 1 4 7 8 |
| Scoloplos sp. (juvenile) | | 1 6 |
| Sigambra tentaculata | | 2 3 6 |
| Spio setosa | | 1 2 3 4 5 6 7 8 |

Table 5. (Cont.)

| Taxa | Common Name | Stations Where Collected |
|---|---|---|
| ANNELIDA, Cont'd. | | |
| Polychaeta | | |
| *Spiochaetopterus oculatus* | | 2 |
| *Spiophanes bombyx* | | 1 2 3 4 5 6 7 8 |
| *Streblospio benedicti* | | 2 3 4 5 7 8 |
| Syllidae spp. | | 1 2 4 5 6 8 |
| Oligochaeta | | |
| Oligochaeta spp. | oligochaete worms | 1 2 3 4 5 6 7 8 |
| ARTHROPODA | | |
| Crustacea | | |
| Cumacea | | |
| *Oxyurostylis smithi* | | 5 6 7 8 |
| Isopoda | | |
| *Edotea* sp. | | 1 4 6 7 8 |
| Amphipoda | | |
| *Ampelisca verrilli* | | 7 |
| *Corophium* spp. | | 1 2 3 |
| *Synchelidium americanum* | | 1 |
| *Unciola irrorata* | | 2 3 4 5 6 7 8 |
| *Unciola serrata* | | 6 |
| *Unciola* sp. | | 3 5 |
| Decapoda | | |
| *Pagurus* sp. | hermit crab | 5 |
| *Pinnixa* sp. | commensal crab | 2 5 7 |
| ECHINODERMATA | | |
| Echinoidea sp. | sand dollar | 1 2 5 6 7 8 |
| CEPHALOCHORDATA | | |
| *Branchiostoma virginiae* | lancelet | 1 4 5 6 7 8 |

Table 6. Epibenthic species sampled with otter trawl by FWS (1982) and the stations (see Fig. 4) at which they occurred.

| Taxa | Common Name | Stations Where Collected | | |
|---|---|---|---|---|
| MOLLUSCA | | | | |
| Gastropoda | | | | |
| *Busycon canaliculatum* | channeled whelk | | T2 | |
| *Crepidula fornicata* | slipper shell | T1 | | |
| *Nassarius trivittatus* | mud snail | | T2 | |
| Pelecypoda | | | | |
| *Mytilus edulis* | blue mussel | | T2 | T3 |
| Cephalopoda | | | | |
| *Loligo pealei* | common squid | T1 | | T3 |
| *Lolliguncula brevis* | brief squid | | T2 | |
| ARTHROPODA | | | | |
| Merostomata | | | | |
| *Limulus polyphemus* | horseshoe crab | | T2 | |
| Crustacea | | | | |
| *Callinectes sapidus* | blue crab | | | T3 |
| *Cancer irroratus* | rock crab | T1 | T2 | T3 |
| *Libinia emarginata* | spider crab | | T2 | |
| *Pagurus longicarpus* | hermit crab | T1 | T2 | T3 |
| *Pagurus pollicaris* | hermit crab | T1 | | |
| *Panopeus herbstii* | mud crab | | | T3 |
| ECHINODERMATA | | | | |
| Echinoidea | | | | |
| *Asterias forbesi* | common starfish | | T2 | |
| CHORDATA | | | | |
| Pisces | | | | |
| Carangidae sp. | scad | | | T3 |
| *Centropristes striata* | black sea bass | | T2 | T3 |
| *Cottus* sp. | sculpin | T1 | T2 | T3 |
| *Etropus microstomus* | smallmouth flounder | T1 | | T3 |
| *Prionotus carolinus* | searobin | T1 | | T3 |
| *Raja eglanteria* | clearnose skate | T1 | T2 | T3 |
| *Scophthalmus aquosus* | windowpane | | T2 | |
| *Stenotomus chrysops* | southern scup | T1 | T2 | |
| *Urophycis regia* | spotted hake | T1 | T2 | T3 |

Table 7. List of benthic species reported by Hydroscience, Inc. (1974) and the stations at which they occurred (see Fig. 5).

| TAXA | Stations T3-1 | T3-3 | T5-1 | T5-3 | T7-1 | T7-3 |
|---|---|---|---|---|---|---|
| CNIDARIA | | | | | | |
| Halcampoides sp. | x | | | | | |
| Hydractinia sp. | | | | x | | |
| Lovenella gracilis | | x | | | | |
| NEMERTEA | | | | | | |
| unid. nemertean | | | x | x | | x |
| NEMATODA | | | | | | |
| unid. nematode | | x | x | x | | |
| BRYZOA | | | | | | |
| Electra sp. | | | | x | | |
| POLYCHAETA | | | | | | |
| Ampharete acutifrons | | | | x | x | |
| Amphicteis gunneri | | | | | | x |
| Aricidea cerruti | x | x | | | x | x |
| Branchiostoma caribeaum | | | | | x | x |
| Brania dispar | | | | | | x |
| Ceratonereis irritabilis | | | | x | | |
| Diopatra cuprea | | | | x | | |
| Drilonereis filum | x | x | x | x | | |
| D. magna | | | | | x | |
| Exogone setosa | | | | | | x |
| Glycera dibranchiata | x | x | x | x | x | |
| Heteromastus filiformis | | | | x | | |
| Lepidonotus sublevis | | | | x | | |
| Loimia medusa | | | | x | | |
| Magelona rosea | x | | x | | | |
| Nephtys magellanica | x | | | | | |
| N. picta | | x | | | x | |
| Nereis succinea | | | | x | | |
| Notomostus sp. | x | x | x | | x | x |
| Odontosyllis fulgurans | | | | | x | x |
| Owenia fusiformis | x | | x | | | x |
| Paraonis fulgons | | x | | | | |
| Phyllodoce mucosa | | | | x | | |
| Phylo felix | | | | | x | |
| Polycirrus eximins | | | | x | x | |
| Polydora sp. | | | | | x | |
| P. socialis | | | | x | | |
| Polygordius sp. | | x | | x | x | x |
| Prionospio cirrifera | | | | x | | |
| P. dayi | | | x | | | |

Table 7. (Cont.)

| TAXA | Stations T3-1 | T3-3 | T5-1 | T5-3 | T7-1 | T7-3 |
|---|---|---|---|---|---|---|
| POLYCHAETA (cont.) | | | | | | |
| Sabellaria vulgaris | | x | | x | x | |
| Scolecolepides viridis | | | | | | x |
| Scoloplos fragilis | x | | | | | |
| Sigalion arenicola | | | | | x | x |
| Spio setosa | | | | | x | x |
| Spiochaetopterus oculatus | | | | x | | |
| Spiophanes bombyx | x | x | x | | | |
| Tharyx marioni | | | x | x | x | x |
| Tharyx setigera | x | | | | | |
| Travisia parva | | | | | x | x |
| OLIGOCHAETA | | | | | | |
| unid. oligochaetes | x | x | | x | x | |
| GASTROPODA | | | | | | |
| Acteocina canaliculata | | | x | | | |
| Clione sp. | | x | | | x | |
| Crepidula convexa | | x | | x | x | |
| Cylichna alba | | | x | | | |
| Doridella obscura | | | | x | | |
| Mitrella lunata | | | | x | | |
| Polinices duplicatus | | | | | x | |
| Turbonilla interrupta | | | x | | | |
| BIVALVIA | | | | | | |
| Abra aequalis | x | x | x | x | x | x |
| Amygdalum papyria | | | x | | | |
| Mercenaria sp. | x | | | | | |
| Mercenaria mercenaria | | | x | | | |
| Modiolus sp. | | | | x | | |
| Nucula proxima | | x | | x | x | |
| Pandora trilineata | | x | | | x | |
| Spisula solidissima | | x | | | x | |
| Tellina virsicolor | x | | x | x | x | x |
| CIRRIPEDIA | | | | | | |
| unid. barnacles | x | | | | | |
| STOMATOPODA | | | | | | |
| Squilla empusa | | | | | x | |
| CUMACEA | | | | | | |
| Oxyurostylis smithi | x | | x | | x | |
| ISOPODA | | | | | | |
| Edotea triloba | | | x | | | |

Table 7. (Cont.)

| TAXA | Stations T3-1 | T3-3 | T5-1 | T5-3 | T7-1 | T7-3 |
|---|---|---|---|---|---|---|
| AMPHIPODA | | | | | | |
| Ampelisca verrilli | | | | x | | |
| Corophium acherusicum | | | | x | | |
| Erichthonius brasiliensis | | | | x | | |
| Photis sp. | | | | x | | |
| Protohaustorius wigleyi | | | | | | x |
| Stenothoe minuta | | | | x | | |
| Trichophoxus epistomus | x | x | | x | | |
| Unciola irrorata | | | | x | x | |
| MYSIDACEA | | | | | | |
| Neomysis americanus | x | x | x | x | x | |
| DECAPODA | | | | | | |
| Callanassa atlantica | | | | | x | |
| Crangon septemspinosa | x | | | x | | |
| Euceramus praelongus | | | | x | x | |
| Pagurus annulipes | x | | x | x | | |
| P. pollicaris | | | | x | | |
| Pinnixa chaetopterana | x | x | | x | x | |
| Portunus sayi | | | | x | | |
| Pelia mutica | | | | x | | |
| unid. xanthid | | x | | x | | |
| ECHINODERMATA | | | | | | |
| Mellita quinquiesperforata | | | | | | x |

Table 8. List of species collected during NMFS groundfish surveys conducted along three depth transects between the mouth of Chesapeake Bay and the Virginia/North Carolina border. The list is based on four annual surveys from 1977 through 1980 with 3 cruises conducted each year, usually in late March, early August and late September.

| Species | Fathoms 0-5 | 5-10 | 10-15 |
|---|---|---|---|
| Odontaspis taurus | | | x |
| Mustelus canis | x | x | x |
| Carcharhinus obscurus | | x | |
| Rhizoprionodon terraenovae | x | x | x |
| Sphyrna lewini | x | | |
| Squalus acanthias | x | x | x |
| Squatina dumerili | x | x | x |
| Raja eglanteria | x | | x |
| R. erinacea | | x | |
| Aetobatus narinari | x | | |
| Dasyatis centroura | | x | |
| D. sabina | x | | |
| Gymnura altavela | x | x | x |
| G. micrura | x | | |
| Myliobatis freminvilli | x | x | x |
| M. goodei | x | | |
| Rhinoptera bonasus | x | | |
| Accipenser oxyrhynchus | | x | |
| Clupea harengus | x | x | x |
| Alosa aestivalis | x | x | x |
| A. pseudoharengus | x | x | x |
| A. sapidissima | x | x | |
| Opisthonema oglinum | x | x | |
| Brevoortia tyrannus | x | x | |
| Etrumens salina | | x | x |
| Anchoa mitchilli | x | x | x |
| A. hepsetus | x | x | |
| A. lyolepis | | x | x |
| Conger oceanicus | | x | |
| Synodus foetens | x | x | x |
| Urophycis chuss | x | x | x |
| U. regia | x | x | x |
| Merluccius bilinearis | x | x | x |
| Paralichthys dentatus | x | x | x |
| Pseudopleuronectes americanus | x | | x |
| Etropus microstomus | x | x | x |
| Citharichthys arctifrons | | x | x |
| Scophthalmus aquosus | x | x | x |
| Trinectes maculatus | x | | |
| Symphurus plagiusa | | x | x |
| Syngnathus fuscus | | x | |
| Menidia menidia | x | x | x |

Table 8. (Cont.)

| Species | Fathoms 0-5 | 5-10 | 10-15 |
|---|---|---|---|
| Ammodytes americanus | x | x | x |
| Scomber scombrus | | x | x |
| Trichiurus lepturus | | x | |
| Peprilus alepidotus | x | x | |
| P. triacanthos | x | x | x |
| Selar crumenophthalmus | x | x | |
| Seriola zonata | x | | |
| Caranx fusus | x | x | |
| C. bartholomaei | x | | |
| Selene setapinnis | | x | |
| Trachurus lathami | | x | x |
| Pomatomus saltatrix | x | x | x |
| Centropristis striata | | x | x |
| Stenotomus chrysops | x | x | x |
| S. caprinus | x | x | x |
| Leiostomus xanthurus | x | x | x |
| Micropogonias undulatus | x | x | x |
| Menticirrhus saxatilis | x | x | |
| M. americanus | x | x | |
| Cynoscion regalis | x | x | x |
| Prionotus evolans | x | x | x |
| P. tribulus | | | x |
| Tautoga onitis | | | x |
| Astroscopus guttatus | | x | |
| Ophidium marginatum | x | x | x |
| Monacanthus hispidus | x | x | |
| Sphoeroides maculatus | x | x | x |
| S. trichocephalus | x | | |
| Lophius americanus | x | | |
| Decapterus punctatus | | x | x |
| Macrozoarces americanus | | | x |
| Total | 53 | 58 | 45 |
| All total | 76 species | | |

Table 8. (Cont.)

| Species | Fathoms 0-5 | 5-10 | 10-15 |
|---|---|---|---|
| Ammodytes americanus | x | x | x |
| Scomber scombrus | | x | x |
| Trichiurus lepturus | | x | |
| Peprilus alepidotus | x | x | |
| P. triacanthos | x | x | x |
| Selar crumenophthalmus | x | x | |
| Seriola zonata | x | | |
| Caranx fusus | x | x | |
| C. bartholomaei | x | | |
| Selene setapinnis | | x | |
| Trachurus lathami | | x | x |
| Pomatomus saltatrix | x | x | x |
| Centropristis striata | | x | x |
| Stenotomus chrysops | x | x | x |
| S. caprinus | x | x | x |
| Leiostomus xanthurus | x | x | x |
| Micropogonias undulatus | x | x | x |
| Menticirrhus saxatilis | x | x | |
| M. americanus | x | x | |
| Cynoscion regalis | x | x | x |
| Prionotus evolans | x | x | x |
| P. tribulus | | | x |
| Tautoga onitis | | | x |
| Astroscopus guttatus | | x | |
| Ophidium marginatum | x | x | x |
| Monacanthus hispidus | x | x | |
| Sphoeroides maculatus | x | x | x |
| S. trichocephalus | x | | |
| Lophius americanus | x | | |
| Decapterus punctatus | | x | x |
| Macrozoarces americanus | | | x |
| Total | 53 | 58 | 45 |

All total 76 species

## OLD DOMINION UNIVERSITY BIOLOGICAL FIELD STUDIES

### FINFISH

Old Dominion University (Dr. Ray S. Birdsong) has completed a one-year study in the area of Dam Neck Disposal Site to determine the relative distribution and abundance of fish species. Both commercial-type trawl nets and fixed gillnets were used to conduct this study. The following is the Discussion and Conclusions section of their February, 1985 Final Report:

> "In general the northern stations nearer the bay mouth yielded higher concentrations of most species than did the southern stations. Both diversity and overall abundance of fishes was greatest in the fall, however, some species (Anchoa mitchilli and Urophycis regia) peaked in abundance in the summer and others such as the alosines (shads) in the spring.
>
> No information on fish concentrations in adjacent areas appears to be available except for that accumulated by the author in an allied study to this report titled "Fin Fish Seasonality and Utilization of Hampton Roads and the Entrance Channels", submitted to the U. S. Army Corps of Engineers, Norfolk District in September 1984. Data from a trawl station located in approximately 60 feet of water just north of the study area yielded results for the years 1982 and 1983 similar to those at the northern stations of the present study. Available commercial catch data are not appropriate for evaluating fish concentrations in the study area, however, a late summer and fall trawl fishery primarily directed toward flounder and weakfish does operate in the area.
>
> The Northern portion of the study area is utilized to a considerable extent by spot, croaker, and weakfish, especially during their fall migrations out of the bay. Many other species which are seasonal in bay waters also pass through the sites, however little detail is known concerning the migratory paths of fishes entering and leaving the Chesapeake Bay. The importance of the study area as a migratory pathway for fishes cannot be assessed from existing information other than to state that fishes do make some use of the area during migrations.

The Study area does not appear to be used to any important extent for spawning by any of the commercial or sport species inhabiting it."

PLANKTON

ODU (Butt and Alden) has also conducted a study to determine the relative distribution and abundance of the zooplankton in the Dam Neck study area during a one year period (1983-1984). The following is the Summary and Conclusions section of their March, 1985 Final Report:

"To summarize the significant patterns of meroplankton in the vicinity of the DNDS, many of the estuarine species stay to the north and inshore of the site (e.g. Xanthid, Pinnothesis, Pinnixid, and Uca crab larvae). A number of offshore spawners are found primarily seaward of DNDS (e.g. the Bothids, Sciaenids and most of the other fishes; the Cancer irroratus larvae, the penaeid shrimp larvae). The only species which apparently move through the study area in ecologically significant numbers are the blue crab (Callinectes sapidus) larvae, the Bay anchovy (Anchoa mitchilli) larvae, the larvaceans, and the sand shrimp (Crangon septemspinosa) larvae. This fact was made evident by the PCA analysis of the data which showed that over 97% of the variance in the data could be described by factors describing the abundance patterns of these few species. Even the blue crab zoeae tend to be found in greatest numbers along the Atlantic Channel stations, offshore of DNDS. So this particular area does not appear to represent a major larval transport route for any but the most common and commercially insignificant species (e.g. sand shrimp, Bay anchovies, and possibly gastropods and hermit crabs). The only possible exception would be the blue crab megalopae found in the neuston in the center of the study area. However, this population may represent only a small portion of the recruitment stock to the Bay. Previous studies have documented equal or greater concentrations of megalopae farther offshore."

BENTHOS

Ranasinghe, Harlan and Dauer (1984) investigated the macrobenthic communities of the Dam Neck Disposal Site during 1983-1984. The findings of their study are summarized in the "Discussion" section of their Final Report:

"The benthic macroinfaunal community in the Dam Neck Disposal Site area may be considered a typical sandy substrate assemblage. Species restricted to sandy substrates, or known to prefer them, such as Spiophanes bombyx, Pseudunciola obliquua, Tellina agilis, Amastigos caperatus, Apoprionospio pygmaea, Pectinaria gouldi and Asabellides oculata occurred with greater consistency and abundance than habitat generalists such as Mediomastus ambiseta and Polydora ligni. This may indicate an environment under low natural and anthropogenic stress.

The community shows local variation related closely to mean particle size of the habitat. Although a few species showed disjunct distributions, the large majority were simply more abundant in coarser sediments, thus showing a different relative abundance (see also Dauer 1984a). The stations visited probably represented samples from a community which was a continuum with micro-habitat related local variation.

In view of the temporally limited scope of sampling, especially for the Interim stations, no analysis of temporal trends was attempted. Further, the data were considered inadequate for all but exploratory statistics.

Three methods were used for comparison of biological species assemblages from the Norfolk Disposal Site with those from the Dam Neck stations. Comparison of dominants from 1979-1984, 1983-84 and 1984 sampling periods at the Norfolk Disposal Site showed essentially the same assemblage of species as the Dam Neck stations, although differences in relative abundance and some qualitative differences existed. All 'top 20' dominants at the Norfolk Disposal Site were found during Dam Neck sampling. There was 60-70% correspondence between 'top 5', 'top 10' and 'top 20' species lists. Overall, it would appear that the same general benthic macroinvertebrate community exists at the Dam Neck and Norfolk Disposal Sites with some micro-environment specific variation."

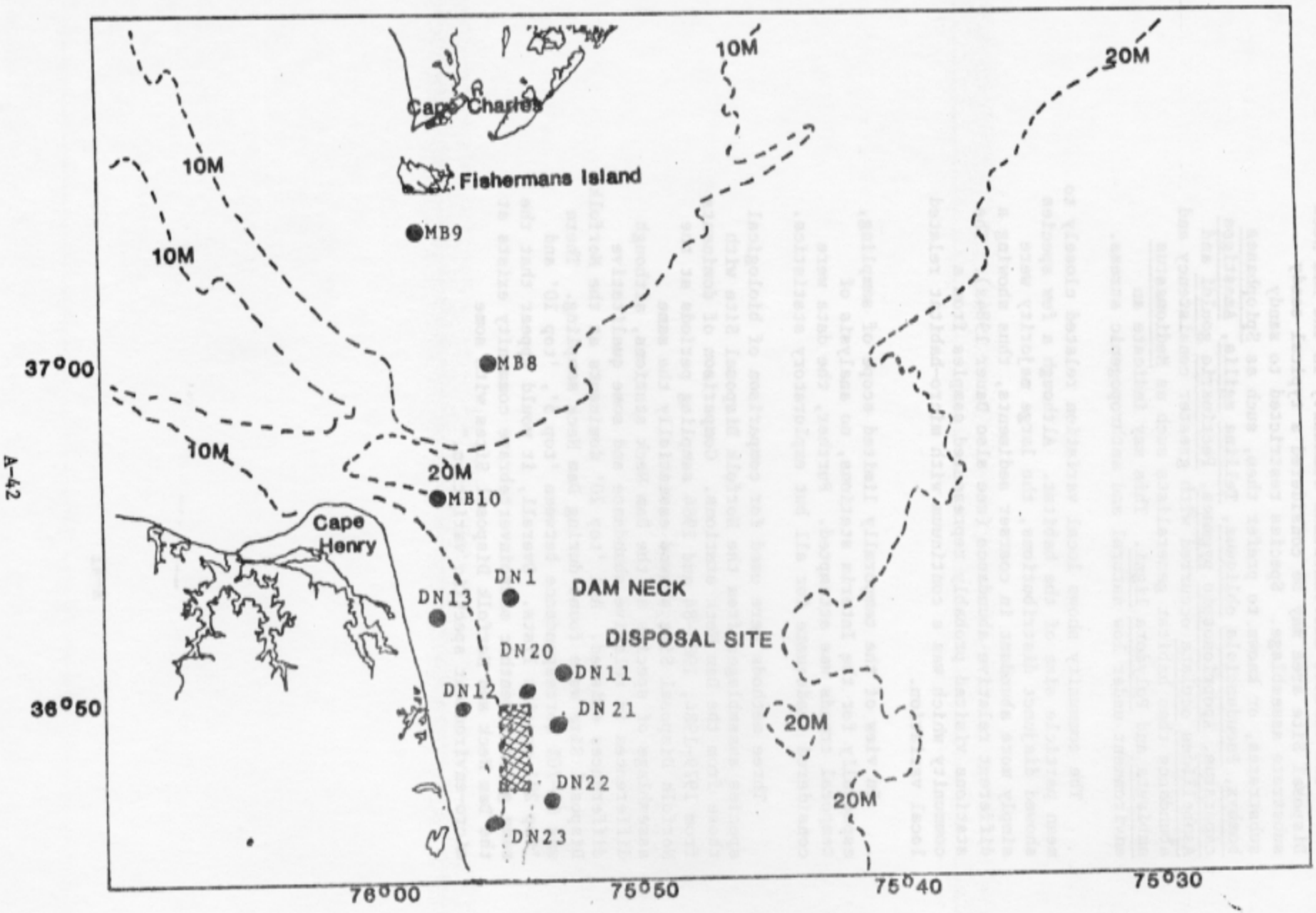



Figure A-1. ODU Sampling Stations (Zooplankton)

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# APPENDIX B

# WATER AND SEDIMENT QUALITY

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WATER QUALITY

B.01 The Virginia State Water Control Board has classified the Atlantic Ocean and its tidal tributaries from Cape Henry Light east to the 3-mile limit and south to the North Carolina state line as Class I-B-a.

B.02 Class I standards specify a minimum dissolved oxygen requirement of 5.0 mg/l, a pH range of 6.0 to 8.5 and a permissible rise above natural temperatures of 4.0°F (September-May) and 1.5°F (June-August). Subclass B describes water generally used for public or municipal water supplies, primary contact recreations, propagation of fish, and other beneficial uses. This subclass requires that fecal coliforms within a 30-day period not exceed a log mean of 200/100 ml and not more than 10 percent of samples within a 30-day period exceed 400/100 ml. Special standard 'a' pertains to additional coliform standards enforceable in areas where shellfish beds are present. However, there are no shellfish beds within the area of the Atlantic Ocean and its tributaries from Cape Henry east to the 3-mile limit and south to the North Carolina state line (from "Public, Leased, and Condemned Shellfish Growing Areas in the Commonwealth of Virginia," November, 1971). On this basis, shellfish standards do not apply to the study area, and the primary contact, propagation of marine organism, and other beneficial use provisions of the classification become the governing standard for the area. While the Dam Neck Disposal Site lies just east of the 3-mile limit, water quality is analogous to the previously described.

B.03 According to a report prepared by Hydroscience, Inc. for the Hampton Roads Sanitation District in 1974, the surface dissolved oxygen concentrations in the area of Dam Neck are generally at or near saturation. It was also observed that background levels of dissolved oxygen in the bottom waters of the study area are periodically below the standard of 5 mg/l set for these waters by the Virginia State Water Control Board. Nitrogen and phosphorus levels, as measured during this study, were moderate, exhibiting mean concentrations of 0.3 mg N/l and 0.06 mg P/l. A strong thermal-salinity density stratification was also identified over the entire study are (Cape Henry to North Carolina state line) during the survey period (summer and fall, 1973). Limited historical data indicates the presence of some stratification in other years. This effect appears to be minimized in winter, when vertical mixing is greatest.

B.04 The Hampton Roads Sanitation District (HRSD) began operation of the Atlantic Plant outfall discharge with a 1/2-mile long diffuser pipe in the Dam Neck area off Virginia Beach in the summer of 1983. Depressions in dissolved oxygen concentrations have been observed in bottom waters in the Dam Neck area during the summer months when stratification is greatest. This phenomena was observed prior to 1983. The Hydroscience report (1974) predicted a depression of 0.5 mg/l of ambient dissolved oxygen at first stage flow for an effluent from secondary treatment and filtration facilities.

B.05 Thirteen stations were monitored for salinity, temperature, and dissolved oxygen (DO) off Dam Neck during July through September 1984 (figure

B-1) by Old Dominion University (ODU) under contract to the Corps. The following excerpt is taken from the Final Report prepared by Alden and Butt (1985):

> "The reported values for depressed dissolved oxygen off Dam Neck during the Summer of 1984 tend to support allegations that water quality adjacent to the world's largest resort city may be declining. Although no single cause of the depressed readings has been determined two possible sources are the Atlantic STP stations and the Dam Neck Disposal Sites.
>
> Historically, sewage treatment processes employ dilution as a major means of waste disposal. This is particularly true along the coastal zone where daily tidal action help dilute and flush primary and/or secondary treated waste to offshore waters. Depressed oxygen readings are often characteristic of diffuser outfalls, particularly during the summer months when the biochemical oxygen demands increase. Typically, as the water column becomes stratified. The mixing of the bottom and surface waters are restricted to the point that tidal action may not be enough to allow the oxygen diffusion process to work. The restricted mixing becomes of increasing concern as temperatures rise because the oxygen carrying capacity of the water declines at the same time that metabolic demands of the endemic biota peak. Despite depressed DO readings observed during the warmer months, this hypothetical scenario does not appear to represent the conditions off Dam Neck.
>
> The lowest oxygen values were reported after temperatures began to decline in late September. Moreover, the a priori hypothesis that lower oxygen readings would be expected to be associated with the stations located in the vicinity of the diffuser outfall was proven false. In addition, the historical record for the area shows low oxygen readings prior to the plant start-up in 1983 (Hampton Roads Sanitation Department, personal communication, 1984; Hydroscience, 1974).
>
> In view of these findings, the Dam Neck Site appears to be a reasonable alternative as the source of depressed DO readings. Biological and chemical oxygen demands may be expected to depress oxygen supplies when high concentrations of silts and organics are released during disposal operations. However, the dredged material typically relocated to Dam Neck comes from the relatively pristine Cape Henry Channel and Thimble Shoal Channel of Chesapeake Bay.

The navigational channels of lower Chesapeake Bay and Bay mouth are heavily scoured. Tidal actions alone have resulted in a sandy sediment type low in organics. In addition, the channels serve as major arteries for merchant and military vessels. Propeller wash cause additional scouring to these channels. Therefore, the sediment oxygen demand of the fine sand from these sites would be minimal in comparison to those found in most seaports. Analysis of the material to be dredged from the channels met EPA guidelines for ocean disposal. A test dump at NDS with sediments from Thimble Shoal Channel caused no significant changes to the physical or chemical parameters monitored (Darby et al., 1981). The fact that the site is only aperiodically used for maintenance dredging operations also brings into question its role as a potential chronic source of oxygen depletion in the area. The findings of the present study point to the conclusion that the location of the DNS is not significantly associated with oxygen patterns of the region.

The depressed oxygen concentrations of the hypolimnion are apparently on a much broader scale than previously believed. Low DO readings have been found as far south as North Bay along the inshore zone and as far north as Cape Henry (HRSD, personal communication, 1984). A possible clue to this condition may lie in the circulation pattern associated with the Chesapeake Bay Plume.

Offshore shelf waters along the Mid-Atlantic Bight exhibit primarily a southerly drift. The outflow from Chesapeake Bay constitutes over 50% of the freshwater inflow to the Bight, where it flows towards the south (Beardsley et al., 1976). Virtually all the freshwater inflow to the study area is from the Bay. Associated with this large volume of outflow is suspended matter rich in organics. There is also evidence of sewage-associated particulates in the waters of the Bay plume (Brown and Wade, 1980; Byrnes and Oertel, 1980). Once expelled from the Bay these suspended materials are deposited along the inshore areas adjacent to Virginia Beach and Dam Neck. According to Brehmer (1971), a clockwise eddy is present along the shore south of Cape Henry. During the summer months there is a slight northerly flow of bottom water. Therefore, organic-rich suspended materials which settle into the bottom waters may represent a significant B.O.D. source to the study area. The inshore-offshore banding patterns of the oxygen-contours of the bottom waters of the study area supports this contention. This inshore pattern is believed to extend as far south as False Cape (Brehmer, 1971).

The seaward extent of this circulation pattern is unknown. However, its influence on the coastal ecology, particularly along Dam Neck and Virginia Beach cannot be ignored. Studies have shown that debris, organic-rich fine sediments and sewage-associated particulates are flushed out of the Bay and settle along the inshore zone (Gingerich and Oertel, 1980; Byrnes and Oertel, 1980). Their presence and concentrations appear to be influencing the oxygen pattern in the study area.

Oxygen levels were not observed to drop below 4.0 mg/l during the present study. However, they were seen to approach this level, which is often cited as representing the minimum concentration required for the maintenance of healthy aquatic communities. Considering the ecological problems believed to be associated with anoxia in the Chesapeake Bay and the coastal waters of the New York Bight, the low oxygen phenomenon off Dam Neck should be seen as a potentially significant environmental problem. Unfortunately, since the evidence points to the Bay plume as the major non-point source of the oxygen demand, the means for controlling long-term trends in the water quality of the region remain unclear."

TOXINS AND SEDIMENT QUALITY

B.06 Old Dominion University (ODU) conducted a one-year study at the Dam Neck Disposal Site to characterize toxins. The following "Summary and Conclusions" section is taken from their February 1985 Final Report prepared by Alden, et al.:

"A study was conducted from December 1983 to October 1984 to characterize the toxins in water, sediment and biota collected in the vicinity of NDS and DNDS. The levels of organic toxins (PNAH's and CHC's) in the water were usually below detection limits at both sites. The levels of most of the metals were somewhat higher in the waters of DNDS then NDS, possibly indicating a greater influence of the Bay plume. However, the metals in water at both sites were well within the range of concentrations reported for other coastal areas. Mercury values have been observed to be periodically elevated throughout the region, but the source was unknown.

The levels of PNAH's and CHC's in the sediments of DNDS were fairly low. The source of PNAH's appears to be either atmospheric deposition or the transport of combustion products via the suspended solid load of the Bay plume. Trace levels of DDT metabolities were the only CHC's detected in the sediments.

Concentrations of metals in the sediments of DNDS study area were somewhat higher than those observed previously at NDS but below those reported for the lower Chesapeake Bay. The metal content of the sediments of DNDS also appear to reflect the greater influence of the Bay Plume relative to the more offshore NDS.

Likewise, the PNAH's in tissues of biota collected in the vicinity of DNDS were elevated compared to those observed at NDS, which were almost always below the detection levels. However, the body burdens of biota at DNDS were orders of magnitude below the range of values reported for animals taken from less pristine environments. The CHC's in the biota of the DNDS were found in trace amounts and generally consisted of DDT metabolities.

The concentrations of heavy metals in tissues of biota collected in the vicinity of NDS and DNDS were quite variable from season to season. This variability was due primarily to the varying species composition collected from the representative taxonomic groups. However, the levels of metals in the groups fell well within the ranges of values reported for similar organisms in previous studies. The fish tissues generally exhibited the lowest metals values, the macroinvertebrates had intermediate levels, while the zooplankton contained the highest concentrations. Even samples containing what appeared to be somewhat "elevated" levels of certain metals could be explained in terms of natural species-specific accumulation patterns.

The overall picture of toxins at the two sites indicate that both are fairly pristine. However, the somewhat higher levels of metals in water and sediments, and organic toxins in the biota of DNDS tend to indicate that, of the two, this site is more greatly influenced by anthropogenic sources of contamination via the Bay Plume. The fact that body burdens of biota collected at DNDS increased following a period of maximum outwelling of the Bay may also be indicative of the subtle plume effects in the region. Nevertheless, the potential effects of the Plume on toxins in the vicinity of DNDS appear to have not reached a level that would provoke environmental concern."

SEDIMENT QUALITY OF NORFOLK HARBOR AND CHANNELS

B.07 Chemical and biochemical studies, which began in 1979 and continued through 1983, were conducted by Old Dominion University (ODU) to assess sediments from the Norfolk Harbor and entrance channels. The bioassay results at the sites tested indicated that all prospective dredged material destined for the Dam Neck Site has met EPA/Corps criteria for ocean disposal. The following narrative is taken from ODU's synoptic report (Alden, et. al., 1980):

> "Suspended solid phase bioassays conducted on sediments from dredge sites in the Thimble Shoals and Cape Henry Channels indicated that sediments from all stations exhibited low levels of acute toxicity for the grass shrimp Palaemonetes pugio and the blue mussel Mytilus edulis. In all cases, the mortality of test organisms exposed to the various elutriate concentrations was not significantly different from that exhibited by the controls. The solid phase bioassay experiments also indicated a low degree of toxicity for sediments taken from the Thimble Shoals and Cape Henry access channels. The osmoregulation experiments which followed the suspended solid phase bioassays indicated that spoils from all access channel areas did not produce significant sublethal effects. Elutriates of sediments from Thimble Shoals Inner, Thimble Shoals Outer and Cape Henry Channels did not effect the ability of P. pugio to hyperregulate at low salinities (10 ppt) or hyporegulate at high salinities (35 ppt)."

A more detailed presentation of the quality of Norfolk Harbor and Channel sediments is provided in the Norfolk Disposal Site FEIS and Appendices, July 1982. This document is available at Norfolk District.

B.08 Based on this study, all dredged material which will be placed in the Dam Neck Site meets or exceeds EPA/Corps standards for ocean disposal.

B.09 Figure C - 3 (Appendix C - Physical Processes) shows sediment size and distribution within the Zone of Siting Feasibility (ZSF).

Table B-1. PNA and CHC Detection Limits

| Compound | Method Detection Limits (ug/l) |
|---|---|
| ALDRIN | 0.004 |
| α BHC | 0.003 |
| β BHC | 0.004 |
| 4,4'-DDD | 0.004 |
| 4,4'-DDE | 0.011 |
| 4,4'-DDT | 0.012 |
| ENDOSULFAN SULFATE | 0.066 |
| HEPTACHLOR | 0.003 |
| HEPTACHLOREPOXIDE | 0.083 |
| PCB-1221 | 0.065 |
| PCB-1254 | 0.065 |
| ACENAPHTHENE | 1.8 |
| ACENAPHTHYLENE | 2.3 |
| ANTHRACENE | 0.66 |
| BENZO (a) ANTHRACENE | 0.013 |
| BENZO (a) PYRENE | 0.023 |
| BENZO (b) FLUORANTHENE | 0.018 |
| BENZO (k) FLUORANTHENE | 0.017 |
| BENZO (ghi) PERYLENE | 0.076 |
| BENZIDINE | 0.08 |
| BUTYL BENZYL PHTHALATE | 0.34 |
| BIS (2-CHLOROETHOXY) METHANE | 0.5 |
| BIS (2-CHLOROETHYL) ETHER | 0.3 |
| BIS (2-ETHYLHEXYL) PHTHALATE | 2.00 |
| 4-BROMOPHENYL PHENYL ETHER | 2.30 |
| 2-CHLORONAPHTHALENE | 1.90 |
| 4-CHLOROPHENYL PHENYL ETHER | 3.90 |
| CHRYSENE | 0.15 |
| DIBENZO (a,h) ANTHRACENE | 0.030 |
| DI-N-BUTYL PHTHALATE | 0.36 |
| 1,2-DICHLOROBENZENE | 1.14 |
| 1,3-DICHLOROBENZENE | 1.19 |
| 3,3'-DICHLOROBENZIDINE | 1.34 |
| DIETHYLPHTHALATE | 0.49 |
| DIMETHYL PHTHALATE | 0.29 |
| FLUORANTHENE | 0.21 |
| FLUORENE | 0.21 |

Table B-1. (cont'd) PNA and CHC Detection Limits

| Compound | Method Detection Limits (ug/l) |
|---|---|
| HEXACHLOROBUTADIENE | 0.34 |
| HEXACHLORO-CYCLOPENTADIENE | 0.30 |
| HEXACHLOROETHANE | 0.03 |
| INDENO (1,2,3-cd) PYRENE | 0.043 |
| ISOPHORONE | 5.7 |
| NAPHTHALENE | 1.8 |
| NITROBENZENE | 3.6 |
| N-NITROSODI-n-PROPYLAMINE | 0.46 |
| N-NITROSODIPHENYLAMINE | 0.81 |
| PHENANTHRENE | 0.64 |
| PYRENE | 0.27 |
| 1,2,4-TRICHLOROBENZENE | 0.05 |

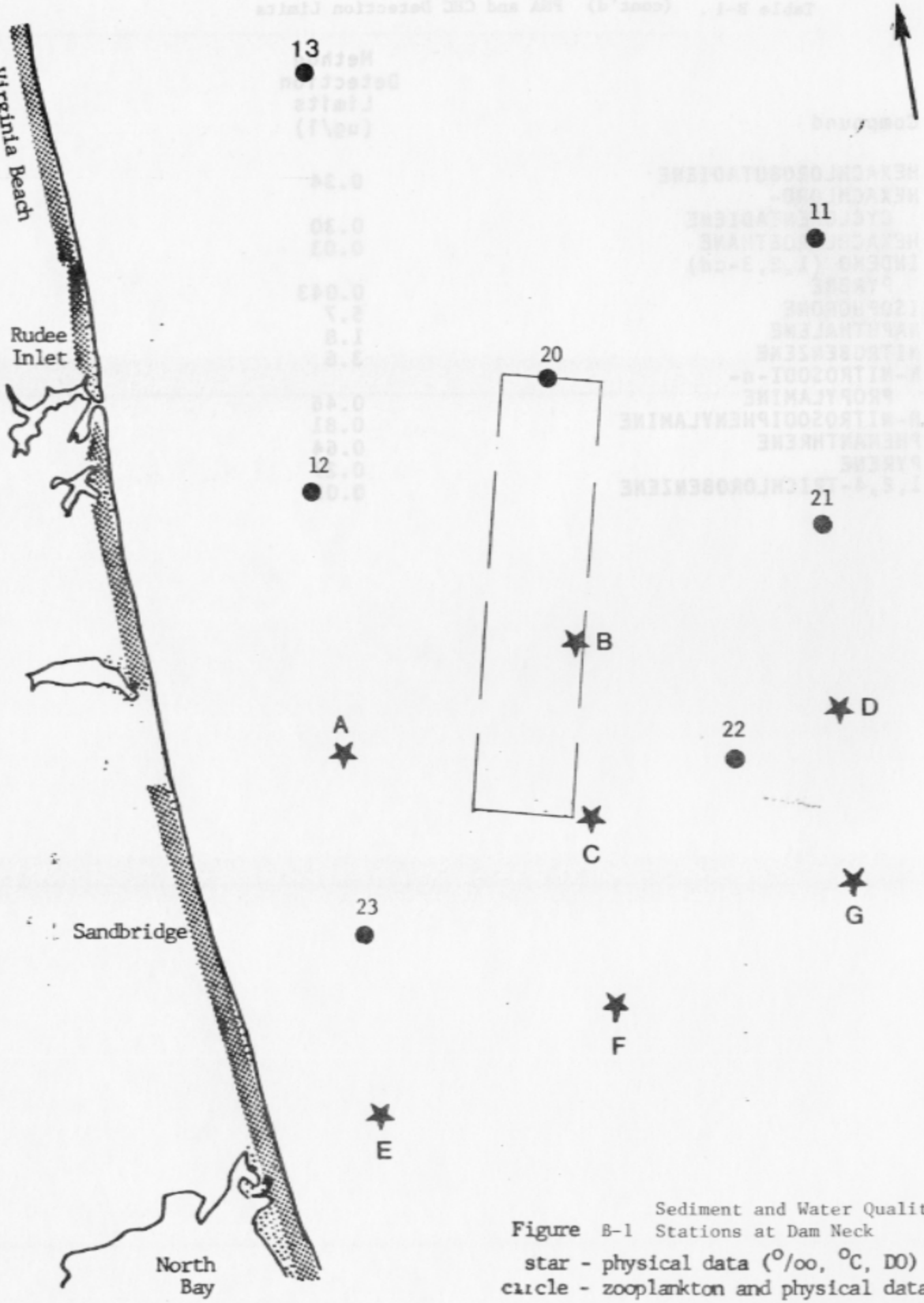


Figure B-1 Sediment and Water Quality Stations at Dam Neck

star - physical data ($^{o}/oo$, $^{o}C$, DO)
circle - zooplankton and physical data

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# APPENDIX C

# PHYSICAL PROCESSES

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CIRCULATION OF VIRGINIA CONTINENTAL SHELF WATERS

C.01 Circulation of continental shelf waters is, on the average, subparallel to bathymetric contours. It is well defined and documented as far as a basic understanding of the interaction of tidal, residual and wind stress currents and magnitudes involved (Beardsley and Boicourt, 1980). Generally, there is a net southward oceanic circulation on the continental shelf off the Maryland and Virginia coasts which turns east and joins with the northward moving Gulf Stream off the North Carolina coast. The circulation decreases in magnitude from a maximum near the shelf break to a minimum near the coast, where the inner shelf is shallow and subjected to increased bottom friction (Bumpus, 1973).

C.02 Harrison et al. (1967) developed generalized synopses for the circulation of the Virginia inner continental shelf including the mouth of the Chesapeake Bay (See figures C-1 and C-2). In the region just offshore of the entrance to the bay, mean bottom currents are directed toward the bay entrance for all seasons (figure C-2). Furthermore, Bumpus (1973) hypothesized that, in the mean, the bottom circulation seaward of the Chesapeake Bay mouth occurs as a slow, broadly distributed flow from the north and east.

C.03 Two oceanographic seasons predominate in Virginia continental shelf circulation - summer and winter. The mean circulation is southward at all depths in the winter when prevailing winds are northerly, adding a wind-driven component to the southward mean flow (Harrison, et al., 1967). The primary difference between summer and winter on the Virginia continental shelf are

stratification and the prevailing wind regime. During the summer, increased stratification and prevailing southerly winds can reverse the mean southward flow (Bumpus, 1973). According to Alden and Butt (1985), vertical mixing in the study area is at a maximum during the winter.

C.04 In the fall, south-directed winds are stronger than those in the summer, but although corresponding surface currents are still to the south, they are weaker than those in the summer. During the fall, north-directed winds of light to moderate speed act in the same direction as the gentle slope and generate weak surface currents to the north (Boicourt, 1981).

CIRCULATION OFF THE CHESAPEAKE BIGHT

C.05 Actual field measurements of currents have been performed in Virginia continental shelf water using current meters moored in the Bay entrance and the inner shelf region. Since 1973, several reports have been published for current meter deployments (Hydroscience, 1974; Boicourt, 1981; Ludwick and Saumsiegle, 1976) and seabed drifter experiments (Harrison et al., 1967; Harrison et al., 1964) on the Virginia inner continental shelf. Based on these efforts, results indicate a prevailing southerly drift occurring over the inner shelf region. Though seasonal changes may occur in the summer due to increased stratification and predominantly south winds, field measurements indicate these are short-lived and weak in magnitude. Thus, circulation off the Chesapeake Bight generally maintains its southerly directed flow as expected.

C.06 Continental shelf sediment dynamics are well documented for areas within the zone of siting feasibility (Boicourt, 1981; Ludwick and Saumsiegle, 1976; Darby et al., 1981: Saumsiegle, 1976; Ludwick, 1978). Sediment distribution is clearly defined and documented in the study area (Figure C-3). However, due to the nature of inner continental shelf physical processes, quantitive mass transport predictions of dredged material for the entire Dam Neck site are not within the state of the art. In an ongoing study conducted by VIMS concerning the benthic broundary layer, in depths comparable to the Dam Neck site, the sediment transport characteristics are considered one of the last frontiers of oceanography. More specifically, one of the research objectives is to figure out the process of sediment transport. (Wright, 1985).

C.07 The fate of fine-grained and dissolved materials introduced into the water column at the time of dumping of dredged material or at a later time is influenced by physical factors. According to Boicourt (1981), physical processes are largely responsible for the southerly transport of dredged materials in the zone of siting feasibility. Results suggest that, in the presence of diffusive transport, tides and wind-driven variability act to minimize any significant net movement of dredged material. Although seasonal changes may occur, they are insignificant at best. Current measurements suggest that, during the winter, net transport of these materials is southerly, thus producing only a remote chance of transport into the Chesapeake Bay. While some flow reversals may occur in the summer, velocities are weak so that no substantial transport occurs via the mean motion (Boicourt, 1981).

DISPOSAL SITE CURRENTS

C.08 Near-bottom and near-surface current measurement have been obtained from stations located in the general vicinity of the Dam neck disposal site (Ludwick, 1978; Ludwick and Johnson, 1977; Coastal Engineering Research Center, 1984; Watts, 1983). Seasonal measurements implemented over four to five week periods indicated near-surface currents in the vicinity of the 11 to 14m deep disposal site averaged between 5 and 9 cm/s during the summer, and between 4 and 6 cm/s during the fall. Measurements performed under the same conditions indicated near-bottom currents averaged between 0 and 2 cm/s during the summer and between 1 and 3 cm/s during the fall (Ludwick, 1978). According to Watts (1983), transport of dredged material out of the Dam Neck area by residual currents should be minimal.

C.09 Detailed current measurements have been obtained from stations located in the Dam Neck disposal site (Ludwick and Saumsiegle, 1976; Saumsiegle, 1976). Bottom current measurements were taken from two current meter stations which occupied the study area during July and September, 1974, for periods of 21 and 26 hours, respectively. Bottom currents were oriented north-south at 3 to 12 cm/s during the presence of moderate wave action. In the present study area, the threshold for transport if medium-grained sand was taken at 20 cm/s in the presence of moderate wave action. Effectively, Ludwick and Saumsiegle (1976) concluded that wave induced sediment movement was oscillatory, and unless unbalanced, produced no net translation of particles. Sediment movement by currents at the site was of low intensity and infrequent in occurence with principal movement occuring only during storms.

LONG-PERIOD WAVES

C.10 Wave information oceanward of the Chesapeake Bay entrance and throughout the zone of siting feasibility is well defined and documented (Chao, 1974; Carson, et al., 1982; Goldsmith, 1975). Wave directions, i.e. the direction from which the waves come, reflect the prevailing wind patterns over the study area. Results indicate the majority of the longest period waves travel from the north-northeast (Univ. of Rhode Island, 1973).

C.11 Tidal currents in the offshore study region are slight. Away from any constricted flow regions, especially the Chesapeake Bay entrance, tidal currents are rotary with a velocity vector tracing out an ellipse during a tidal cycle. Closer to shore, tidal currents become less rotary and more bidirectional near the Chesapeake Bay entrance; i.e. ebb and flood currents are in alignment with the general channel orientation into and out of the bay. Tidal currents offshore and south of Cape Henry generally flood towards 340°T and ebb towards 160°T. (Norfolk Harbor Coastal Data Study, 1981).

C.12 Near-bottom tidal currents in the general vicinity of the Dam Neck disposal site have been measured at between 1 and 3 cm/s and according to Ludwick (1978) account for more than half of the tidal currents over periods of several weeks. (Saumsiegle, 1976).

C.13 The wave climate is well documented and understood for the inner continental shelf area within the zone of siting feasibility (Chao, 1974;, Goldsmith, 1975; Carson, 1982; Jensen, 1983). Using a numerical transformation technique, significant wave data have been computed for the 20-year interval 1956 through 1975 for the areas encompassing the study region (Jenson, 1983). This is illustrated in Figure C-4. According to a U.S. Naval Weather Service Detachment, annual summaries of wave heights and frequencies have been recorded for areas along the East Coast, including the study region. Results indicate wave heights of 2 feet or less occur approximately 45% of the time, wave heights of 3-4 feet occur 30% of the time, wave heights of 5-9 feet occur 22% of the time, and wave heights of 10 feet or greater occur approximately 3% of the time.

C.14 During the winter, wave heights in excess of 20 feet occur about 2% of the time. The median significant wave height for the area, i.e. the value exceeded by half of the observations of significant height, is about 4 feet for the winter season. During the summer, the median significant wave height is about 2 feet. Thus, the zone of siting feasibility is not an area of noticeably high waves and would indicate a stable environment (Univ. of Rhode Island, 1973).

SURFACE WAVES

C.15 Surface waves are produced by local and worldwide wind conditions. Waves generated by local winds generally approach the coastline from the southeasterly sector during fall and winter (Univ. of Rhode Island, 1973).

Longer period swells generated by more distant storms approach from the NE-E or E-SE sectors. Local storms are considered to produce higher waves than swell with the largest waves generally occurring during the winter and approaching from the NE-E sector. Smallest sea and swell periods occur during the summer. Greatest swell periods occur most frequently during autumn while greatest period seas occur during winter.

DEEPWATER WAVES

C.16 Deepwater waves are modified by shoaling and refraction as they approach shore. According to Ludwick and Saumsiegle (1976), results from wave refraction studies at the Dam Neck Disposal Site indicate the build-up of the mound has caused little or no focusing of wave energy at the shoreline, except possibly under the conditions of northeast storms. Even under these conditions, it is certain that the site would be beneficial during periods of severe storm attack. As far as it can be determined the disposal area would cause no adverse effects to the shore sector (Watts, 1983).

C.17 The U.S. Army Corps of Engineers Coastal Engineering Research Center currently has technical reports which provide coastal engineers and oceanographers with summaries of nearshore wave measurements from locations along the Atlantic coast, particularly in the study area. Summaries of wave climate information provide useful data for the zone of siting feasibility (Chao, 1974; Carson, 1982).

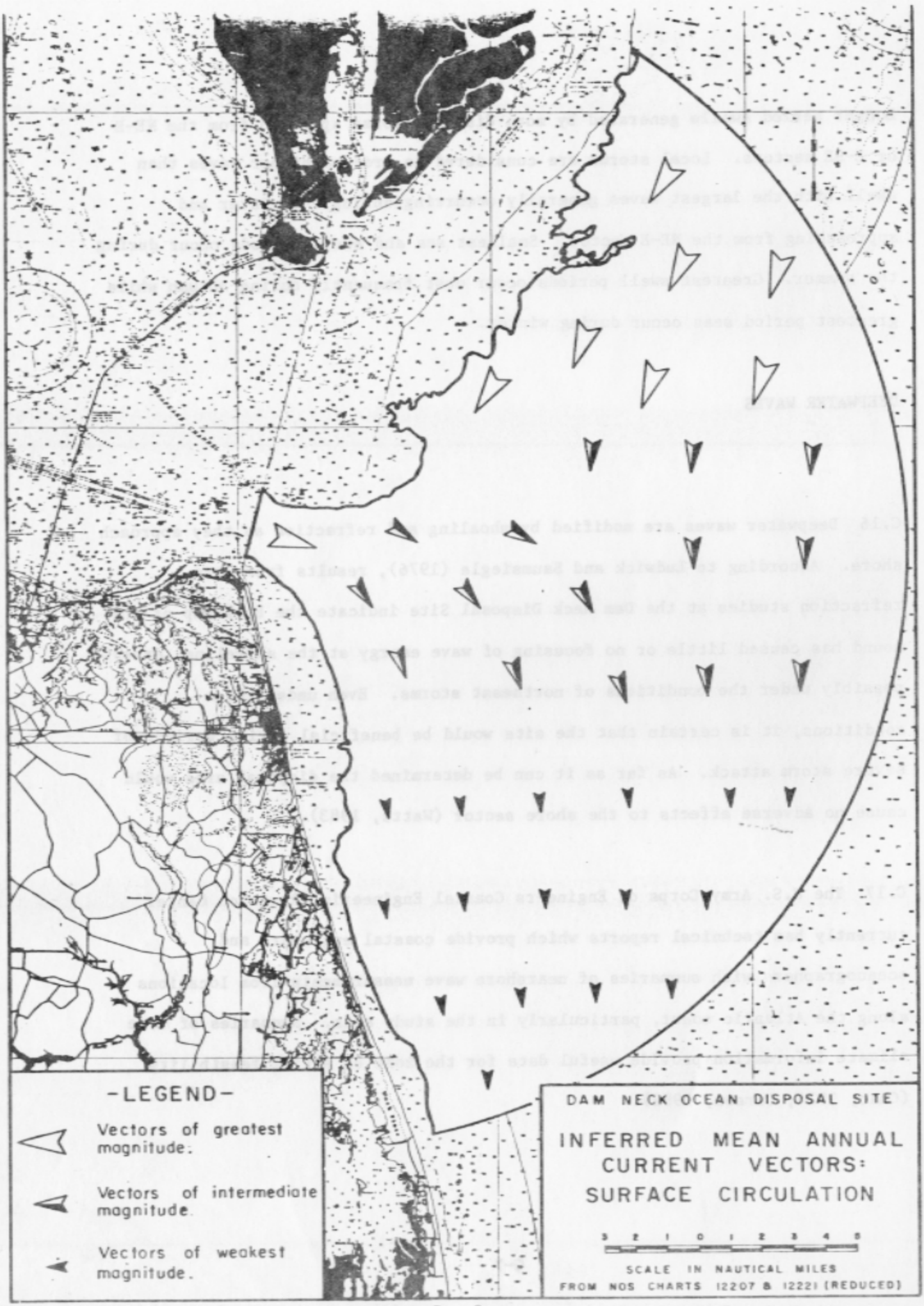
-LEGEND-
Vectors of greatest magnitude.
Vectors of intermediate magnitude.
Vectors of weakest magnitude.
DAM NECK OCEAN DISPOSAL SITE
INFERRED MEAN ANNUAL CURRENT VECTORS: SURFACE CIRCULATION
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES
FROM NOS CHARTS 12207 & 12221 (REDUCED)



FIGURE NO. C-1

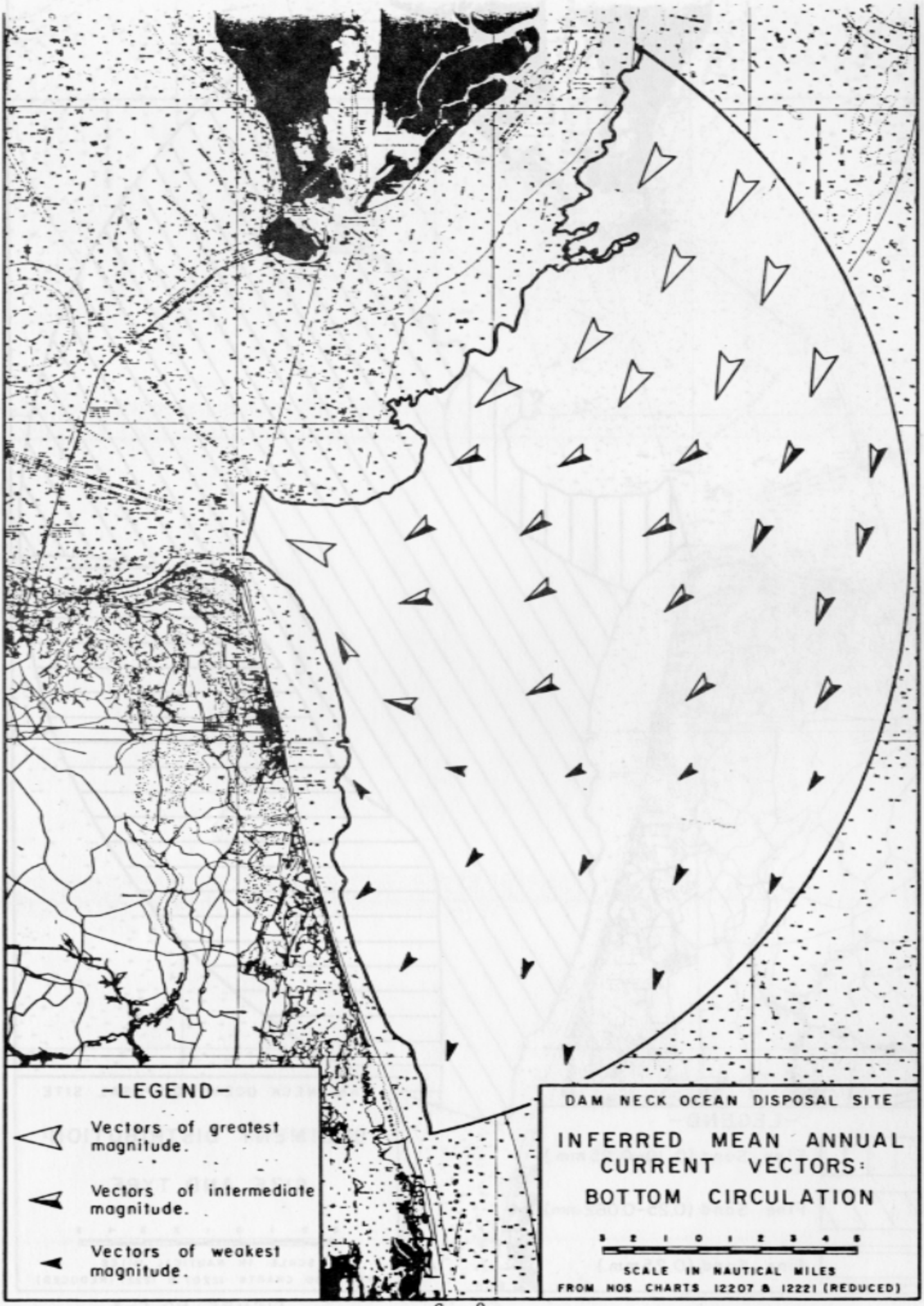
-LEGEND-
Vectors of greatest magnitude.
Vectors of intermediate magnitude.
Vectors of weakest magnitude.
DAM NECK OCEAN DISPOSAL SITE
INFERRED MEAN ANNUAL CURRENT VECTORS: BOTTOM CIRCULATION
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES
FROM NOS CHARTS 12207 & 12221 (REDUCED)



FIGURE NO. C-2

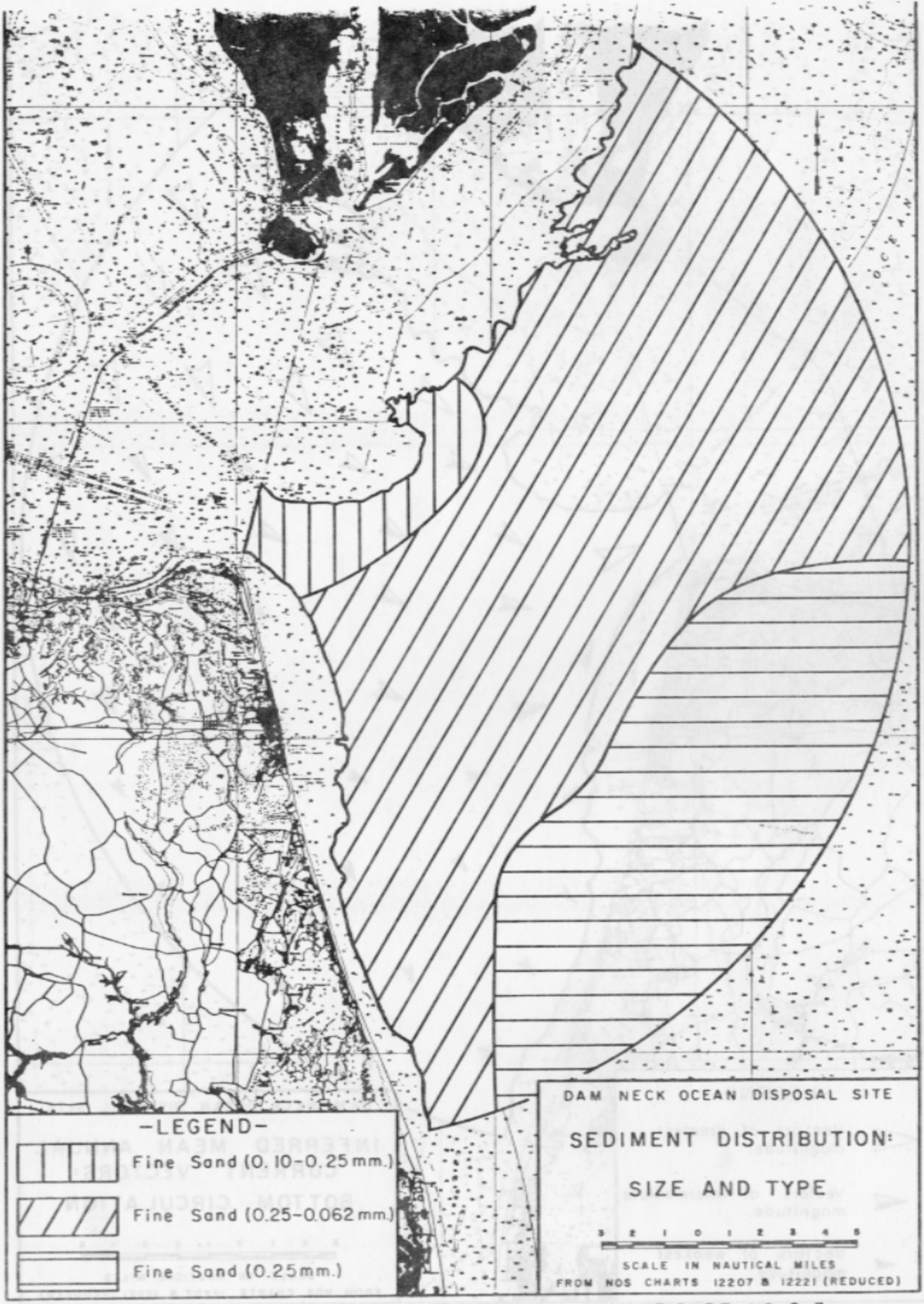
-LEGEND-
Fine Sand (0.10-0.25 mm.)
Fine Sand (0.25-0.062 mm.)
Fine Sand (0.25 mm.)
DAM NECK OCEAN DISPOSAL SITE
SEDIMENT DISTRIBUTION:
SIZE AND TYPE
3 2 1 0 1 2 3 4 5
SCALE IN NAUTICAL MILES
FROM NOS CHARTS 12207 & 12221 (REDUCED)



FIGURE NO. C-3

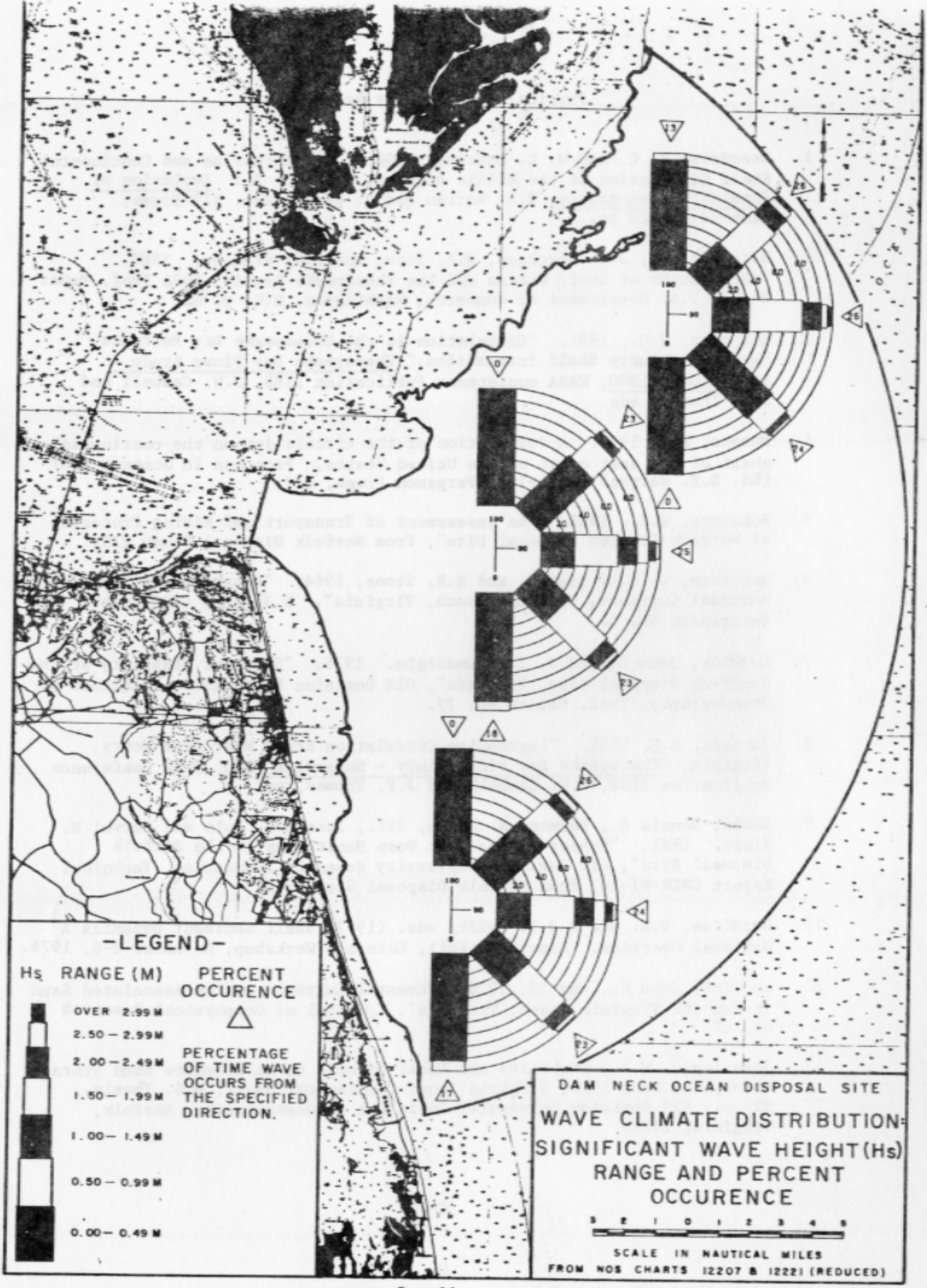
-LEGEND-
Hs RANGE (M)
PERCENT OCCURENCE
OVER 2.99 M
2.50 – 2.99 M
2.00 – 2.49 M
1.50 – 1.99 M
1.00 – 1.49 M
0.50 – 0.99 M
0.00 – 0.49 M
PERCENTAGE OF TIME WAVE OCCURS FROM THE SPECIFIED DIRECTION.
DAM NECK OCEAN DISPOSAL SITE
WAVE CLIMATE DISTRIBUTION:
SIGNIFICANT WAVE HEIGHT (Hs)
RANGE AND PERCENT
OCCURENCE
SCALE IN NAUTICAL MILES
FROM NOS CHARTS 12207 & 12221 (REDUCED)



FIGURE NO. C-4

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# APPENDIX D

# DISPOSAL SITE DESIGN EVALUATION

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## INTRODUCTION

D.01. The Dam Neck Ocean Disposal Site was given an interim designation in 1977, based on its historical use. The location, size, and configuration of the interim site were appropriate for past ocean disposal requirements, and in the absence of any major channel deepening projects, would continue to be suitable for the disposal requirements of presently maintained channels. With the planned deepening of Thimble Shoal, Cape Henry, and Atlantic Ocean Channels, substantial quantities of new work dredged material and increased future maintenance dredging will also require ocean disposal. These additional quantities can be accommodated at the Dam Neck Site, with appropriate expansion and reconfiguration of the site. This appendix provides the analysis which led to the recommended site design for final designation.

## GENERAL CRITERIA AND GUIDANCE

D.02 General Criteria - The general criteria for ocean disposal codified at 40 CFR 228.5 require the disposal site design to be determined as part of the site evaluation study. At this stage, the design consists of the site size, configuration, and location. Since an existing interim site is being evaluated for final designation, its geographic location was previously established by the COE and EPA. Therefore, the size and configuration remain to be determined. The general criteria also state that ocean disposal sites will be limited in size to localize immediate impacts and allow effective surveillance.

D.03 Technical Guidance - Additional guidance on site design is provided in the Technical Guidance dated October 1983, developed jointly by the EPA and COE. This guidance states that a critical consideration is whether the site tends toward dispersion or retention of dredged sediments, in addition to emphasizing the previously stated general criteria.

DESIGN CRITERIA AND CONSTRAINTS

D.04 Existing Conditions - The bathymetry and dispersion characteristics of the site are important considerations which constrain how the disposal site is designed. These are both addressed in the main report under the specific criteria. The Dam Neck Site has been shown to be a relatively stable hydraulic environment, with good retention characteristics for dredged material deposited there. Dredged material will continue to build up at the site, rather than be dispersed over a wide area. This requires the site to be sized to accommodate the total channel dredging requirements for both new work and future maintenance, rather than sized only as an area of immediate impact.

D.05 The buildup, or fill, of dredged material over the life of the disposal site will be constrained on the lower end by the existing bathymetry. Thus, the bathymetry is an important consideration in evaluating the site size. Existing water depths within the interim site are about 35 to 40 feet. Expansion of the site should be in directions that will minimize the capacity gained, by adding bottom areas at least as deep or deeper than the interim site. This consideration excludes expansion toward the west (shoreward) because water depths in that direction become more shallow.

D.06 Required Dredged Material Capacity - The disposal site should be designed with a sufficient volumetric capacity to accommodate the presently estimated dredged material quantities requiring ocean disposal. Based on the best available data, these quantities are estimated to be 36 million cubic yards (mcy) of new work dredging, an additional 32 mcy of future maintenance dredging over a 50-year life, for a total estimated quantity of 70 mcy. For the purpose of this evaluation, there is considered to be a 1:1 relationship between volumes of dredged material measured in place in the channel, and volumes of dredged material deposited at the Dam Neck Site. This is reasonable because: (1) the site has good retention characteristics with a minimum of dredged material loss expected, and (2) any consideration of long-term consolidation and settlement would be within the accuracy limit of present dredged material quantity estimates. Accordingly, 68 mcy will be used as the required design capacity for the Dam Neck Site.

D.07 Dredging and Disposal Plant - The navigable depth required by the dredging and disposal plant is considered a constraint on site design. It is expected that medium to large class seagoing hopper dredges will be used for the dredging and subsequent disposal operations at Dam neck, as in the past. The largest of these vessels requires depths approaching 30 feet. Therefore, the site should be sized so that the design depth of water above the ultimate site profile will be at least 30 feet deep. This will enable the larger more efficient dredges to be used over the life of the site and will not exclude options such as smaller hopper barges.

D.08 Design Profile - For this evaluation, the design profile is average elevation, or depth, within the disposal site as a result of dredged material deposits. Based on agency coordination to date it is not intended to create a maximum relief feature, such as an offshore bar, with the dredged material. Such a manmade bathymetric feature would likely have no significant adverse effects to the hydraulics of the area and may have positive effects. However, the excessive cost and time required to conclusively predict the effects of an offshore bar have precluded consideration of this type of design profile. Instead, it is intended to arrive at a low profile, minimum relief design. This will have the effect of requiring an enlarged disposal site, but will result in a profile that is compatible with adjacent bathymetry to the west and south.

D.09 Wind and Wave Climate - Appendix C provides details regarding the physical processes at the Dam Neck Site. In theory wind-driven waves could create bottom velocities with the potential to move the surface sediments within the disposal site, which might have an influence on the choice of design profile. Wave stuidies carried out by the U. S. Army Corps of Engineers Coastal Engineering Researvh Center during 1983 to analyze the effects of a submerged bar at Dam Neck indicated that in each of three cases (swell wave, H = 2.5 ft.; storm wave, H = 10 ft.; and extreme wave H = 13 ft.), the predicted bottom velocities at the bar crest were above that necessary to initate sand motion. For the purposes of thus study the disposal site design profile had a crest elevation of -25 ft. Studies of the 1982 disposal operations at Dam Neck tend to confirm this, in that material placed to a crest elevation of -22 ft. was subsequently reworked by natural

processes. The emplaced material was monitored by bathymetric surveys, which showed that no significant reworking of material occurred on the disposal impression at elevations deeper than -26 ft. The lastest survey of Dam Neck (Feb 85) showed that the material has remained stable during a 1 to 2 year period following the initial reworking at the crest. During essentially the same period, the material placed at Dam Neck in 1982 was exposed to the storm events listed on Table D-1. Assuming a 6-hour duration, several of these events could have produced significant wave heights exceeding 10 feet. In theory, these events were severe enough to move the dredged material, and yet the material remained stable.

D.10 These aforemetioned studies and others suggest that for a dredged material design profile with elevation above -30 feet, some reworking at the crest is expected. However, if the disposal site design profile is kept to elevations deeper than -30 feet, under normal conditions significant net movement of dredged material would not be expected.

Table D-1 DERIVED SIGNIFICANT WAVE HEIGHT FOR RECORDED WIND EVENTS

| Date | Maximum Sustained Winds (mph) | Period (sec.) | Significant Wave Height (Hs) (ft.) |
|---|---|---|---|
| 11 Feb 83 | 36 | 7.1 | 10.1 |
| 14 Feb 83 | 35 | 7.0 | 9.8 |
| 24 Mar 83 | 36 | 7.1 | 10.1 |
| 27 Feb 84 | 35 | 7.0 | 9.8 |
| 08 May 84 | 37 | 7.3 | 10.5 |
| 18 Jun 84 | 37 | 7.3 | 10.5 |
| 12 Sep 84* | 38 | 7.5 | 11.5 |

*Tropical storm/hurricane

Sources: 1. The events are the most severe occurrences recorded during Feb 83 - Dec 84. From Monthly Summaries compiled in the Local Climatological Data recorded at National Weather Service Office, Norfolk International Airport, Norfolk, Virginia.

2. Significant wave height ($H_s$) and period derived from Figure 3-24, deepwater significant wave prediction, page 3-50, U.S. Army Corps of Engineers Shore Protection Manual, Fourth Edition, 1984, as limited by 6-hour duration.

D.11 Other Criteria and Constraints - The disposal site design analysis should also consider other pertinent criteria, such as known navigation areas, resource areas, significant wrecks or obstructions, and other established uses of the ocean. These criteria were addressed in the main report under the specific criteria for site evaluation. For expansion of the Dam Neck Site either northward or eastward, existing wrecks and navigation areas can be considered as constraints. Therefore the enlarged site boundaries will be held a conservative distance from these features to prevent interference. As stated in D.05, westward expansion has disadvantages because of more shallow bathymetry. With these exceptions, the other specific criteria do not establish significant constraints. However, cost should also be considered in the design analysis. To the extent allowed by the previously stated constraints, enlargement of the site to the north and east brings the disposal site boundaries slightly closer to the channel dredging areas, and thus would be advantageous by reducing the dredged material transportation cost. All other factors being equal, expansion of the site to the south would be disadvantageous because of increased haul distance and cost, and for this reason will not be considered.

SITE DESIGN ANALYSIS

D.12 Size - The disposal site size may be considered as the bottom area required to accommodate the needed design capacity. Since the capacity of a non-dispersive disposal site is a function of the bottom area and average thickness of dredged material deposits, the site size and design profile cannot be considered independently. The choice of a given bottom area, for example, coupled with the constraint of existing bathymetry, determines the

thickness of dredged material deposits and the design profile. Stated another way, choice of the design profile will determine the required bottom area. Figure D-1 depicts the relationship between design depth and bottom area required for the existing bathymetry at Dam Neck and the needed design capacities. The curves were fitted to points taken from the calculations in table D-2. For bottom areas larger than the existing Dam Neck Interim Site, it was assumed that expansion would be toward the north and east into deeper waters.

Table D-2. BOTTOM AREA/DEPTH CALCULATIONS

| | Bottom Area ($10^6$ ft$^2$) | Avg. Depth Existing (ft) | New Work Fill for 36 mcy (ft) | Total Fill 68 mcy (ft) | Design Depth (ft) |
|---|---|---|---|---|---|
| | 90 | 36 | 11.0 | 21 | 15 |
| | 105 | 38 | 9.0 | 18 | 20 |
| (DNIS) | 110(a) | 38 | 9.0 | 17 | 21 |
| | 125 | 40 | 8.0 | 15 | 25 |
| | 170 | 41 | 6.0 | 11 | 30 |
| (DNIS x 2) | 220 | 42 | 4.5 | 9 | 33 |
| | 270 | 42 | 4.0 | 7 | 35 |
| (DNIS x 3) | 330 | 44 | 3.0 | 6 | 38 |
| | 400 | 45 | 2.5 | 5 | 40 |

(a) DNIS - Area of Dam Neck Interim Site.

D.13 The size of the Dam Neck Interim Site was initially considered, shown by the vertical line on figure D-1. Also considered were reduction in size, expansion to as much as more than triple the area of the interim site, and intermediate sizes that would involve enlargement of the interim site. Figure D-1 enables the following comparisons:

a. The Dam Neck Interim Site, with an area of $110 \times 10^6$ ft$^2$, results in a design depth of about 21 feet. This design depth would restrict the size of dredging plant that could be used over the life of the site and would result in a large elongated mound of dredged material significantly different from the nearby bathymetry.

b. Reduction in size of the Dam Neck Site would further reduce the design depth and more radically change the local bathymetry. For bottom areas less than $100 \times 10^6$ ft$^2$, design depths are less than 20 feet. Such designs would approach conditions that may restrict local navigation as well as hopper dredges and will definitely produce a prominent offshore bar.

c. Enlargement of the site to three or four times the area of the interim site would result in design depths of about 38 to 40 feet, similar to the bathymetry within and adjacent to the interim site. Although this would unquestionably be a low profile design, such an expansion may be unnecessarily large and possibly conflict with other site selection criteria.

d. Enlargment of the site to between two to three times the area of the interim site would result in design depths of about 33 to 35 feet, still similar to and compatible with existing bathymetry. This would result in a low profile design, and the bottom area required can be accommodated within the established constraints.

D.14 Among the aforementioned alternatives, design such as c. will most advantageously satisfy the established design criteria. Based on site sizes within this range of double to triple the are of the interim site, the site configuration will be evaluated.

D.15 Configuration and Orientation - The expansion of the Dam Neck Site should be in a configuration that gains area in the north and east directions, while avoiding known wrecks and navigation areas. Expansion toward the west or south has effectively been ruled out. The existing Dam Neck Site is orientated parallel to the nearby bathymetric contours. For compatibility with existing bathymetry, the reconfiguration should also be aligned with these depth contours. Geometric shapes such as rectangles, parallelograms, or trapezoids are conducive to providing this type of configuration with a minimum of corner points.

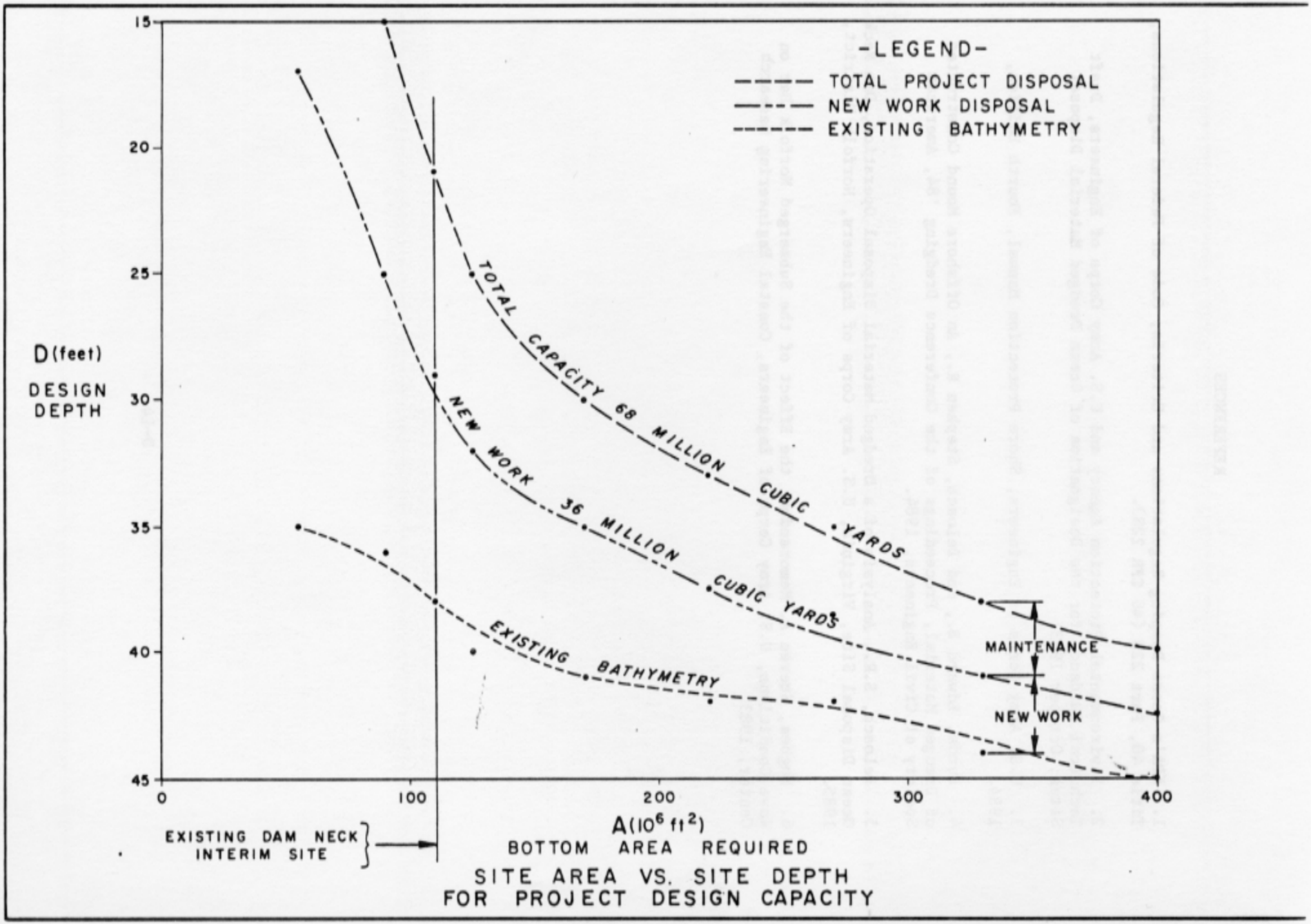
RECOMMENDED SITE DESIGN

D.16 Recommended Size - Based on the preceding analysis, a site size of 290 x $10^6$ $ft^2$, or about 10 square miles, is recommended. This is about 2-1/2 times the area of the existing interim site. The disposal site dimensions would be increased from 5,000 feet by 22,000 feet, to about 6,000 to 13,000 feet by 30,000 feet. Enlargement of the site size by this amount will result in a relatively low design profile, and not be unduly large for initial impact zone and surveillance considerations.

D.17 Design Depths - For the recommended size, the existing depth is about 42 feet, the design depth for new work dredging is 38 feet, and the design depth for the total disposal capacity is 35 feet.

D.18 Recommended Configuration - Figure 11 of the main report depicts the recommended configuration for the Dam Neck Ocean Disposal Site. This reconfiguration is based on a parallelogram aligned with existing contours, and fully encompasses the limits of the interim site. The corner point coordinate are approximately:

36 degrees 51' 20", 75 degrees 54' 43"; 36 degrees 51' 20", 75 degrees 53' 31"; 36 degrees 50' 52", 75 degrees 52' 49"; 36 degrees 46' 28", 75 degrees 51' 51"; 36 degrees 46' 28", 75 degrees 54' 19"; 36 degrees 50' 06", 75 degrees 54' 19".




SITE AREA VS. SITE DEPTH
FOR PROJECT DESIGN CAPACITY

FIGURE NO. D-1

## REFERENCES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# APPENDIX II

# SFEIS

# COMMENT/RESPONSE

# SECTION

APPENDIX II

COMMENTS/RESPONSES

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## 1. U.S. DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE, 28 JANUARY 1985

### 1.01 Comment

The biological studies mentioned in the document have not been completed and the preliminary data and findings are insufficient to support the conclusions presented.

Both the Summary (SFEIS-4, paragraph 1.10) and document (page 52-54) indicate that biological studies have been conducted. The summary erroneously refers to these studies as "extensive." The U.S. Fish and Wildlife Service study utilized existing literature for the most part and included one time sampling of benthic infauna at eight stations and epifauna at three additional stations. The Old Dominion University (ODU) study included four stations near the Dam Neck Site to characterize the non-commercial benthos. Based on three samples taken in March 1984 with a "commercial clam dredge" and three more taken in May 1984 with a rocking chair dredge, this same study concluded that there are no commercially important benthic infaunal populations in the Dam Neck area. The NMFS does not consider these studies to be sufficient to assess adequately the impacts of the proposed action. In fact, the fisheries and plankton studies conducted by ODU have not yet been finalized.

### 1.02 Response

The ODU biological studies referenced were conducted during the period of October 1983 to October 1984. These studies are now completed and the summarized results as documented in the ODU Final Reports are included in the FSFEIS and Appendix. The final reports include fisheries, plankton, benthos and water quality studies coordinated with and recommended by the Federal agencies for Dam Neck Ocean Disposal Site (meetings of 15 September and 9 November 1983). The results confirm the preliminary data disseminated in the Draft SFEIS. In addition, EPA has conducted a thorough survey of commercial benthic resources at Dam Neck Ocean site

and the results of this survey confirm the ODU studies (EPA letter of comment, January 25, 1985). We believe the combined field data and information from the literature permits adequate assessment of the impacts of the proposed action.

1.03 Comment

The stability of the existing disposal site has not been adequately demonstrated to support expansion to the larger disposal area.

In several instances, the document states that material disposed at the site will be stable and not migrate out of the disposal site. Appendix C on Physical Processes, which describes these phenomena in greater detail, Technical Report No. 27 prepared by Ludwick and Saumsiegle (1976). This refers to a report, entitled "Sediment Stability at the Dam Neck Disposal Site, Virginia," which indicates that existing waves can move fine sand material 80 to 90 percent of the time in the 35-foot deep sections of the site and 50 percent of the time in the 45-foot sections. Coarse sand particles on the 35-foot deep section can be moved by wave action 65 to 75 percent of the time and 35 percent of the time at 45-foot depth. The study, and a subsequent Corps report, both using a current velocity threshold of 20 cm/sec, concluded that currents are usually too weak to move such sediment, although wave energy is usually sufficient to induce oscillatory motion. However, Appendix C indicates that tidal current speeds have been measured in the study area between 8 and 49 cm/sec on the ebb and between 8 and 56 cm/sec on the flood. In another study involving the Norfolk Disposal Site (Boicourt, 1981), velocities of 50 cm/sec were recorded over a 5-day period inshore of station MF7 just north of the Dam Neck Site. Are these figures included in the 2.5 percent of the time that current speeds exceed the threshold of sediment translation, as noted in the report? It should also be noted that the 2.5 percent figure only represents the current velocities during mid-summer (July, August). Since Ludwick and Saumsiegle (1976) indicated that the principal movement of sediment probably occurs during storm events, the frequency, duration, and extent of storms should be

documented. The amount of material that could be displaced by one of these events should be calculated. Finally, the effect of the non-tidal eddy, (Johnson, 1976) on the study site should be discussed. While this reference is included in the list for Appendix C, we could not find it cited in the text.

1.04 Response

In regard to the non-tidal eddy, the circulation associated with the system has the most significant effect on the littoral zone, i.e., within the 30-foot contour. According to Brehmer (1971), a clockwise eddy is present along the shore south of Cape Henry. Thus, the inferred, non-tidal eddy should have no adverse impact on the disposal area. In reference to the stability of the existing disposal site, the District has found Dam Neck, both in the past and present, to be in a stable hydraulic environment. Although current velocities have been measured (Ludwick and Saumsiegle, 1976; and Boicourt, 1981) in excess of the threshold velocity required to induce sediment movement, the orientation and low relief of the proposed site are conducive to a negligible net effect that tide induced currents will have on the disposal impression. In view of principal movement of sediment produced during storm events (Ludwick and Saumsiegle, 1976), numerous wind events during the span of a Corps study (1985) had corresponding significant wave heights in excess of that needed to induce movement of bottom sediment (see Table D-1). However, from February 1983 to February 1985, the only apparent loss of dredged material at the disposal area was probably a result of settlement or scour along the crest due to the various storms that passed through the area. The total quantity of apparent dredged material losses were less than 0.5 % of the total amount of material placed at the site during 1982 disposal operations. The results of this study are further discussed in Appendices C and D.

1.05 Comment

The effects of the enlarged disposal site and altered bathymetry on shoreline wave energy patterns distributions have not been evaluated completely.

Ludwick and Saumsiegle (1976) state in their report that the mound (8 feet high, 9000 feet long, and 3500 feet wide) has caused an increase in wave height of 20 percent on a section of the coast. This phenomenon was only observed with waves from the northeast having a 12-second period. On the basis of these results, the document concludes that there will be no shoreline impacts from the enlarged disposal site as a result of altered wave energy distributions.

The NMFS does not agree with this evaluation. Winds from the northeast and east are associated with surge elevations which render shorelines vulnerable to high rates of erosion damage. In fact, your District has just completed an extensive plan for the protection of Virginia Beach from hurricanes and beach erosion. Since there is substantial development in the coastal area of Virginia Beach from Cape Henry to Sand Bridge, including the Dam Neck Naval Training Center, and the alteration of wave energies could compromise your hurricane and erosion control plan, it would appear prudent to conduct a formal wave refraction analysis for the enlarged disposal site configuration.

1.06 Response

In reference to shoreline wave energy pattern distributions associated with the enlarged disposal site and altered bathymetry, the Corps maintains its position that the proposed disposal area will not adversely effect the shorelines located 3 to 4 nautical miles onshore. Recent studies (CERC, 1983; Watts, 1983) have examined potential alterations in wave climate, caused by proposed ocean disposal in the vicinity of the Dam Neck site. CERC implemented a model study that evaluated the wave conditions with and without a proposed maximum-relief disposal site. The model considered three cases of wave conditions representing swell, storm seas and extreme storm seas. Case 1 was a swell represented with height (H) = 2.5 feet and period (T) = 14.4 seconds, occurring 1.2 percent of the time. The second case was typical of a northeaster with (H) = 10.0 feet and (T) = 8 seconds, occurring 0.6 percent of the time. The final case represented the extreme wind event with (H) = 13.0 feet and (T) = 12 seconds, occurring 0.03 percent of the time.

The wave scenario selected for the study was chosen as being most likely to be affected by the presence of an offshore disposal impression.

It was concluded that the phase difference between waves passing over the disposal site and those passing by either end will produce some refraction of the wave into the region in the lee of the site. Model simulation results show this refraction for the storm wave case, but the effect does not appear to be significant. It is felt that any shoreline impact will be minor and without consequence. As far as it can be determined, the disposal area would cause no adverse effects to the Virginia Beach - Cape Henry coastal sector (Watts, 1983). More importantly, these analyses were done on a worst-case situation - an offshore bar with a crest at elevation - 25 ft., which is a substantial change in local bathymetry. The presently proposed Dam Neck configuration and site use plans will result in an impression with minimum relief, compatible with adjacent bathymetry.

1.07 Comment

The impacts of the enlarged dump site on local tidal, riverine, and wind-generated current patterns have not been documented adequately.

While the DSFEIS acknowledges that the proposed disposal site is located within the influence of the Chesapeake Bay plume, it discounts any possible project-related impacts on the plume or local currents.

1.08 Response

In regard to the impacts on the Chesapeake Bay plume, local tidal, riverine, and wind-generated current patterns; the Corps maintains its position that the enlarged disposal site at Dam Neck will produce negligible effects. The Bay plume and other natural forces and influences result in a highly variable current pattern. In a recent study, CERC (1985) addressed the hydrodynamic conditions, relative to the Dam Neck disposal site area, which result from the interaction of tides, waves and winds. Results from analyses of data acquired September to December 1983 indicate that long period bottom currents are dominated by flows toward the south. Furthermore, the majority of outflowing surface

water from the Bay, i.e., the Chesapeake Bay plume, travels towards the south-southeast along the Atlantic sealanes, just east of DNDS. Coupled with the local Bay plume, the southerly drift of shelf water has the predominant influence on advective transport in the region (Alden & Butt, 1985). The influence of the enlarged disposal area on the plume and local currents is expected to be insignificant, in view of its location and low relief, and the substantial natural variances of the Bay outflow and climatic influences.

1.09 Comment

Ludwick and Saumsiegle (1976) indicated that the present Dam Neck Site was located on the boundary zone between the flood-dominated flow associated with the Thimble Shoals Channel at the Bay entrance and the ebb-dominated flow associated with the entrance margin off Cape Henry. Thus, water movements on opposite sides of the mound are in opposite directions. If the site is expanded to the north and east as proposed, it will extend into the water mass dominated by the flood flows and moving in a generally westerly direction toward the Thimble Shoal Channel. Changes in these existing current patterns either as a result of the proposed Atlantic Ocean Channel or the expanded use of the Dam Neck Site could significantly affect the recruitment of fish, crabs, and juvenile sea turtles to Chesapeake Bay.

Figure 5 and 27 shows the blue crab nursery area. This zone might in fact be more appropriately labeled as a part of the blue crab spawning and overwintering area. Mated female blue crabs migrate to this area of the lower Bay where they overwinter buried in the sediments. Sponge crabs (egg-carrying females) are usually first seen in late May and June, with a second spawning in August. Eggs hatch 14 to 17 days after spawning, zoeae are released into high salinity waters, and then zoeae move in the neuston out of the Bay into offshore waters where development proceeds. Following metamorphosis into the megalops stage, the crabs settle toward the bottom and begin to migrate back into the Bay.

Both the exact recruitment mechanism and the dimensions of the nearshore blue crab nursery area are unknown. However, current patterns around the

Bay mouth play an important role in retaining blue crabs in Chesapeake Bay. Thus, any alterations in current patterns could adversely affect blue crab recruitment. The value of this fishery can be seen by the fact that in 1983 the mid-Atlantic states reported landings of 98 million pounds with a value of $29 million. The Virginia fishery was 46.1 million pounds with a value of $11 million.

Other important commercial and recreational species which utilize the Bay and could be adversely affected by changes in current patterns include but are not limited to, Atlantic croaker (Micropogonias undulatus), spot (Leiostomus exanthurus), black sea bass (Centropristis striata), and summer flounder (Paralichthys dentatus). Of these, the following are known to spawn within the area proposed for the disposal site: Atlantic croaker, spot, weakfish, black sea bass, and Atlantic menhaden (Grosslein and Azarovitz, 1982). Estuaries and coastal waters in Virginia and North Carolina produce more than 50 percent of the Atlantic coast menhaden fishery. In 1983, this fishery harvested 927 million pounds valued at $37 million.

1.10 Response

As described in Appendix C of the Site Evaluation Study, no significant changes in current patterns is anticipated.

The concern over the potential changes in the existing current patterns, either as a result of the proposed Atlantic Ocean Channel or the expanded use of the Dam Neck site, significantly effecting the recruitment of fauna to the Chesapeake Bay is acknowledged. However, by virtue of the physical studies conducted in the aforementioned area, analyses reflect a predominant flow parallel to the coast. Proposed eastward and northward site expansion would yield a low profile and configuration that is compatible with the surrounding bathymetry. Thus, existing current patterns should remain unaltered despite the long term disposal. The normal recruitment of fish, crabs and juvenile sea turtles to the Chesapeake Bay should be unencumbered by disposal operations at Dam Neck.

1.11 Comment

The impacts of the existing and proposed expanded disposal site on endangered and threatened species found in or migrating through the disposal site have not been addressed adequately .The NMFS disagrees with the conclusion that the endangered and threatened sea turtles will not be affected by the use of the Dam Neck Site for a permanent ocean disposal site (page 26, paragraph 45).

Four species of sea turtles regularly occur in the Dam Neck Site area during the summer (May-October): threatened loggerhead (Caretta caretta), endangered green (Chelonia mydas), endangered leatherback (Dermochelys coriacea), and endangered Atlantic ridley (Lepidochelys kempii). All species migrate north along the Atlantic Coast during the spring following the 20°C water thermocline. As a result, they arrive in the Chesapeake Bay area as a group rather than as individual animals. Both the loggerhead and ridley forage on jellyfish near the mouth of the Bay until the Fall (October-November). In addition, it is not known conclusively just how these species find the Bay. If they utilize chemical cues, then alterations in current patterns at the Bay mouth could disrupt or delay their entrance into the Bay.

While a considerable amount is known about the movements of the loggerhead and ridley inside Chesapeake Bay, little is known about their coastal migration patterns. Since both the loggerhead and ridley are benthic epifaunal invertebrate feeders, disposal operations which would alter the benthos could adversely affect these two species. Any disruption of their feeding habits could be significant since turtles arriving at the Bay following their winter migration are usually in poor condition.

It is our opinion that the best method of avoiding any impacts to these threatened and endangered species is to designate the Norfolk Disposal Site, not Dam Neck. However, should you pursue the Dam Neck proposal, we recommend completing studies to determine the coastal migratory patterns of sea turtles. We would suggest that you utilize a radio tagging approach using sea turtles captured near Diamond Shoals in North Carolina.

Finally, while not actually a part of the proposed project, dredging in the Thimble Shoals Channel as part of the deepening could have an adverse impact on migrating turtles. Recent data indicate that the loggerhead and ridley migrate into the Bay in May and June through the Thimble Shoals Channel. In order for the NMFS to issue a finding of no effect pursuant to Section 7 of the Endangered Species Act of 1973 (ESA) for a proposed Virginia Department of Highways and Transportation project located in Thimble Shoals outside the Bridge Tunnel, dredging should be precluded from between May 1 and June 30. A meeting in Norfolk on January 11, 1985, established time constraints, which the NMFS intends to apply to all dredging projects within the Thimble Shoals Channel. Therefore, the NMFS suggests that the Corps consider expanding the migration study to include the sea turtles' entry into and dispersal within the Chesapeake Bay. Following the receipt and analysis of the data gathered during these studies, the NMFS will re-evaluate the status of these proposals pursuant to ESA.

1.12 Response

The disposal of dredged material at Dam Neck Disposal Site will not alter current patterns at the Chesapeake Bay mouth. The suspended solids associated with disposal, as described in paragraphs 51- and 86-89 would be a minor and short-lived water column change and should in no way disturb the migration of sea turtles. The impact on benthic communities will be localized to an area which is only a miniscule portion of the total bottom area over which the migrating turtles pass. The turtles, being opportunistic feeders, should have no difficulty in finding adequate adjacent food resources to sustain their winter migration. The jellyfish, which both the loggerhead and ridley forage on near the Bay mouth should in no way be adversely impacted by disposal at Dam Neck Disposal Site, 10 miles away. A more detailed discussion of this subject and dredging impacts has been included in paragraph 51 of the Site Evaluation Study.

1.13 Comment

The NMFS strongly disagrees with the statement (page 66, paragraph 92) that there are no conflicts or problems for each of the 11 specific and

five general criteria for selecting a disposal site. This letter outlines problems which the NMFS considers to be unresolved. We compare these impacts with the general and specific criteria presented in Code of Federal Regulations, Title 40, Section 228.5 and 228.6 (the Environmental Protection Agency's Final Revision of Regulations and Criteria for Ocean Disposal Site Designation).

Section 228.5(a) states: "The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation."

The NMFS concludes that these conditions have not been met. The document indicates that the area supports commercial and recreational fisheries (pages 39-44, paragraph 65, (a) and (b)). In addition, there is a substantial amount of recreational navigation through this area.

1.14 Response

While it is recognized in the document that Dam Neck is a region of commercial and recreational navigation and existing fin-fisheries, the deposition of dredged material at the site (as stated in paragraphs 49, 71(a) and (b), 74 and 82 of the S.E.S.) would not interfere with these activities. Dumping material from a split hull or bottom-dump hopper dredge would take from 5 to 15 minutes, not adequate time to impede any other navigation through the area. The U.S. Coast Guard (letter of 18 January 1985) has requested advance notice of dredging and disposal activities, but has expressed no objections to use of the Dam Neck Site from a navigations standpoint. In test dumps performed at the Norfolk Disposal Site using Thimble Shoal Channel sediments (Darby, et.al. 1981) it was observed that the bulk of the dumped material settled quickly to the bottom, and little if any was still in suspension one hour after each dump. Regardless of bottom surge velocities, it was found that dumped material was largely confined to within a 300-m radius from a point source (also confirmed by Bokuniewicz, 1979). In both studies bottom

surges decayed rapidly within the first 6 to 10 minutes. Given the small total area of impact in the water column, the short duration of this impact and the ability of finfish to actively avoid this relatively small area, interference with fisheries is reasonably expected to be either minimal or non-existant.

1.15 Comment

Section 228.5(b) states: (b) "Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery."

The NMFS concludes that the conditions noted in subsection (b) have not been met. Conclusive evidence has not been presented to show that the impacts of the disposal operations will not affect local beaches. Secondly, the NMFS considers the blue crab overwintering, spawning, and nursery zone both inside and outside the mouth of Chesapeake Bay as a known geographically limited shellfishery. We consider a geographically limited fishery to include not only the actual area in which the fishery occurs but also any important habitat critical to that fishery. Since the exact extent of the nearshore blue crab nursery and recruitment patterns are not known, the NMFS concludes that it is not possible to determine accurately just what effect the use of the Dam Neck Site as a disposal site will have on this important resource. Therefore, since the proposed Dam Neck Site is located near a geographically limited shellfishery, and since it cannot be demonstrated that there are no impacts to this resource, this condition of subsection (b) has not been met.

1.16 Response

Refer to response 1.20 regarding effects on beaches.

Dam Neck Disposal Site was evaluated with full knowledge that the limited and temporary perturbations in water quality during the initial mixing after dumping would be reduced to normal ambient seawater levels shortly following dumping. This is described in paragraphs 87 and 88 of the Site Evaluation Study as observed during test dumps at the Norfolk Disposal Site. Based on these results and information presented in paragraphs 91-93 no significant impact to blue crabs is anticipated.

1.17 Comment

Section 228.6(a) lists 11 factors which must be considered in the selection of disposal sites. Results of this consultation must be presented in environmental impact statements. NMFS feels that consideration of the following factors has not been adequate: Section 228.6(a)(2): "Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases."

Page 26, paragraph 43 of the document states that there are extensive fish migrations through the study area. Our earlier comments under Current Pattern Changes and Endangered Species explained the importance of this area to living marine resources. Virtually all of the biological processes listed in this subsection occur within the proposed disposal site.

1.18 Response

Section 228.6(a)(2) has been addressed in further detail in paragraphs 46-49, 71(a) and (b), and 91-93 of the Site Evaluation Study. Biological processes occurring in the area off Dam Neck Disposal Site, including fish migrations, larval transport, etc., and the impacts associated with these processes, is also documented in the above referenced section of the SES Appendix.

1.19 Comment

Section 228.6(a)(3): "Location in relation to beaches and other amenity areas."

While the document states that disposal will not affect Virginia Beach, located approximately 3.5 miles away, the NMFS does not concur. It has not been demonstrated conclusively that dredged material or increased turbidity will not be carried from the site to the beaches or that the created disposal mound will not increase or alter longshore wave energy distributions. Our conclusions are supported by previous sections in this letter dealing with Spoil Site Stability, Shoreline Impacts, and Current Pattern Changes.

1.20 Response

The concern for dredged material or increased turbidity being transported from the site to the beaches or the expanded disposal area altering longshore wave energy distributions is acknowledged. The Corps has obtained substantial evidence to support the continued use of the Dam Neck disposal area. Based on results of a study (DeLoach, 1985) that evaluated the stability of 854,000 cubic yards of dredged material deposited in the Dam Neck disposal area between August and November 1982, the only apparent loss of the material between February 1983 and February 1985 was a direct result of settlement or scour along the crest due to various storms that passed through the area. Based on hydrographic surveys, which were used to monitor the construction and stability of the low profile impression, the total quantity of apparent dredged material loss was above the 26 foot contour. The gross loss of material from the dump area was not detectable within the accuracy limits of state-of-the-art bathymetric surveys, and thus cannot be considered as significant net movement. Consequently, the probable impact of disposal activity on beaches 3.5 nautical miles away should be negligible. Increased turbidity, resulting from disposal operations at Dam Neck, is expected to be short term and concentrated primarily over the disposal area. Thus, no significant impacts should be felt along the beaches of Virginia Beach. The enlarged, low relief disposal site is expected to have insignificant effects to shoreline wave energy distribution, based on studies of a maximum-relief bar profile. See response 1.06. It should be noted that the change from the maximum-relief disposal profile

proposed in 1983 to the presently proposed minimum-relief low profile was a result of NMFS's and other agencies' concerns with the wave effects of the maximum-relief profile.

1.21 Comment

Section 228.6(a)(6): "Dispersal, horizontal transport and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any."

Page 35, paragraph 61, notes that no data are available on the vertical mixing characteristics at the site. This section states that no adverse impacts are expected since the dredge material dumped at the site is not expected to shift substantially by vertical mixing (emphasis added). The NMFS does not concur, as noted in our previous comments dealing with Spoil Site Stability and Current Pattern Changes.

1.22 Response

In reference to dispersal, horizontal transport and vertical mixing characteristics of the area, the Corps maintains its position that no adverse impacts are expected. The dredged material dumped at the site is not expected to shift substantially by vertical mixing which in the study area is at a maximum during the winter. The southerly drift of shelf water combined with the local Bay plume dominate advective transport in the region. As a result, the advective transport and the maximum vertical mixing in the study area would not produce adverse impacts. See paragraphs 65-67.

1.23 Comment

Section 228.6(a)(9): "The existing water quality and ecology of the site as determined by available data or trend assessment of baseline surveys."

Paragraph 79 on page 59 indicates that depressed dissolved oxygen values have been reported for the Dam Neck area during the summer, perhaps due to the disposal of fine grained dredge spoil, which may interact with the Hampton Roads Sanitation District (HRSD) outfall. Because the local area

around this proposed disposal site is so productive, any increase in the extent or severity of the dissolved oxygen depression because of dredge spoil disposal could affect significant living marine resources.

Since the proposed disposal site is presently experiencing low dissolved oxygen levels as a result of an apparent interaction between the existing disposal operation and the HRSD outfall, the NMFS concludes that consideration of these conditions in this subsection has been inadequate.

1.24 Response

The Site Evaluation Study (paragraphs 86-89 and Appendix B, paragraphs B.03-B.05) has been revised to include a discussion of the subject of the dissolved oxygen patterns of DNDS and vicinity. There is no apparent connection between the low D.O. levels in the area and either the HRSD outfall or the DNDS. A monitoring plan for D.O. is included in paragraph 112, section (f) of the SES.

1.25 Comment

Page 48, paragraph (h) Wastewater Discharge states that the continued use of Dam Neck for the disposal of dredged spoil is not expected to affect HRSD's use of the area for wastewater disposal. Paragraph 79 on page 59 indicates that some inter-action between these two activities may take place and depress some local dissolved oxygen levels. These two sections should be revised.

1.26 Response

The text has been revised. Recent studies (Alden and Butt, 1985) and data provided by HRSD indicate that neither the wastewater outfall nor dredged material disposal were significantly associated with the oxygen pattern of the region.

1.27 Comment

Page 59, paragraph 80, indicates that the material disposed of at Dam Neck would meet Corps/EPA Ocean Disposal Criteria and be uncontaminated. These criteria utilizing chemical and biochemical analysis do not eliminate contaminated material. Therefore, some contamination over

background levels may be introduced into the disposal site. This is particularly true if this site is designated for the disposal of any material meeting the criteria. The statement should be changed to reflect the fact that some of the material proposed to be placed at the site could be contaminated.

1.28 Response

This paragraph has been revised (paragraph 87 of the SES).

2. U.S. ENVIRONMENTAL PROTECTION AGENCY, JANUARY 25, 1985

2.01 Comment

On November 9, 1983, the resource agencies met to define the major areas of biological concern. These included assessing the existing fisheries, shell fisheries, nursery, feeding or passage areas of living resources in adult or juvenile phases and, any interferences with fishing and fish and shellfish culture. Studies by the U.S. Fish and Wildlife Service and Old Dominion University, as well as our own surveys have fairly well defined the existing benthic, shellfish, and fin fishery populations. However, the impacts to the vulnerable larval and juvenile stages of the many ocean spawning species are not well understood. As an example, it is known that the blue crab (Callinectes sapidus) spawns at the mouth of the Chesapeake Bay and according to the Draft Supplement, is found as planktonic larvae at the site. Further, it has been shown by Johnson (1982) that the megalopae stage may exhibit extremely patchy distributions. This could lead to substantial mortality of megalopae in the event that dredged material disposal coincided with the location of a high density patch. Similar distributions of larval concentrations may also occur for the croaker (Micropogon undulutus), spot (Leiostomus xanthurus), mackerel (Scomber scombrus) and the window pane flounder (Pseudopluronectes americanus) (Grosslein and Azarovitz, 1982). There is insufficient information in the Supplement to assess the overall impacts to the larval communities. It was not clear in the Supplemental whether the uncompleted studies contracted to Old Dominion University would address this issue. If significant losses are a potential, then

mitigation may be required such as limiting the discharge or placing time of year restrictions. Attached is a study completed for the Norfolk Site on this issue.

2.02 Response

The potential impacts to larval and juvenile stages of fish and shellfish is addressed in the Final Supplement and in more detail in paragraphs 89-93 of the Site Evaluation Study. The conclusion of this evaluation is that significant losses are not anticipated, therefore, mitigation for these resources in the manner suggested or by some other means is not required.

2.03 Comment

The Supplement, in paragraphs 49 and 61, discussed sediment transport from the site. It was concluded that there was sufficient energy at the site to suspend and work the sediments, but that the long-term trend was to produce oscillating motion resulting in insignificant net transport of sediments. Therefore, it was concluded that there would be no impacts outside the site and minimal inside, and that recolonization of benthics would occur rather quickly. First, we do not believe there is sufficient data to assure that there is not net transport from the site and that any transport would not be toward beaches or toward areas of higher productivity such as at the mouth of the Bay. Second, if oscillating motion is assured and given sufficient energy to maintain sediments in suspension, the rate of recolonization would be greatly reduced as infaunal communities would be constantly subjected to high turbidity, burial, and to any contaminants within the dredged material. Further, once particles are suspended in oscillatory flow, the critical value of fluid velocity significantly decreases, requiring only a small fluid velocity to maintain motion (Sleath, 1984). In reviewing the report on impacts from dumping, it was assumed that turbidity and sediment bed instability was a temporary phenomana. As noted above, this may not be the case.

2.04 Response

Your concern over the sediment transport characteristics at Dam Neck is acknowledged. However, analyses of recently completed studies associated with Dam Neck indicate that virtually all dredged material dumped at the disposal area remained within the site boundaries. This information is discussed in further detail in Appendix C. Although a small fluid velocity is required to transport sediment once the particles are suspended in oscillatory flow, the conditions at Dam Neck are such that the wave induced currents, which decrease with depth, and the tidal and residual currents, which decrease in magnitude with distance from the mouth of the bay, together with consolidation of sediments with respect to time, produce a climate that is incompetent in transporting significant amounts of dredged material from the site. Local sediment movement and sorting, within the boundaries of the proposed site, may occur but consolidation of those materials together with the incompetent physical factors predominating in the region produce little net movement. This is further substantiated by bathymetric surveys which reveal very little change in the post-dump condition over time.

2.05 Comment

Physical

We are concerned with the transport of sediments toward beaches, shorelines, marine sanctuaries; or toward any known geographically limited fishery or shellfishery as defined in Section 228.5(b) of EPA's Ocean Dumping Regulations. While Appendix C of the DEIS contains an overview of the physical processes at the mouth of the Chesapeake Bay and along the coast of Virginia, it may not adequately address the transport of fine grained sand and silt from the site. Figure No. C-2 shows the mean annual current vectors for bottom circulation toward shore along Virginia Beach. While it was noted that the vectors were of weakest magnitude, it was still in an on-shore direction. If transport were to occur, it would be toward one of the east coast's most expensive resortcommunities. As shown by Sleath (1984), once initial motion has occurred, even the weakest steady current can carry the sediments along.

Further, the creation of mounds significantly decreases the energy required for entrainment as opposed to a flat bed of sediments as presently exists.

2.06 Response

While it was noted that the vectors from figure no. C-2 show the main annual current to be directed toward Virginia Beach, it must be emphasized these vectors are representative for the areas seaward of the littoral zone. Thus, mean annual vectors directed toward the coastline from the pelagic zone cannot be assumed nor projected onto the littoral zone. If any significant transport events were to occur, it would be parallel or sub-parallel to the coast.

2.07 Comment

The configuration of the proposed disposal site as identified on page 64 was not adequately discussed. The disposal site design evaluation of Appendix D provides a detailed explanation of what the minimal size of the site must be. While we concur with the calculation of what the minimum site requirements should be for disposal of 70 MCY we believe that the configuration does not conform to 40 CFR 228.5(d). The configuration may not permit effective monitoring and surveillance. While the configuration conforms to the depth contours, it would be more difficult for a contractor to stay within the site boundaries. Further, there is a possibility of materials from the disposal site being redeposited in the Atlantic Ocean Channel. As an alternative, we would recommend that the site be designed in a uniform rectangular pattern of 13,000 by 22,000 feet. The actual width may be modified based upon the amount the new configuration could hold.

2.08 Response

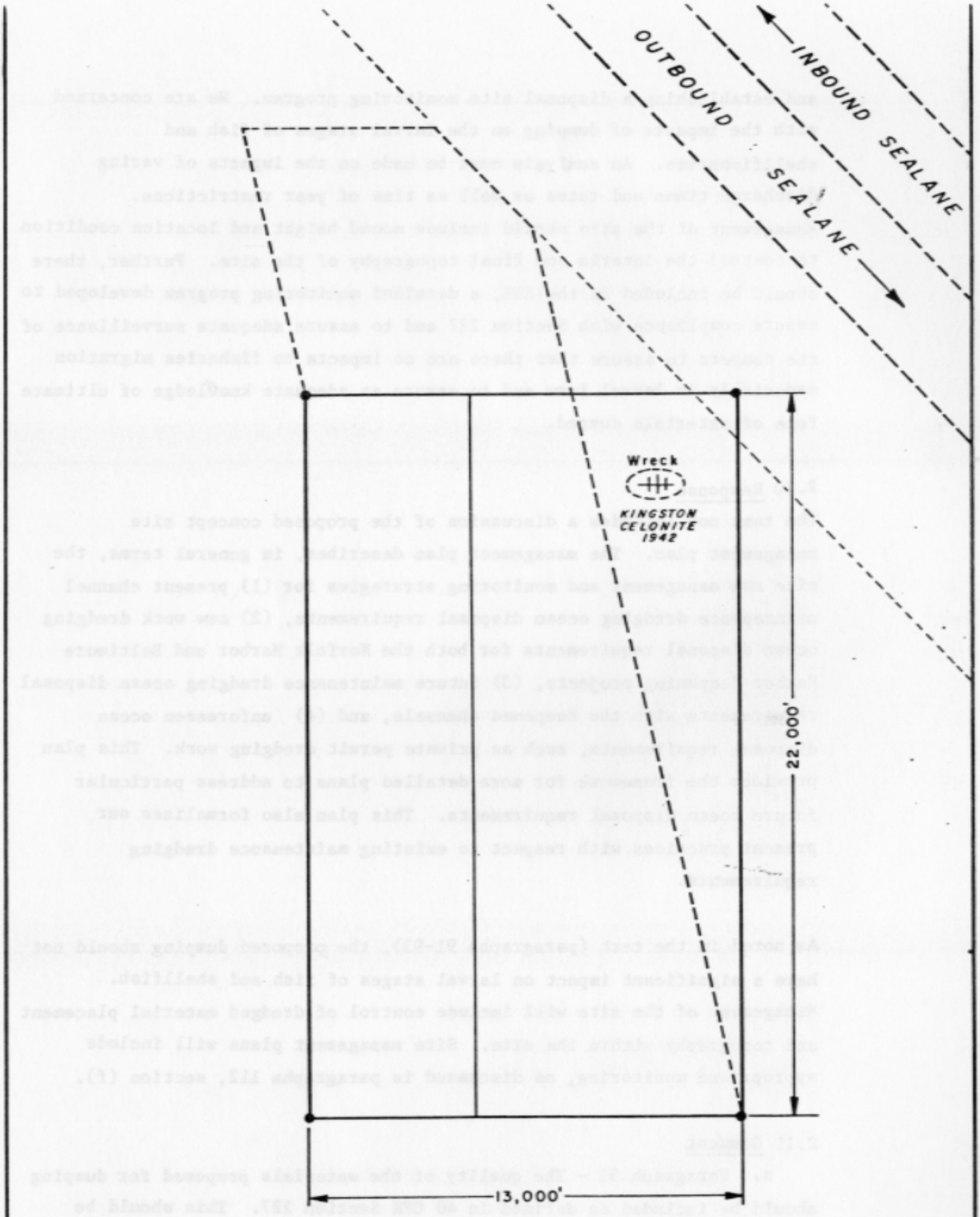
The discussion of the proposed configuration has been expanded in the text (paragraph 98). We believe this configuration conforms with 40 CFR 228.5(d). The effectiveness of surveillance and monitoring is not so much a function of site configuration, but is greatly influenced by total site area and remoteness or distance offshore. EPA agrees the total

recommended site area is needed to provide adequate disposal capacity. As described in the revised text (paragraphs 102-114), we propose to manage the site use by dividing the configuration into sub-areas that will enable effective surveillance and monitoring and afford a sediment management strategy. Disposal operations will be further aided by the use of marker buoys and electronic positioning systems which are now common on the modern hopper dredges. Staying within the specified disposal sub-area should not be difficult for the contractors. As checks, contract surveillance normally will include routine inspection, reporting requirements, and after disposal surveys, which are all standard practice now for Thimble Shoal and Cape Henry Channel maintenance dredging. There is only a remote possibility that significant quantities of sediments will be transported from the site more than 5000 feet to the Atlantic Ocean Channel. This is due to the predominant long term currents which are directed parallel or sub-parallel to the coast. Furthermore, consolidation of fine and course grained sediments minimizes the possibility of appreciable dredged material being transported from the site.

While it is true the EPA recommended alternative configuration, a rectangular pattern 13,000 feet by 22,000 feet, would provide essentially the same capacity as the COE proposed configuration, the EPA plan may be less conducive to sediment management. Part of the proposed management strategy would be to deposit the predominantly granular materials, that would not, for whatever reason, be used immediately for beach nourishment, within the shoreward portions of the site. The COE plan provides a northern sub-area for this purpose which is strategically located with respect to Virginia Beach and the channel dredging requirements. In addition, the EPA plan may result in burial of a known wreck, the 500-ton vessel KINGSTON CELONITE which sank in June 1942 (see paragraph 78 and figure no. II-1).

2.09 Comment

The DEIS has not addressed regulation of disposal use as provided in 40 CFR Section 228.7. This should include establishing limitations on times of dumping, rates of discharge, locations, if any, within site boundaries,




DAM NECK OCEAN DISPOSAL SITE
EXAMPLE OF
EPA PROPOSED CONFIGURATION
TOTAL AREA = 10.3 st. mi$^2$

SCALE: 1" = 4,000'



FIGURE NO. II-1

and establishing a disposal site monitoring program. We are concerned with the impacts of dumping on the larval stages of fish and shellfisheries. An analysis must be made on the impacts of varing discharge times and rates as well as time of year restrictions. Management of the site should include mound height and location condition to control the interim and final topography of the site. Further, there should be included in the EIS, a detailed monitoring program developed to assure compliance with Section 227 and to assure adequate surveillance of the dumpers to assure that there are no impacts to fisheries migration especially in larval form and to assure an adequate knowledge of ultimate fate of materials dumped.

2.10 Response

The text now includes a discussion of the proposed concept site management plan. The management plan describes, in general terms, the site use management and monitoring strategies for (1) present channel maintenance dredging ocean disposal requirements, (2) new work dredging ocean disposal requirements for both the Norfolk Harbor and Baltimore Harbor deepening projects, (3) future maintenance dredging ocean disposal requirements with the deepened channels, and (4) unforeseen ocean disposal requirements, such as private permit dredging work. This plan provides the framework for more detailed plans to address particular future ocean disposal requirements. This plan also formalizes our present practices with respect to existing maintenance dredging requirements.

As noted in the text (paragraphs 91-93), the proposed dumping should not have a significant impact on larval stages of fish and shellfish. Management of the site will include control of dredged material placement and topography within the site. Site management plans will include appropriate monitoring, as discussed in paragraphs 112, section (f).

2.11 Comment

a. Paragraph 52 - The quality of the materials proposed for dumping should be included as defined in 40 CFR Section 227. This should be

included as an Appendix rather than in the body of the EIS as information was already provided in the Channel deepening study.

2.12 Response

This information has been included in Appendix B entitled "Sediment and Water Quality."

2.13 Comment

b. Paragraph 65 - We are presently preparing a separate report on the findings of our studies at the Dam Neck Site. Preliminary indicators are similar to the findings by Old Dominion University. There were no commercial benthic species and the area appeared to have no unique features, either physically or biologically. It should be noted that we do have ship time and contract support to assist the COE in developing any future monitoring program.

2.14 Response

The results of EPA's field studies have been referenced in the final document. EPA's support is gratefully accepted.

2.15 Comment

c. Paragraph 65(g) Coastal Zone Management - While Virginia does not have an existing CZM program, they have initiated the first phase in its development. As such, they should be contacted and provided the opportunity for comment on the Draft. Due to the proximity to the state of North Carolina and the potential for transport of materials from the disposal site into North Carolina's waters, a consistency determination with North Carolina's Coastal Zone Management Plan must also be made. This would be required prior to site designation.

2.16 Response

The Virginia Council on the Environment is responsible for the emerging CZM program in Virginia. As such, they have been given opportunity for comment but have none at these preliminary stages of Virginia's CZM development. The North Carolina Department of Natural Resources and

Community Development, Division of Coastal Management has reviewed the Draft SFEIS and Site Evaluation Study for consistency with North Carolina's CZM plan. Their letter of response, dated February 19, 1985, states that " . . . it does not appear that the proposed expansion and final designation of the site will directly affect coastal resources in the state of North Carolina."

U.S. ENVIRONMENTAL PROTECTION AGENCY, 21 MARCH 1985

"Requirements to Comply with Sections 228.5 and 228.6(a):"

2.17 Comment

228.5(a) "The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation."

The Draft Supplement (DS) does not adequately address these conditions. As noted on page 17 of the DS, the EPA/Corps Draft Technical Guidance document provides detailed comments on what should be addressed to comply with site designation. The Zone of Siting Feasibility (ZSF) was developed to provide a graphical depiction of the area feasible for disposal. It is understood that the optimal site selected from ZSF should be economically, operationally, and environmentally feasible. There are six specific factors for ZSF which were broadly addressed on pages 18-23, several of which must be expanded.

2.18 Response

The discussion of the factors for delineating the ZSF has been revised. See paragraphs 27-42.

2.19 Comment

The costs of transportation for disposal should be compared with the costs of the navigation project and the benefit cost ratio then used to set the maximum distance feasible based upon the type of dredging and

disposal plant. Simply stating, as on page 20, that transporting the material a greater distance costs more is not sufficient. It should be clearly understood what the costs are versus distance, and how that compares to the overall project costs. For example, we know that the Norfolk site is further from the channel than the Dam Neck site, but we do not know the cost differential.

The dredge plant limitations should be clearly understood. Page 19 specifically states why the 30 foot depth contour is used but does not state what the maximum transportation distance could be. For example, if the plant must make four trips to the disposal site per day, travels at 10 knots, and takes two hours to load, the maximum distance might be 25 miles. In the DS the maximum distance was arbitrarily selected at 19 miles based upon the distance to the Norfolk site.

The feasibility of disposal off the continental shelf should be based upon the ZSF as defined above.

2.20 Response

See revised text paragraphs 27-42. The costs of the navigation project as a whole are used in the project benefit-cost analyses, as are the benefits of the project as a whole. To single out portions of the project, e.g. Thimble Shoal and Atlantic Ocean Channels, then assume the costs of these portions can be increased to the limit of the total project benefits, is not an appropriate analysis and is not what was intended by the EPA/Corps Draft Technical Guidance. In the case of strongly justified projects such as Baltimore Harbor or Norfolk Harbor, limited segments of the overall project could be assigned cost increases of several orders of magnitude within the limit of the total project benefits. The benefit-cost ratio (BCR) would not realistically set the maximum feasible ocean disposal distance unless the project approached a marginal justification (i.e. BCR = 1.0) as the ocean disposal costs increased.

Comparative ocean disposal costs for points within the ZSF are given in the revised text. In the case of the Norfolk Harbor or Baltimore Harbor

project, adequate contractor dredge plant is available to do the job, and does not pose a limit to the daily number of disposal trips nor to the disposal distance. The distance of 19 miles to the limit of the ZSF was not arbitrarily set, since it would not be practical to haul material farther than the Norfolk site. It is our understanding that EPA designation of the Norfolk site is imminent.

Disposal beyond the continental shelf is clearly infeasible because of the distance involved.

2.21 Comment

The DS indicates that the Dam Neck site was selected to avoid areas of existing fisheries, shellfisheries, and regions of heavy commercial and recreational navigation. However, page 41 and 42 indicated a significant trawler and conch fishery. Further, the site is adjacent to Rudee Inlet, a rather large recreational port. This compares to the Norfolk site which is considered to have neither high recreational, commercial fisheries, nor navigational interest. Justification for selection of the Dam Neck site must therefore be made.

2.22 Response

The Norfolk District is continuing to pursue final designation of the Norfolk Disposal Site. The Dam Neck Site is also being pursued for final designation. The option of having two ocean disposal sites may prove to be beneficial in the future. As detailed in the SEIS and Appendices, no significant impact to recreational or commercial fisheries or associated navigation is anticipated (see paragraphs 81-82).

2.23 Comment

228.5(b) "Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine santuary, or known geographically limited fishery on shellfishery."

The DS has not adequately addressed these issues as noted in our letter of January 25, 1985. First, it was stated in Appendix A7 that there is extensive fish migration through the area including the vulnerable larval and juvenile stages of many ocean spawning species. The potential mortalities of these fisheries should be defined both during the primary mixing and during resuspension. As noted in the DS, there may be resuspension due to oscillating currents causing resuspension. Further, this may inhibit recolonization as infaunal communities are constantly subjected to high turbidity, burial, and any contaminants within the dredged material.

2.24 Response

See response to January 25, 1985 letter (response 2.02).

2.25 Comment

The potential for a significant fraction of the silts and clay fraction of the spoils reaching the beach, shoreline, or even possibly being reintroduced to the Bay has not been adequately addressed. As noted in our January 25, 1985 letter, once particles are suspended in oscillatory flow, the critical value of fluid velocity significantly decreased, requiring only a small fluid velocity to maintain motion.

2.26 Response

See responses to January 25, 1985 letter (2.04 and 2.06).

2.27 Comment

The Hampton Roads Sanitation District (HRSD) operates on ocean outfall within one nautical mile of the Dam Neck site. According to Appendix 13-2, there are depressions in dissolved oxygen concentrations observed in the Dam Neck area during summer months when stratification is greatest. The synergistic effects between ocean dumping and discharge from the outfall must be evaluated. Further, there was no analysis of BOD levels from the spoils which could be used for comparison. These analyses must be done.

2.28 Response

The issue of dissolved oxygen has been addressed previously in the National Marine Fisheries Service comment/response section (see response 1.24). As described in paragraphs B.07-B.08 of Appendix B to the Site Evaluation Study, the Norfolk Harbor and Channels sediments destined for ocean disposal have undergone thorough and extensive bioassay testing in compliance with the final criteria specified in the Federal Register (January 1977) and the complementary Implementation Manual (EPA/COE, 1978) which sets the technical guidelines by which the ecological effects of dredged material disposal must be evaluated before an ocean site may be permitted. The 3 year study of Norfolk Harbor and Channels sediments was designed to not only meet the EPA/COE guidelines, but to provide additional data to characterize acute and subtle sublethal effects of dredged material disposal on the biota of the proposed ocean site. The more sophisticated bioassays required by the EPA/COE Implementation Manual supercede the more elementary BOD analysis.

2.29 Comment

228.5(c) "If any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in Section 228.5-6, the use of such sites will be terminated as soon as suitable alternatives disposal sites can be designated."

On January 29, 1985 we received a request from the National Marine Fisheries Service requesting that we withdraw interim approval of the Dam Neck on the basis that the criteria were not being met. Upon completion of the Final EIS on this site and the designation documentation, it is our intention to make recommendations to EPA Headquarters on designation which will be consistent with Section 228.5(c).

2.30 Response

Comment noted.

2.31 Comment

228.5(d) "The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permits the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study."

As noted in our January 25, 1985 letter, the configuration of the proposed Dam Neck site as identified on page 64 was not adequately discussed. Appendix D must be expanded to present both capacity and configuration requirements.

2.32 Response

See response 2.08 to January 25, 1985, letter and revised text, paragraph 98.

2.33 Comment

228.5(e) "EPA, will whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used."

Concerning uses of sites off the continental shelf, we believe that this will be addressed in the ZSF as noted on page 21 of the DS. If the revised ZSF does include areas off the shelf, then a detailed feasibility study would be necessary.

The Dam Neck and Norfolk sites have been historically used and as such should be regarded as candidate sites.

2.34 Response

Comment noted.

2.35 Comment

228.6(a)(1) "Geographical position, depth of water, bottom topography and distance from coast."

Page 25 addressed this criteria. In addition, a detailed bathymetric survey chart should be included.

2.36 Response

Detailed bathymetry is shown on Figure 5.

2.37 Comment

228.6(a)(2) "Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult and juvenile phases."

As noted above, there is significant fishery and shellfishery at the mouth of the Chesapeake Bay. The DS has not documented the breeding, spawning, and nursery for this area nor adequately assessed the potential impacts to these resources.

2.38 Response

The Site Evaluation Study has been revised to include this information. (paragraphs 46-49, 71(a) and (b), 91-93 and Appendix A - "Living Resources - ODU Biological Field Studies").

2.39 Comment

228.6(a)(3) "Location in relation to beaches and other amenity areas."

The DS on pages 26-29 presents the shore areas of concern. However, Appendix C does not provide sufficient analysis of the potential impacts of the disposal to the beach areas. Specifically, we are concerned with the transport of fines to the beaches or other amenity areas.

2.40 Response

See responses to January 25, 1985, letter (2.04 and 2.06).

2.41 Comment

228.6(a)(4) "Types and quantities of wastes proposed to be disposed of, and proposed methods of release, including methods of packing the waste, if any."

In our January 15, 1985 we specifically stated that a detailed analysis of the spoils must be included. We further recommend that BOD and COD be included.

2.42 Response

See response to January 25, 1985 letter (response 2.28).

2.43 Comment

228.6(a)(5) "Feasibility of surveillance and monitoring."

The feasibility was discussed on page 33. However, the site designation should be also include a monitoring plan and a site management strategy.

2.44 Response

Site management and monitoring are discussed in paragraphs 102-114.

2.45 Comment

228.6(a)(6) "Dispersal, horizontal transport and vertical mixing characteristics of the area, including prevailing current direction and velocity."

As noted above, the horizontal transport and ultimate fate of the spoils was not adequately addressed.

2.46 Response

See response 1.22 to National Marine Fisheries Service.

2.47 Comment

228.6(a)(7) "Existing and effects of current and previous discharges and dumping in the area."

While the DS does present a good summary of previous dumping, the effects on biota and the coastal area is meager at best.

Such statements as presented on page 35 " . . . Because of the broad area over which these materials were dispersed during this period, there are no apparent cumulative effects of these deposits," are not based upon scientific data gathered and analyzed on such things as sediment contamination, charges in benthic community structure or other parameters from which to base these conclusions.

2.48 Response

These paragraphs have been revised to reflect the results of the ODU field studies performed (see paragraphs 68-70).

2.49 Comment

228.6(a)(8) "Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the oceans."

See our comments on 228.5 above.

2.50 Response

Response noted above (2.18).

2.51 Comment

228.6(a)(9) "The existing water quality and ecology of the site as determined by available data or by trend assessment on baseline surveys."

The recent studies by ODU should adequately address this issue. The DS noted that these studies were not completed as yet.

2.52 Response

Water quality and ecology has been addressed in greater detail in the final document (paragraphs 72-75). The results of the completed ODU studies have been incorporated into the supplement and appendices (Appendix A - "Living Resources").

2.53 Comment

228.6(a)(10) "Potentiality for the development or recruitment of nuisance species in the disposal site."

Page 55 of the DS only touches on the potential recruitment of nuisance species. To properly respond to this, the final report must address the following concerns. First, the existence of nuisance species in the spoils such as bacteria, viruses, and amoeba must be identified. Second, the viability of these species surviving at the site must be assessed. Finally, the potential change in community structure within or around the disposal site which would lead to nuisance species must be described. An example would be the organic enrichment of the sediments causing a change from a diverse healthy benthic population to a monotypic community dominated by nuisance species such as polychaetes.

2.54 Response

Disposal at Dam Neck Site has taken place for approximately 20 years with over 20 million cubic yards of material being deposited at the site. The macrobenthic investigations conducted by ODU did not reveal any significant differences in the benthic makeup of the site as compared to adjacent "unaffected" areas. While no specific microbiological investigations have been conducted, there is no reason to suspect that bacteria, viruses or amoeba would develop as nuisance species at the DNS. The channel sediments are relatively coarse-grained and low in organic content (poor growth medium), in addition, bacteria such as coliform are not likely to proliferate at the low bottom temperatures and high salinities associated with the open ocean site. Little or no change in biological makeup at DNS has been observed to date and the continued use of the site is not expected to alter this situation.

3. DEPARTMENT OF THE INTERIOR, U.S. FISH AND WILDLIFE SERVICE, JANUARY 28, 1985

3.01 Comment

The discussion of "Areas of Controversy" in Paragraph 1.15 states that the proposed rate of dredged material disposal at the Dam Neck Site is on

the same order of magnitude as historical rates. This statement is misleading. While the previous maximum rate of disposal (12 million cubic yards in 1969-1970) is the same as the maximum proposed rate, that previous rate occurred only once and the long-term historical rate is much less (less than 1 mcy per year). Under the present proposal, rates of 7 to 12 mcy per year would be maintained over a 3 to 5 year period, which is substantially higher than any historical use. In addition, the proposed placement of 70 mcy is more than 3 times the amount previously placed and encompasses an area 2-1/2 times the size of the existing site. Therefore, the potential impacts of the proposed project are not comparable to those associated with disposal activities that historically occurred as the site.

3.02 Response

This paragraph has been revised to reflect our presently anticipated construction schedule. The new work quantities are the same as in the draft, however the expected duration of project construction has now been revised to seven (7) years. This is based on construction in increments of 45 to 50 feet, and 50 to 55 feet. Table 9 shows the estimated construction schedule. The average rate of ocean disposal will be about 5 million cubic yards (mcy) per year, with a maximum of about 11-12 mcy occurring during the fourth year of construction. These rates of disposal are the same order of magnitude as the rates which occurred during earlier deepening projects.

3.03 Comment

Based on discussions between the Fish and Wildlife Service and the Corps, we understand that the primary purpose for seeking final designation of the Dam Neck Disposal Site is to provide a more economical site than the Norfolk Disposal Site for new work and future maintenance from the Norfolk Harbor and Channels deepening project. Paragraph 33 of the Appendix states that "these (transportation) costs are not in this case an absolute limiting factor, but will be used in comparing the relative economic merits of alternatives to the Dam Neck Site." However, the SFEIS fails to provide any information on the relative costs of these two

disposal sites or how these costs affect the overall cost-benefit ratio of the entire project. The Dam Neck Site was eliminated in 1981 from consideration as an acceptable disposal site for the Norfolk Harbor deepening project because of the important biological resources in the area and the site's proximity to the shoreline. It is apparent that the environmental "costs" of the Dam Neck Site are higher than the Norfolk Disposal Site alternative; however a full public interest review is not possible unless these environmental "costs" can be evaluated in relation to the economic savings associated with the Dam Neck Site. Section 1502.23 of the "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" (40 CFR 150-1508) states that "If a cost-benefit analysis relevant to the choice among environmentally different alternatives is being considered for the proposed action, it shall be incorporated by reference or appended to the statement as an aid in evaluating the environmental consequences." We maintain that if the Corps chooses a less environmentally acceptable alternative than the Norfolk Disposal Site, the economic savings must be documented.

3.04 Response

The primary purpose of seeking final designation of the Dam Neck site is to provide an environmentally acceptable and operationally efficient site for present and future ocean dredged material disposal requirements. The text (paragraphs 32 to 37) has been revised to show the relative costs of alternatives to the Dam Neck site. However, as stated in the text, the choice among disposal alternatives is not relevant to the overall navigation project benefit-cost analyses. The Dam Neck site was never eliminated from consideration, as you suggest. While we cannot agree that the Dam Neck site is less environmentally acceptable than other alternatives, we have documented the savings versus alternatives farther offshore.

3.05 Comment

The SFEIS is unclear as to whether the Dam Neck Site is being proposed for disposal of dredged material other than that from the Thimble Shoal, Cape Henry, and Atlantic Ocean Channels. Paragraph 6 of the Appendix states "In addition, the Dam Neck Ocean Disposal Site could be needed for

the disposal of material from Norfolk Harbor . . . if adequate disposal areas in the Norfolk Harbor area were not available." Since the SFEIS states that the Dam Neck Site is being sized to contain only the 70 million cubic yards of new work and maintenance dredging from the three aforementioned channels, the question must be raised whether the Corps anticipates expanding the Dam Neck Site at some future date. If this is the case, the SFEIS should address this possibility and its impacts.

3.06 Response

Once the Dam Neck site is approved for continuing use its use could be permitted for any materials meeting the ocean dumping criteria. Presently, we anticipate only the ocean disposal requirements for the three (3) Federal channels addressed in the text. Future expansion of the Dam Neck site would be a possibility, however, it is inappropriate to speculate on future ocean disposal requirements which cannot yet be identified.

3.07 Comment

Section 40 CFR 1502.14 states that the evaluation of alternatives "is the heart of the environmental impact statement" and that the EIS should "present the environmental impact of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public." The SFEIS contains virtually no meaningful comparison of the biological resources and physical processes at the Norfolk Disposal Site and the Dam Neck Site. Such a comparison should be included.

3.08 Response

The evaluation of disposal alternatives has already been considered in detail in the FEIS on Norfolk Harbor and Channels Deepening. Based on this extensive evaluation, ocean disposal was selected after considering economic, environmental, social and other criteria. The Supplement merely begins with ocean disposal as the most viable alternative and pursues designation of Dam Neck Disposal Site as an option under that alternative. Norfolk District is continuing to pursue designation of the Norfolk Disposal Site, so that both sites would be available, if required.

3.09 Comment

The environmental studies that were conducted by Old Dominion University (ODU) at the Dam Neck Disposal site have not been completed and the SFEIS states that they will be presented in a Supplemental Information Report later in 1985. The EIS is to be used as part of the decision making process and 40 CFR 1502.22 requires that relevant information shall be included in the document. Without this information it is impossible to adequately evaluate the impacts of the proposed project or to compare the Dam Neck Site to the Norfolk Disposal Site. We believe that the Corps was premature in issuing the draft SFEIS without the results of the ODU studies and that a revised draft should be issued once this information is available.

3.10 Response

The preliminary results of the ODU field work at Dam Neck were included in the draft document. The final reports are now available and substantiate in full the preliminary findings. Since the final reports merely confirm, in detail, that which was presented in the draft we see no need to reissue the Draft SFEIS.

3.11 Comment

As stated above, it is not possible to fully evaluate the impacts of the proposed project without the results of the biological studies. We believe that the level of evaluation presented in the SFEIS is insufficient to conclude that there will be no significant adverse effects associated with the proposed project. This will be discussed further under our review of the SFEIS appendices.

3.12 Response

See response above (3.10).

3.13 Comment

Distance from Beaches and Other Amenities - As we will discuss below, the level of analysis presented in the Appendix is insufficient to support the conclusion that the proposed disposal site will not result in any

changes in wave refraction of shoreline erosion. In view of the millions of dollars of private and federal property that are present along the Virginia Beach shoreline, we believe that a detailed evaluation to confirm this statement is warranted. The Department is particularly concerned about any potential effects to our Back Bay National Wildlife Refuge, which is located 3 miles southwest of the disposal site.

3.14 Response

See response to National Marine Fisheries Service (response 1.20).

3.15 Comment

Dispersal, Horizontal Transport and Vertical Mixing Characteristics of the Site - The conclusion regarding site stability in Paragraph 61 that, "the Dam Neck Site and surrounding area are a hydraulically stable environment with little potential for significant net movement of dumped dredge material," is apparently based on the levels of analysis of physical processes presented in Appendices C and D. Appendix D evaluates the suitability of the disposal site based on a criterion labeled as the "level of stability" (LS). However, as the report indicates, this LS evaluation it only useful to compare the relative stability of the various design configurations and does not imply a stable condition. Appendix C presents data that is oversimplified and does not accurately describe the physical statement in Paragraph 59 and in Appendix C that the Dam Neck Site is influenced by a net southward oceanic circulation is not supported by such studies as Johnson (1976), Ludwick (1978) and Boicourt (1981), which indicate that at least the northern portion of the Dam Neck Site is within what appears to be a clockwise gyre at the mouth of the Chesapeake Bay which experiences a net bottom flow toward the north. The evaluation of sediment stability is based entirely on "net annual" and "mean" current directions and velocities, which are inappropriate to predict movement of sediments of the site. For example, period during the summer at a station located just north of the Dam Neck Site. These velocities are more than twice the value Ludwick and Saumsiegle (1976) indicate would move medium-grained sand. Considering that over half of the dredged material to be placed at the Dam Neck Site

consists of clays and silts, the stability of the site is extremely questionable. We have appended to our letter the comments of the Virginia Institute of Marine Science (VIMS) regarding the physical aspects of the disposal site. We believe that the formal analyses recommended by VIMS should be conducted. Indeed, the Fish and Wildlife Service has recommended to the Corps in a meeting of September 15, 1983 and in letters of January 6, 1984 and May 25, 1984 that such studies are necessary to fully evaluate the impacts of the proposed disposal site.

3.16 Response

See responses to National Marine Fisheries Service (1.04, 1.06, 1.08), and responses to Virginia Institute of Marine Science (6.02, 6.04).

3.17 Comment

Effects of Previous Disposal - The statement that there have been very limited detectable effects related to previous use of the Dam Neck Site is based on speculation since there were no baseline or ongoing monitoring studies of biological or water quality impacts. Such a statement should, therefore, be qualified. Ludwick and Saumsiegle (1976) indicate that localized wave enhancement of 17% for 12 second waves from the northeast along a portion of the shoreline could be attributed to the Dam Neck disposal mound. Such a change may indicate that more significant impacts could be associated with a larger disposal site.

3.18 Response

The statement that there have been very limited detectable effects related to previous use of Dam Neck Site has been qualified (see paragraphs 68-70).

3.19 Comment

The document does not utilize accurately the general and specific siting criteria listed for the selection of an ocean disposal site in both the Act and the Environmental Protection Agency's regulations and criteria for ocean dumping.

General Criteria - 40 CFR 228.5 places two stringent requirements on the selection of ocean disposal sites. Section 228.5(a) requires that ocean disposal will be permitted "only" at sites or in areas selected to minimize interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation: (emphasis added). The Corps appears to interpret the word "fisheries" to mean the act of catching fish. However, a fishery is defined as the interaction between populations of fish and their habitat, and their relationship to commercial or recreational fishermen (Everhart et al., 1953). As documented in the SFEIS and Appendix, the Dam Neck area is within the migration route and spawning area of many species of finfish and the blue crab (Callinectes sapidus). The location of a dredged material resources, as indicated by the prohibition in Section 228.5(a). The range of impacts associated with dredged material disposal has been well documented in the literature and includes such effects as interference with finfish respiration, feeding, and migration; destruction and flocculation of phyto- and zooplankton; and destruction of the benthos. (Tereco, 1976; Morton, 1977; O'Connor et at., 1977; Stern and Stickle, 1978; Allen and Hardy, 1980). Contrary to the statement in the document that benthic recolonization can occur within several months, the fact that sediments at the disposal site will not be stable under most wave conditions indicates that up to 10 square miles of ocean bottom may lose its value as a food source for benthic feeding fish.

3.20 Response

See responses 2.01 and 2.21 to EPA comments.
Paragraph 70, has been revised to reflect that it is anticipated that bottom sediment will stabilize sufficiently to allow recolonization from adjacent, unaffected areas.

3.21 Comment

Interference with Other Uses of the Ocean - Figure 8 and other figures in the document are misleading because they show the dimensions of the existing Dam Nec Disposal Site and not the proposed site. The proposed

configuration actually is less than 1 mile from the Atlantic Ocean Channel. This closeness to the channel would appear to compromise navigational safety. Furthermore, it has not been adequately documented that dredged material will not move out of the disposal site and into the channel.

3.22 Response

Results of studies, relative to the Dam Neck Disposal site, indicate that dredged material has remained virtually immobile between February 1983 and February 1985 (DeLoach, 1985). Ludwick and Saumsiegle (1976) stated that sediment movement by currents at the site was of low intensity and infrequent in occurrence with principal movement occuring only during storms. As such, DeLoach (1985) related that, during a span of two years (February 1983 to February 1985), numerous wind events occurred which had corresponding significant wave heights in excess of that needed to initiate movement of bottom sediment. During this period the only movement of dredged material in the Dam Neck site was likely a result of settlement or scour along the crest due to the storms passing through the study area. Furthermore, the orientation of the disposal site's proposed expansion is compatible with the bathymetric environment. Thus, any movement of sediment in the disposal area would likely be transported parallel to the Atlantic Ocean Channel, and navigational safety conditions should be unencumbered.

3.23 Comment

Section 228.5(b) requires that disposal sites will be located so that "temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant levels or effects before reaching any . . . geographically limited fishery or shellfishery." As discussed, the term "fishery" applies both to fish and their habitat. The Fish and Wildlife Service, after consultation with the National Marine Fisheries Service, defines the existing fishery within the project area as geographically limited based on two factors. First, the mouth of the Chesapeake Bay and the adjacent nearshore Atlantic Ocean is the spawning and nursery area

for the entire Chesapeake Bay population of the blue crab. Although the exact offshore limit of this spawning area is not known, Dr. Arthur Butt (Old Dominion University, pers. comm.) indicates that blue crab zoea larvae have been found in the Dam Neck area at levels similar to those found at the mouth of the Chesapeake Bay. Second, the area is within the major migration route for finfish into and out of the Chesapeake Bay. The offshore extent of this migration corridor is also imprecisely known; however, the fact that commercial fishermen trawl to at least 4 miles off the coast indicates the general boundaries of this zone. Several fish species, including flounder (Paralichthys dentatus), croaker (Micropogonias undulatus), weakfish (Cynoscion regalis) and menhaden (Brevoortia tyrannus) spawn in and utilize the project area as a nursery zone. Increases in turbidity levels and losso of benthic habitat resulting for a disposal operations could adversely effect these fisheries, particularly the sensitive early life stages. Studies being conducted by Old Dominion University and Hampton Roads Sanitation District (HRSD) indicate low dissolved oxygen levels in the study area. The disposal of dredged material could increase the biochemical oxygen demand (BOD) and further stress aquatic organisms. The long-term cumulative effects of increased BOD from the disposal operations and the HRSD Atlantic Sewage Treatment Plant outfall are unknown. Since the disposal site is proposed to be located in the zone of geographically limited fisheries, it will be impossible to meet the requirement of 40 CFR 228.5(b).

3.24 Response

1. As described in paragraphs 46-49, 71(a) and (b) and 91-93, the area has not been found to support commercial fish spawning or sensitive early life stages to any great degree nor would turbidity levels be significant.

2. Paragraphs 84-93 of the Site Evaluation Study describe, based on test dumps of Thimble Shoals Channel sediments in the open ocean, anticipated impacts to fisheries and water quality. The evidence presented from these test dumps indicates that physical parameters including temperature, salinity and dissolved oxygen are expected to change only slightly (in test dumps D.O. actually increased) and values return to

ambient rapidly. Based on two separate reports by Old Dominion University (Alden and Butt, 1985) evidence points to the Chesapeake Bay plume as the major non-point source of oxygen demand in the Dam Neck area and the findings of their study " . . . point to the conclusion that the location of the Dam Neck Site is not significantly associated with oxygen patterns of the region." This conclusion is based on (1) the relatively pristine nature of sediments destined for Dam Neck and (2) the aperiodic use of the site for disposal. No long term cumulative effects on water quality are, therefore, anticipated. A monitoring plan for D.O. to look at possible short-term synergistic effects is included in paragraph 112, section (f) of the SES.

3.25 Comment

The items discussed in our comments should be addressed in the environmental impact statement in order to allow a full evaluation of project alternatives and impacts as required by the National Environmental Policy Act. This information is also necessary for the Fish and Wildlife Service to provide final comments on the project as required by the Fish and Wildlife Coordination Act (FWCA). Due to the inadequacy of the draft SFEIS, we recommend that a revised draft be prepared in accordance with the requirements of 30 CFR 1502.9(a) once the biological studies conducted by Old Dominion University and physical studies recommended by the Virginia Institute of Marine Science have been completed. With respect to the physical studies, we suggest that a meeting between the District and physical scientists at VIMS, ODU and the Coastal Engineering Research Center would be appropriate to fully define the level and method of analysis that is necessary.

3.26 Response

The comments have been responded to in full and the SFEIS and Appendix has been revised in some instances. These revisions are additions and clarifications of previously presented information. There are no concepts presented in the final document which are radically different from those presented in the draft and the need to recirculate a draft document, therefore, is not necessary.

There are adequate data from previous and recent studies to address the physical effects of disposal at Dam Neck to the extent required by the site evaluation criteria of 40 CFR 228.5 and 228.6. Thus, no additional physical studies will be conducted in support of the Dam Neck site evaluation and designation. Certain studies may be appropriate in order to best manage the placement of the large quantities of future new work dredging. As part of he final site management plan Norfolk District will be working with VIMS and other consultants on strategies to minimize the risk of adverse long term physical effects.

3.27 Comment

Based on the information presented in the SFEIS and Site Evaluation Study, the Department cannot concur with the Corps' conclusions that there will be no significant impacts on biological resources, water quality, or physical processes in the vicinity of the Dam Neck Disposal Site. Furthermore, the Dam Neck Site does not meet the designation criteria set forth in 40 CFR 228.5(a) and (b) and is, therefore, unacceptable as an ocean disposal site. Although the Fish and Wildlife Service will not provide final FWCA comments until the information requested in this letter is available, they have indicated that they intend to maintain the position stated in their draft FWCA report of May 25, 1984. That report recommended the designation and use of the Norfolk Disposal Site.

3.28 Response

The objection to the 40 CFR 228.5 (a) and (b) designation criteria as they have been addressed in the Site Evaluation Study have been responded to in full in this comment/response section of the SFEIS. In each instance, the final document has been revised with more adequate information to substantiate the position of no significant impact. The Dam Neck Site, therefore, does meet the designation criteria set forth in 40 CFR 228.5(a) and (b). Should we receive comments from Fish and Wildlife Service on this Final Supplement, they will constitute the final FWCA comments.

4. U. S. DEPARTMENT OF TRANSPORTATION - U. S. COAST GUARD, JANUARY 18, 1985

4.01 Comment

We would like to point out, however, the need for advance notice to the Coast Guard of any actual dredging activity n the "Traffic Separation Scheme", including the "Precautionary Area", traffic lanes, and their approaches. At least five months lead-time is necessary for us to notify the International Maritime Organization of the work involved, and its duration.

4.02 Response

Channel design for the Atlantic Ocean Channel will be completed in 1986. Norfolk District will continue to coordinate with the Coast Guard to assure adequate lead time is given for notifying the International Maritime Organization and other navigation interests.

5. U. S. NAVY - NAVAL BASE, NORFOLK, VIRGINIA, JANUARY 17, 1985

5.01 Comment

At present, no need for suitable material from dredging Norfolk Harbor and Channels exists for use at Sewells Point Naval Complex. However, future construction and operational requirements may result in our request for suitable dredge material for use at the Naval Complex.

5.02 Response

Norfolk District will consider any such requests in light of existing plans for dredged material disposal and other uses for suitable material.

5.03 Comment

Alternative disposal plans consider outer harbor dredge material to be disposed in the Chesapeake Bay and at Craney Island. Increased use of these areas for disposal of outer channel dredge material can potentially have an adverse effect on U.S. Navy activities (SFEIS 7-3.01a) and, therefore, should not be considered.

5.04 Response

For the reasons described in paragraph 3.01a of the SEIS, the lower Chesapeake Bay is not now being considered as an alternative disposal plan.

6. COMMONWEALTH OF VIRGINIA, COUNCIL ON THE ENVIRONMENT, JANUARY 28, 1985

6.01 Comment

We are almost ready to agree with your recommendation that the Dam Neck Interim Site be given final designation as a dredged material disposal site. However, while it is true that the document has addressed the specific and general criteria for ocean disposal site evaluation, we do not think that final conclusions regarding the impact of designation of a greatly expanded site can be drawn at this time. Analyses related to site stability and wave impacts, in particular, need to be completed in order to allow a determination tht environmental impacts on shoreline properties and on marine biota will not be unacceptably severe.

6.02 Response

Based on analyses by CERC (1983) and Watts (1983), there does not appear to be much likelihood of significant changes to wave energy distribution as a result of the planned use of Dam Neck. The recommended enlargement of Dam Neck is intended to keep the material in a low profile, thus minimizing wave refraction effects and shoreline wave heights. As part of the site management plan, Norfolk District will be working closely with VIMS on strategies for dredged material placement to minimize or prevent long term physical effects. In conjunction with this strategy wave refraction analyses may be conducted using existing data to assess the effects of intermediate and long term site profiles. No additional studies are needed now in support of site evaluation and designation.

6.03 Comment

First, with respect to shoreline impacts, the proposed Site Plan would reduce depths at the Dam Neck Disposal Site from about 42 feet to 35 feet. This might alter significantly the longshore wave energy

distributions. The Saumsiegle report (1976), referenced in the Draft Supplement, recommends restricting the size of the Dam Neck Disposal Site to reduce wave refraction effects and shoreline wave height. Since the site must be enlarged to accommodate the volume of material anticipated from the deepening project, formal consideration of wave refraction effects is needed so that consequences of site enlargement will be fully understood. It should be noted that the understanding of shore response to waves has changed since the Ludwick report on Dam Neck was issued in 1976, and simulation of potential wave conditions is easier now because of advanced computer techniques.

6.04 Response

See previous response and response to Virginia Institute of Marine Science (8.02).

6.05 Comment

Finally, some biological studies are not in final reportable form. When completed, the biological studies should be integrated with the results of the formal site stability analysis to examine potential impacts on the biota.

6.06 Response

The biological and chemical studies performed at Dam Neck by ODU are in final report form and the results have been incorporated into the final document. These reports are summarized in the Appendices to the Site Evaluation Study.

6.07 Comment

Again, we recommend that the analyses suggested by VIMS and others be accomplished, not just because the potentially affected resources are singularly important, but to allow consideration of ways in which this undertaking may go forward in consonance with resource protection. These additional analyses are important not only for an understanding of potential impacts upon the shoreline and affected biota, but because the shoreline and the affected biota are singularly important in their own right. The mouth of the Chesapeake Bay is a nursery area for blue crab;

it is traversed by migratory species which give the Bay and surrounding areas much of their ecological, recreational, and economic importance. The importance of the Hampton Roads shorelines needs no explanation.

6.08 Response

As described in paragraphs 46-49, 71(a) and (b) and 91-93 of the Site Evaluation Study no impacts to spawning or larval forms of fish or shellfish are anticipated.

7. SOUTHEASTERN VIRGINIA PLANNING DISTRICT COMMISSION, DECEMBER 5, 1985

7.01 Comment

During disposal operation at the Dam Neck site, water quality should be monitored to insure that the disposal operation does not have a synergistic impact when combined with the impacts of the Hampton Roads Sanitation District Atlantic Wastewater Treatment Plant discharge.

7.02 Response

See response to F&WS comment (3.24).

7.03 Comment

Disposal operations should be scheduled so as to avoid potential conflict with recreation and commercial fishing vessels during the peak fishing seasons.

7.04 Response

As described under "Commercial and Recreational Fishing" (paragraphs 74-76) of the Site Evaluation Study, the effects of disposal at Dam Neck should not effect recreational or commercial fishing for more than a very brief period of time (usually less than 30 minutes) over a very limited area. No conflict with fishing vessels, therefore, has been experienced in the past nor is anticipated in the future.

## 8. VIRGINIA INSTITUTE OF MARINE SCIENCE, JANUARY 18, 1985

### 8.01 Comment

The Site Plan proposed would alter existing depths from "about 42 feet" to 35 feet. This alteration over the bottom area planned has the potential to significantly alter longshore wave energy distributions. Formal execution of wave refraction analysis is essential given the nature of shoreline use and value. These analyses should include wave periods up to 14 secs. and directions ranging from north to south with particular emphasis to the northeast and east. These are particularly important since storm waves from these directions are associated with surge elevations rendering shoreline properties particularly vulnerable. Saumsiegle (1976), 1974 condition indicate local shoreline wave height enhancement of 17% for twelve second waves from the northeast. As well, that report recommends restricting the size of the site so that refraction effects are reduced. We recognize that the site expansion is necessary to accommodate the project volumes. Given this, formal consideration of wave refraction effects is needed.

### 8.02 Response

The placement of dredged material in the site will be managed in sub-areas for each phase of channel maintenance and construction. The reduction of average existing depths of about 42 feet to an average of about 35 feet was given as the overall change due to use of the site for future channel deepening and 50 years of maintenance. Based on analyses by CERC (1983) and Watts (1983), this planned use of Dam Neck is not likely to cause significant long-term changes to wave energy distribution nor shoreline erosion patterns. However, to further assure that this is the case, as part of the site management plan Norfolk District may conduct wave refraction analyses for the existing profile, intermediate profiles, and the long term site profile. Norfolk District will work closely with VIMS and other consultants on the site management plan, and has already met with representatives of VIMS to further discuss these physical concerns.

8.03 Comment

Our concern about site stability is ultimately focused on potential impacts on the biota. We note that Table 5 (page 38) of the Draft indicates that approximately 4 mcy of maintenance dredged material from Thimble Shoals Channel was placed at Dam Neck between June 1970 and November 1982. Of this approximately 2.8 mcy was placed between June 1970 and December 1974. Presumably a significant fraction of this amount was silt and clay material from the section west of the Chesapeake Bay Bridge-Tunnel. Saumsiegle (1976) includes 68 sediment analyses for Dam Neck samples of 1973, 1974 and 1975 (Corps) as well as those he secured in spring 1974. What is striking from these analyses is the very low levels of the silt/clay fraction in those sediments identified as dredged material. The average silt/clay content of samples identified as native sediments is about 6% by weight whereas that for material identified as dredged material is less than 1% by weight. The apparent absence of the silt/clay fraction raises the following questions:

1) Was the mud fraction lost in the dredging process because of economical loading?

2) If the mud fraction was placed in the disposal site was it lost due to short term dispersion processes or lost due to longer term entrainment by waves and currents?

The significance of these questions is that if the mud fraction was lost via previous economical loading then the proposed disposal of "predominantly clays and silts" from Thimble Shoals Channel (para. 53, Draft) represents new conditions which need to be addressed in examination of site stability. If the material is stable at the site then the grain size characteristics may differ significantly from the native sediments and the benthic community recolonizing the area may differ significantly form the native populations. The relative resource value of the recolonizing community is important since a large area is impacted, about ten square miles.

On the other hand if the material is resuspended and entrained into the water column then the enhanced turbidity may impact biological processes, and the aesthetic aspects of water qualilty along the recreational beaches. Clearly, these matters are of sufficient importance to require a penetrating analysis of site stability.

8.04 Response

It is agreed that a significant fraction of the material placed in Dam Neck during 1970-1974 would have been silt and clay material, since as much as 40% of the dredging may have been west of the bridge-tunnel. However, we cannot conclude that the silt/clay fraction was lost, based on the samples referenced by Saumsiegle (1976).

The Dam Neck samples taken by the Corps in 1973, 1974, and 1975 were obtained by a pipe dredge towed from the survey vessel ADAMS. Additional samples were collected in 1974 using a Shipek grab sampler. Both these methods may have disadvantages in recovering the silt-clay fraction from the ocean floor:

(1) Both methods sample only the surface and may miss consolidated fines covered by shifting sands.

(2) The pipe dredge is dragged on the surface and may only scrape the peaks of the sand ridges, missing fines which have settled into depressions or troughs.

(3) Both methods would tend to lose material from the sample by entrainment while being lifted to the surface. In addition, there are no correlations between the specific times and locations of dumping and the times and locations of sediment sampling.

Based on what is now known about the dredging and disposal process, it does not appear there are significant losses of material either at the dredge during loading or at the disposal site.

Hopper dredge loading in the lower bay channels, whether to the point of overflow or beyond to "economical load", does not result in a significant loss of the mud fraction. In most cases these losses would likely be less than 1%, based on studies by WES. In the case of the lower bay channels, the materials have good settlement characteristics in the hopper, and there is not much difference in loading to the point of overflow and the so-called economical load. Samples taken from the hoppers during 1982 maintenance dredging correspond closely with channel and disposal area sediment samples, in terms of the percentages of fines.

These dredged materials also have good settlement characteristics at the disposal site. Short term losses and turbidity levels are expected to be minimal. Volumetric losses are too small to account for by state-of-the-art bathymetric survey methods.

After the 1982 maintenance dredging, sediment grab samples and cores were taken at the dump site. The silt-clay fraction was evident in these samples. Local movement and sorting of material does occur at the site following a disposal operation, but net losses are insignificant due to consolidation of the material. Repeated bathymetric surveys showed the longer-term losses are also insignificant (DeLoach, 1985).

Since it appears the material is stable at the site, disposal may alter the overall composition of the bottom sediments. However, as noted in paragraph 68 of the text, recent studies have shown no significant differences in toxicity, benthos and water quality between the Dam Neck disposal site and adjacent areas.

8.05 Comment

What is needed in the analysis of site stability is formulation of the frequency distribution of bottom shear stress as a function of the wave climate and tidal currents. These values may then be coupled with existing sediment entrainment formulations to estimate the sediment dispersion. This procedure is within the state-of-the-art. We thus disagree with the assertion (page C-3) that sediment transport predictions would not be improved by application of more elaborate and

sophisticated analysis. The Draft report indicates wave generated currents, on an average annual basis, can move fine sand material 80 to 90 percent of the time in the shallower portion of the site and 50 percent of the time at 45 foot depth. On the basis of vector averaged tidal currents (small) the Draft implies that sediment advection will be very limited. The vector averaging procedure is inappropriate for the case. If averages are to be used at all the root mean square of current speed would be better. Vertical mixing is dismissed because "no data are available." Such information should be incorporated in a wave-current suspended sediment dispersion analysis using estimates from other studies. Specific attention should be given, as well, to wind induced coastal flows.

8.06 Response

See responses to Environmental Protection Agency (2.04 and 2.06).

8.07 Comment

Several of the biological and water/sediment quality studies are not yet in final reportable form. When completed the biological studies should be integrated with the results of the more formal analysis of site stability to examine potential impacts on the biota.

8.08 Response

The studies referred to are now complete and the results of these studies have been incorporated into both the SFEIS and Appendix to evaluate potential impact.

8.09 Comment

Two additional points warrant comment. We submit that the judgement as to the level of monitoring must await the resolution of the questions raised above concerning site stability and resultant bottom characteristics. Also we ask whether a disposal management scheme is to be established such that the very fine grained materials are segregated from those materials which are suitable for future beach nourishment.

8.10 Response

The text of the site evaluation study (paragraphs 102-114) has been revised to include recommendations for a concept site management and monitoring plan. We agree the level of monitoring for channel deepening ocean disposal requirements cannot yet be firmly established, and will require prudent judgement. Sediment management to separate materials suitable for beach nourishment is part of the recommended plan.

9. COMMONWEALTH OF VIRGINIA, HAMPTON ROADS SANITATION DISTRICT, 3 JANUARY, 1985

9.01 Comment

Since available data indicates that our discharge does not cause a depression of dissolved oxygen, the statements implied in your report on Page 59, paragraph 79 and Page B-3, paragraph B.05 are not supported by the available facts. In order that the report not be misleading, revisions should be made to support the findings that low dissolved oxygen concentrations in the bottom waters off Virginia Beach occur naturally and are not suppressed due to the presence of our outfall.

9.02 Response

These statements have been revised to reflect the findings of the ODU final reports (paragraphs 86-90).

10. COMMISSION OF THE CONSERVATION AND DEVELOPMENT OF PUBLIC BEACHES 3 JANUARY 1985

10.01 Comment

The shift to the Dam Neck site has a lot of attractive parts to it. From the perspective of the Commission, emphasis should be given to the alternative uses of suitable material. This is referenced in paragraphs 1.12 and 1.13 on page 4. In particular we are interested in seeing the beach quality material used for beach restoration. This is mentioned in paragraph 2.05 on page 6. We believe this portion of the disposal plan should be given special emphasis. This is reiterated in paragraph 3.0/c on page 8. What the Commission would like to see are the engineering

questions involved in this alternative and the associated costs in detail. As a point of discussion, it is feasible to segregate the beach quality material from the other "stuff" so as to create an underwater stockpile in the Dam Neck area? This type of approach has already been recommended to the Norfolk District for beaches inside the Chesapeake Bay mouth. These two reports are listed on the attached bibliography. Preliminary indications are the proposed dredging could yield 8 to 10 million cubic yards of beach quality material. If it were feasible to place 2.5 million on Virginia Beach, that still leaves a large pile of good material. It seems crazy to waste it if it could be stockpiled for future beach use.

10.02 Response

The final engineering and cost estimates for beach disposal alternatives will not be available until the General Design Memorandum for the project is prepared in 1986. Management plans for the Dam Neck site will include recommendations for sediment management to place beach quality material separately within the site if arrangements are not made for direct use. See paragraphs 102-114 of the text.

10.03 Comment

In general we support the option chosen by the Norfolk District. As outlined it was tremendous potential for additional benefits with a little study and planning. Ultimately it makes the proposal that much more attractive to the citizens of the Commonwealth and the local, state and federal government.

10.04 Response

We agree the Dam Neck site has the potential for benefits that could not be realized with disposal sites farther offshore.

10.05 Comments

In the technical category, we believe the question of the interaction between waves and the proposed "low profile" structure are not well enough covered. The understanding of shore response to waves has changed

since 1976 when the Ludwick report on Dam Neck was issued. In addition advanced computer techniques now make it much easier to simulate potential wave conditions. In the interest of reducing or eliminating possible deleterious effects from storm waves refocused by the disposal site, the proposed configuration should be subjected to certain mathematical wave models to predict their impact on the shoreline. It may be possible to do this without much field work by using existing data sets at VIMS, the CERC facility at Duck, North Carolina and within the Norfolk District.

10.06 Response

As part of the site management plan, wave analyses will be conducted to determine appropriate sediment placement strategies that would reduce or eliminate the risk of the site profile causing adverse changes to wave energy distribution and shoreline erosion. See responses to VIMS (8.02) and Council on the Environment (6.02).

## 11. CITY OF NORFOLK, OFFICE OF THE CITY MANAGER, JANUARY 17, 1985

11.01 Comment

According to the draft, about five million cubic yards of beach quality sand will be generated within the project. This material is suitable for replenishment of Norfolk's erosional beaches as identified in the Willoughby and Vicinity Study by the Corps of Engineers. At your convenience, a discussion would be appreciated regarding beneficial uses of this portion of the project that are consistent with federal requirements.

11.02 Response

The Virginia Port Authority, as the designated local sponsor for the Norfolk Harbor and Channels project, is coordinating all formal requests from local governments to receive suitable dredged material as alternative disposal plans. The technical staffs of the City of Norfolk and Norfolk District have discussed the potential use of Norfolk's

beaches for dredged material disposal. Such discussions will continue during completion of engineering studies and General Design Memorandum for the Norfolk Harbor and Channels project in 1986.

## 12. CHESAPEAKE BAY FOUNDATION, JANUARY 25, 1985

### 12.01 Comment

The Dam Neck Disposal Site is located within the migration route and spawning area of a number of finfish including flounder, croaker, and weakfish. The mouth of the Bay and adjacent nearshore Atlantic Ocean is also the spawning and nursery area for the blue crab. Although the Site Evaluation identifies the biological resources in the area, there is no evaluation of the potential impact of dredged material disposal on these resources.

### 12.02 Response

The "General Criteria" section of the Site Evaluation Study includes evaluation of the potential impact of dredged material disposal on biological resources. Paragraphs 71(a) and (b) conclude that finfish should be able to avoid the localized and temporary impacts associated with disposal. Paragraphs 83 to 93 discuss impacts to water quality and how these impacts relate to the biology of the area. The Site Evaluation Study is an Appendix to the SFEIS, the impact evaluation document, which also addresses impacts.

### 12.03 Comment

The Site Evaluation states that there have been limited detectable effects related to the previous use of the Dam Neck Site. There is no indication, however, that this statement is supported by baseline or ongoing monitoring studies of water quality and/or biological impacts. Also, the proposed rate of disposal (7-12 mcy/yr) is significantly higher than the long term historical disposal rate at this site. A finding of no adverse impact from previous disposal at this site is not a sound basis for determining the potential impact of the proposed project.

12.04 Response

The Dam Neck Disposal Site, based on sampling in and around the area, is not appreciably different with regard to water quality, benthos, sediment quality (toxins), fisheries, etc. than any of the surrounding "unaffected" areas. It would appear from these observations that disposal has had no obvious detrimental effects. While this alone is not adequate for determining potential impact, it is worth noting in conjunction with other information presented in the SFEIS and Site Evaluation Study.

12.05 Comment

The Virginia Institute of Marine Science (VIMS) has reviewed the SFEIS and Site Evaluation Study and believes that the evaluation of the physical aspects of the disposal site is inadequate (see Attachment). CBF believes that the conduct and analysis of the studies recommended by VIMS would enable the Corps to perform a more complete evaluation of the proposed disposal site.

12.06 Response

See response to Fish and Wildlife Service (3.26).

12.07 Comment

The SFEIS does not include a comparison of the biological resources and physical processes at the Dam Neck Site and the Norfolk Disposal Site alternatives. Since the evaluation of alternatives is a major component of an EIW, such a comparison should be included.

12.08 Response

See response to Fish and Wildlife Service (3.08).

12.09 Comment

The SFEIS and the Site Evaluation often refer to incomplete or preliminary biological and water quality studies. Conclusions regarding the potential environmental impact of a project should not be based on incomplete or preliminary information. CBF believes that the Corps

should not have issued the SFEIS until these studies were completed and a more substantive evaluation could be made.

12.10 Response

The studies which were referred to in the draft document are now complete and the results of these studies confirm the preliminary findings revealed earlier. Since the conclusions presented in the final document substantiate the preliminary results, the draft and final documents are seen as compatible.

13. ENVIRONMENTAL DEFENSE FUND, JANUARY 25, 1985

13.01 Comment

We would like to point out that the amount of proposed dredge material is three times the amount of material disposed of at the Dam Neck Site in the past. We consider this to be a significant change which does not allow the direct comparisons between the impacts of the proposed project and impacts of past disposal at the Dam Neck Site. Overall, we feel that the analyses of key components of the document are insufficient to support the conclusion that there will be no significant environmental impacts associated with the use of the Dam Neck Disposal Site.

13.02 Response

While the total amount of material from future channel deepening and 50 years of maintenance which would be placed at Dam Neck is much greater than the amount placed at Dam Neck during the past 18 years (20 MCY), the rates of disposal are comparable. The schedule for channel construction is given as Table 9 of the site evaluation study. During channel deepening the average rate of ocean disposal will be about 5 MCY per year, with a maximum of about 11 - 12 MCY occurring during the fourth year of construction. These rates are the same order of magnitude as the rates which occurred during earlier channel construction projects. Future maintenance requirements with deepened channels will be greater, but the same order of magnitude as present channel maintenance. The impacts of past disposal were minor, and the conclusion that continued

use of the Dam Neck site will cause no significant environmental impacts is sufficiently supported in the document.

13.03 Comment

Cost/Benefit Analysis - The Corps has failed to document the cost/benefit analysis used to evaluate the decision to select the Dam Neck Disposal Site over the Norfolk Disposal Site. This analysis is required under Section 1502.23 of the Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500-1508). The cost/benefit analysis should include a comparison of the environmental costs and transportation costs, of using the Dam Neck Site as opposed to alternative disposal sites.

13.04 Response

See response to Fish and Wildlife Service (3.08). Transportation costs for alternative sites are given in the revised text, paragraphs 32-37.

13.05 Comment

A comparison of the biological resources and physical processes at the Dam Neck Disposal Site and the Norfolk Disposal Site should be included.

13.06 Response

This is not an either/or situation. We are still pursuing the final designation of the Norfolk Disposal Site. At the time that both sites have received final designation, we will have the option of using either for ocean disposal of dredged material.

13.07 Comment

Insufficient data has been collected to evaluate the environmental impacts of the use of the Dam Neck Site and to come to the broad conclusion that there will be no significant impacts. The results of the Old Dominion University studies have not been included, but will be included in a Supplemental Information Report issued later this year. Because the information from these studies is critical to the evaluation of the proposed site and comparisons with the Norfolk Disposal Site, the studies should have been included in the SFEIS for review. It is

difficult to understand how the SFEIS could be sent out for review without the studies to support the document's conclusions. It was inappropriate to issue the SFEIS without all supporting documents.

13.08 Response

See response to Chesapeake Bay Foundation (12.10).

13.09 Comment

The analysis provided on the stability of the Dam Neck Disposal Site is insufficient to support the assertion that the site is stable. We refer you to the January 18, 1985 letter of Dr. Frank Perkins of the Virginia Institute of Marine Science to the Council on the Environment in which this point is discussed at length. (Copy enclosed).

13.10 Response

See responses to Virginia Institute of Marine Science (6.06) and Environmental Protection Agency (2.04 and 2.06).

13.11 Comment

Insufficient attention is given to the impact of the proposed site on the shoreline wave energy distributions. Once again we refer you to Dr. Perkins's letter. Considering the value of the shoreline property which could be affected by the disposal site, a detailed analysis should be included on the impact on wave refraction and shoreline erosion.

13.12 Response

See response to Virginia Institute of Marine Science (8.02).

13.13 Comment

A more detailed analysis should be included on the effect of the proposed site on the migratory pathways at the mouth of the Chesapeake Bay and the impact of the proposed site on blue crab nursery areas.

13.14 Response

A more detailed analysis covering these topics is presented in paragraphs 46-49, 71(a) and (b) and 91-93 of the Site Evaluation Study.

# APPENDIX III

## PERTINENT CORRESPONDENCE

APPENDIX III
PERTINENT CORRESPONDENCE

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Planning

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**

Office of the Administrator
Office of Policy and Planning
Ecology and Conservation Division, PP2
H6111 Herbert Hoover Building
Washington, D.C. 22030

January 28, 1985

Colonel Claude D. Boyd III
District Engineer
Department of the Army
Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510

Dear Colonel Boyd:

Attached are the National Oceanic and Atmospheric Administration's comments on the Draft Supplement to the Final Environmental Impact Statement for Norfolk Harbor and Channels, Virginia - Deepening and Disposal. Please disregard the draft comments sent on January 24, 1985.

Thank you for the opportunity to submit these comments. Please send four copies of the final supplement to the letterhead address.

Sincerely,

Thomas E. Bigford for

Joyce M. Wood
Division Chief

Attachment

**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

January 28, 1984

Col. Claude D. Boyd III
District Engineer
Department of the Army
Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510

Dear Colonel Boyd:

This letter is in response to a December 1, 1984, request from Mr. Frank T. Wootton, Jr., of your staff, for National Marine Fisheries Service (NMFS) comments on the Draft Supplement to the Final Environmental Impact Statement (DSFEIS) for Norfolk Harbor and Channels, Virginia - Deepening and Disposal. This DSFEIS is actually an appendix dealing with designating the Dam Neck Ocean Disposal Site as a permanent ocean disposal site under the regulations and criteria established by the Marine Protection, Research, and Sanctuaries Act of 1972 (Public Law 92-532; 86 Stat. 1052).

In our comments dated June 5, 1984, on an "Environmental Assessment for Ocean Disposal of Dredged Material at the Dam Neck Site for the Norfolk Harbor and Channels Deepening and Disposal, Virginia," the NMFS stated its opposition to both using the Dam Neck Site to dispose dredged material from the Norfolk Harbor Deepening and designating the site as a permanent ocean disposal site. We found no information in the DSFEIS to change our earlier position. In fact, data in the document and published literature only increase our concern of the potential impacts of this proposed action on important marine and estuarine species. Therefore, the NMFS wishes to restate its support for the use of the Norfolk Disposal Site, not Dam Neck, as a long-term ocean disposal site for the deepening project.

Based on our review of the DSFEIS we cannot support or concur with the conclusion that the proposed expansion of the Dam Neck Site will not have significant adverse environmental effects on living marine resources for which the NMFS is responsible. We base this position on the following:

1) The biological studies mentioned in the document have not been completed and the preliminary data and findings are insufficient to support the conclusions presented.

2) The stability of the existing disposal site has not been adequately demonstrated to support expansion to the larger disposal area.

3) The effects of the enlarged disposal site and altered bathymetry on shoreline wave energy patterns distributions have not been evaluated completely.

4) The impacts of the enlarged dump site on local tidal, riverine, and wind-generated current patterns have not been documented adequately.

5) The impacts of the existing and proposed expanded disposal site on endangered and threatened species found in or migrating through the disposal site have not been addressed adequately.

6) The document does not utilize accurately the general and specific siting criteria listed for the selection of an ocean disposal site in both the Act and the Environmental Protection Agency's regulations and criteria for ocean dumping.

The following are more detailed comments on the six items noted above and are to be considered as part of NMFS general comments. Additional specific comments follow.

Biological Studies

Both the Summary (SFEIS-4, paragraph 1.10) and document (page 52-54) indicate that biological studies have been conducted. The summary erroneously refers to these studies as "extensive." The U.S. Fish and Wildlife Service study utilized existing literature for the most part and included one time sampling of benthic infauna at eight stations and epifauna at three additional stations. The Old Dominion University (ODU) study included four stations near the Dam Neck Site to characterize the non-commercial benthos. Based on three samples taken in March 1984 with a "commercial clam dredge" and three more taken in May 1984 with a rocking chair dredge, this same study concluded that there are no commercially important benthic infaunal populations in the Dam Neck area. The NMFS does not consider these studies to be sufficient to assess adequately the impacts of the proposed action. In fact, the fisheries and plankton studies conducted by ODU have not yet been finalized.

Spoil Site Stability

In several instances, the document states that material disposed at the site will be stable and not migrate out of the disposal site. Appendix C on Physical Processes, which describes these phenomena in greater detail, Technical Report No. 27 prepared by Ludwick and Saumsiegle (1976). This refers to a report, entitled "Sediment Stability at the Dam Neck Disposal Site, Virginia," which indicates that existing waves can move fine sand material 80 to 90 percent of the time in the 35-foot deep sections of the site and 50 percent of the time in the 45-foot sections. Coarse sand particles on the 35-foot deep section can be moved by wave action 65 to 75 percent of the time and 35 percent of the time at the 45-foot depth. The study, and a subsequent Corps report, both using a current velocity threshold of 20 cm/sec, concluded that currents are usually too weak to move much sediment, although wave energy is usually sufficient to induce oscillatory motion. However, Appendix C indicates that tidal current

speeds have been measured in the study area between 8 and 49 cm/sec on the ebb and between 8 and 56 cm/sec on the flood. In another study involving the Norfolk Disposal Site (Boicourt, 1981), velocities of 50 cm/sec were recorded over a 5-day period inshore of station MF7 just north of the Dam Neck Site. Are these figures included in the 2.5 percent of the time that current speeds exceed the threshold of sediment translation, as noted in the report? It should also be noted that the 2.5 percent figure only represents the current velocities during mid-summer (July, August). Since Ludwick and Saumsiegle (1976) indicated that the principal movement of sediment probably occurs during storm events, the frequency, duration, and extent of storms should be documented. The amount of material that could be displaced by one of these events should be calculated. Finally, the effect of the non-tidal eddy, (Johnson, 1976) on the study site should be discussed. While this reference is included in the list for Appendix C, we could not find it cited in the text.

Shoreline Impacts

Ludwick and Saumsiegle (1976) state in their report that the mound (8 feet high, 9000 feet long, and 3500 feet wide) has caused an increase in wave height of 20 percent on a section of the coast. This phenomenon was only observed with waves from the northeast having a 12-second period. On the basis of these results, the document concludes that there will be no shoreline impacts from the enlarged disposal site as a result of altered wave energy distributions.

The NMFS does not agree with this evaluation. Winds from the northeast and east are associated with surge elevations which render shorelines vulnerable to high rates of erosion damage. In fact, your District has just completed an extensive plan for the protection of Virginia Beach from hurricanes and beach erosion. Since there is substantial development in the coastal area of Virginia Beach from Cape Henry to Sand Bridge, including the Dam Neck Naval Training Center, and the alteration of wave energies could compromise your hurricane and erosion control plan, it would appear prudent to conduct a formal wave refraction analysis for the enlarged disposal site configuration.

Current Pattern Changes

While the DSFEIS acknowledges that the proposed disposal site is located within the influence of the Chesapeake Bay plume, it discounts any possible project-related impacts on the plume or local currents.

Ludwick and Saumsiegle (1976) indicated that the present Dam Neck Site was located on the boundary zone between the flood-dominated flow associated with the Thimble Shoals Channel at the Bay entrance and the ebb-dominated flow associated with the entrance margin off Cape Henry. Thus, water movements on opposite sides of the mound are in opposite directions. If the site is expanded to the north and east as proposed, it will extend into the water mass dominated by the flood flows and moving in a generally westerly direction toward the Thimble Shoal Channel. Changes in these existing current patterns either as a result of the proposed Atlantic Ocean Channel or the expanded use of the Dam

Neck Site could significantly affect the recruitment of fish, crabs, and juvenile sea turtles to Chesapeake Bay.

Figure 5 on page 27 shows the blue crab nursery area. This zone might in fact be more appropriately labeled as a part of the blue crab spawning and overwintering area. Mated female blue crabs migrate to this area of the lower Bay where they overwinter buried in the sediments. Sponge crabs (egg-carrying females) are usually first seen in late May and June, with a second spawning in August. Eggs hatch 14 to 17 days after spawning, zoeae are released into high salinity waters, and then zoeae move in the neuston out of the Bay into offshore waters where development proceeds. Following metamorphosis into the megalops stage, the crabs settle toward the bottom and begin to migrate back into the Bay.

Both the exact recruitment mechanism and the dimensions of the nearshore blue crab nursery area are unknown. However, current patterns around the Bay mouth play an important role in retaining blue crabs in Chesapeake Bay. Thus, any alterations in current patterns could adversely affect blue crab recruitment. The value of this fishery can be seen by the fact that in 1983 the mid-Atlantic states reported landings of 98 million pounds with a value of $29 million. The Virginia fishery was 46.1 million pounds with a value of $11 million.

Other important commercial and recreational species which utilize the Bay and could be adversely affected by changes in current patterns include but are not limited to, Atlantic menhaden (Brevoortia tyrannus), weakfish (Cynoscion regalis), Atlantic croaker (Micropogonias undulatus), spot (Leiostomus xanthurus), black sea bass (Centropristis striata), and summer flounder (Paralichthys dentatus). Of these, the following are known to spawn within the area proposed for the disposal site: Atlantic croaker, spot, weakfish, black sea bass, and Atlantic menhaden (Grosslein and Azarovitz, 1982). Estuaries and coastal waters in Virginia and North Carolina produce more than 50 percent of the Atlantic coast menhaden fishery. In 1983, this fishery harvested 927 million pounds valued at $37 million.

Endangered Species

The NMFS disagrees with the conclusion that the endangered and threatened sea turtles will not be affected by the use of the Dam Neck Site for a permanent ocean disposal site (page 26, paragraph 45).

Four species of sea turtles regularly occur in the Dam Neck Site area during the summer (May-October): threatened loggerhead (Caretta caretta), endangered green (Chelonia mydas), endangered leatherback (Dermochelys coriacea), and endangered Atlantic ridley (Lepidochelys kempii). All species migrate north along the Atlantic Coast during the spring following the 20°C water thermocline. As a result, they arrive in the Chesapeake Bay area as a group rather than as individual animals. Both the loggerhead and ridley forage on jellyfish near the mouth of the Bay until the Fall (October-November). In addition, it is not known conclusively just how these species find the Bay. If they utilize chemical cues, then alterations in current patterns at the Bay mouth could disrupt or delay their entrance into the Bay.

While a considerable amount is known about the movements of the loggerhead and ridley inside Chesapeake Bay, little is known about their coastal migration patterns. Since both the loggerhead and ridley are benthic epifaunal invertebrate feeders, disposal operations which would alter the benthos could adversely affect these two species. Any disruption of their feeding habits could be significant since turtles arriving at the Bay following their winter migration are usually in poor condition.

It is our opinion that the best method of avoiding any impacts to these threatened and endangered species is to designate the Norfolk Disposal Site, not Dam Neck. However, should you pursue the Dam Neck proposal, we recommend completing studies to determine the coastal migratory patterns of sea turtles. We would suggest that you utilize a radio tagging approach using sea turtles captured near Diamond Shoals in North Carolina.

Finally, while not actually a part of the proposed project, dredging in the Thimble Shoals Channel as part of the deepening could have an adverse impact on migrating turtles. Recent data indicate that the loggerhead and ridley migrate into the Bay in May and June through the Thimble Shoals Channel. In order for the NMFS to issue a finding of no effect pursuant to Section 7 of the Endangered Species Act of 1973 (ESA) for a proposed Virginia Department of Highways and Transportation project located in Thimble Shoals outside the Bridge Tunnel, dredging should be precluded from between May 1 and June 30. A meeting in Norfolk on January 11, 1985, established time constraints, which the NMFS intends to apply to all dredging projects within the Thimble Shoals Channel. Therefore, the NMFS suggests that the Corps consider expanding the migration study to include the sea turtles' entry into and dispersal within the Chesapeake Bay. Following the receipt and analysis of the data gathered during these studies, the NMFS will re-evaluate the status of these proposals pursuant to ESA.

Site Selection Criteria

The NMFS strongly disagrees with the statement (page 66, paragraph 92) that there are no conflicts or problems for each of the 11 specific and five general criteria for selecting a disposal site. This letter outlines problems which the NMFS considers to be unresolved. We compare these impacts with the general and specific criteria presented in Code of Federal Regulations, Title 40, Section 228.5 and 228.6 (the Environmental Protection Agency's Final Revision of Regulations and Criteria for Ocean Disposal Site Designation).

Section 228.5(a) states: "The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation."

The NMFS concludes that these conditions have not been met. The document indicates that the area supports commercial and recreational fisheries (pages 39-44, paragraph 65, (a) and (b)). In addition, there is a substantial amount of recreational navigation through this area.

Section 228.5(b) states: (b) "Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery."

The NMFS concludes that the conditions noted in subsection (b) have not been met. Conclusive evidence has not been presented to show that the impacts of the disposal operations will not affect local beaches.

Secondly, the NMFS considers the blue crab overwintering, spawning, and nursery zone both inside and outside the mouth of Chesapeake Bay as a known geographically limited shellfishery. We consider a geographically limited fishery to include not only the actual area in which the fishery occurs but also any important habitat critical to that fishery. Since the exact extent of the nearshore blue crab nursery and recruitment patterns are not known, the NMFS concludes that it is not possible to determine accurately just what effect the use of the Dam Neck Site as a disposal site will have on this important resource. Therefore, since the proposed Dam Neck Site is located near a geographically limited shellfishery, and since it cannot be demonstrated that there are no impacts to this resource, this condition of subsection (b) has not been met.

Section 228.6(a) lists 11 factors which must be considered in the selection of disposal sites. Results of this consultation must be presented in environmental impact statements. NMFS feels that consideration of the following factors has not been adequate:

Section 228.6(a)(2): "Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases."

Page 26, paragraph 43 of the document states that there are extensive fish migrations through the study area. Our earlier comments under Current Pattern Changes and Endangered Species explained the importance of this area to living marine resources. Virtually all of the biological processes listed in this subsection occur within the proposed disposal site.

Section 228.6(a)(3): "Location in relation to beaches and other amenity areas."

While the document states that disposal will not affect Virginia Beach, located approximately 3.5 miles away, the NMFS does not concur. It has not been demonstrated conclusively that dredged material or increased turbidity will not be carried from the site to the beaches or that the

created disposal mound will not increase or alter longshore wave energy distributions. Our conclusions are supported by previous sections in this letter dealing with Spoil Site Stability, Shoreline Impacts, and Current Pattern Changes.

Section 228.6(a)(6): "Dispersal, horizontal transport and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any."

Page 35, paragraph 61, notes that no data are available on the vertical mixing characteristics at the site. This section states that no adverse impacts are expected since the dredge material dumped at the site is not expected to shift substantially by vertical mixing (emphasis added). The NMFS does not concur, as noted in our previous comments dealing with Spoil Site Stability and Current Pattern Changes.

Section 228.6(a)(9): "The existing water quality and ecology of the site as determined by available data or trend assessment or baseline surveys."

Paragraph 79 on page 59 indicates that depressed dissolved oxygen values have been reported for the Dam Neck area during the summer, perhaps due to the disposal of fine grained dredge spoil, which may interact with the Hampton Roads Sanitation District (HRSD) outfall. Because the local area around this proposed disposal site is so productive, any increase in the extent or severity of the dissolved oxygen depression because of dredge spoil disposal could affect significant living marine resources.

Since the proposed disposal site is presently experiencing low dissolved oxygen levels as a result of an apparent interaction between the existing disposal operation and the HRSD outfall, the NMFS concludes that consideration of these conditions in this subsection has been inadequate.

Specific Comments:

Page 48, paragraph (h) Wastewater Discharge states that the continued use of Dam Neck for the disposal of dredged spoil is not expected to affect HRSD's use of the area for wastewater disposal. Paragraph 79 on page 59 indicates that some inter-action between these two activities may take place and depress some local dissolved oxygen levels. These two sections should be revised.

Page 59, paragraph 80, indicates that the material disposed of at Dam Neck would meet Corps/EPA Ocean Disposal Criteria and be uncontaminated. These criteria utilizing chemical and biochemical analysis do not eliminate contaminated material. Therefore, some contamination over background levels may be introduced into the disposal site. This is particularly true if this site is designated for the disposal of any material meeting the criteria. The statement should be changed to reflect the fact that some of the material proposed to be placed at the site could be contaminated.

In summary, the NMFS concludes that the proposed expansion of the Dam Neck Disposal Site is less acceptable than the Norfolk Disposal Site. We base our conclusion on the fact that two of the general criteria in 40 CFR Section 228.5 have not been met and at least four of the specific criteria in 40 CFR Section 228.6 have not been adequately evaluated and considered. There are also five major areas in which the NMFS finds the document deficient. Therefore, the NMFS recommends that the Corps abandon the proposed action.

Sincerely,

Thomas E Bigford

Thomas E. Bigford
Habitat Protection Branch Chief

## REFERENCES

Biocourt, W.C., 1981. An Assessment of Transport and Mixing Processes at Norfolk Dredge Disposal Site. From Norfolk Disposal Study EIS.

Grosslein, D.M. and T.R. Azarovitz, 1982. Fish Distribution, MESA New York Bight Atlas Monograph 15, New York Sea Grant Institute.

Johnson, R.E. 1976. Circulation Study Near Cape Henry, Virginia, Using Lagranglan Techniques, Old Dominion University, Institute of Oceanography, Tech. Report No. 21.

Ludwick, John C. and W. J. Saumsiegle, 1976. Sediment Stability at the Dam Neck Disposal Site, Virginia. Old Dominion University, Institute of Oceanography, Tech. Report No. 27.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

JAN 25 1985

Mr. Frank T. Wootton, Jr., P.E.
Chief, Planning Division
Norfolk District, Corps of Engineers
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510

Re: Norfolk Harbor and Channels, Deepening and Disposal, Virginia (DS-COE-D32012-VA)

Dear Mr. Wootton:

The Environmental Protection Agency has completed its review of the above referenced Draft Supplemental Environmental Impact Statement. The supplement identifies an expansion of the existing Dam Neck Disposal site as an additional alternative site for disposal of dredged materials from the channel deepening and long-term maintenance operations. Pursuant to the authority granted to the USEPA within Section 309 of the Clean Air Act, we have completed our review and have identified environmental concerns which must be addressed in order to fully protect the environment. As such, we have rated this project as EC-2 in the EPA reference category. A copy of this classification system is enclosed for your information.

Since the initial scoping meeting on this project on September 15, 1983, there have been numerous meetings and discussions. The present draft reflects a significant change in response to the concerns of the various agencies. The original concept of an off shore bar was eliminated due to the potential for changes in current patterns which could have impacted migratory species.

The proposed total usage of the site has been modified to include only the outer channels, reducing the volume of materials to be dumped from 380 million cubic yards to approximately 70 million cubic yards. The remaining material would be placed in the Craney Island contaminent site. Also, up to 2.5 million cubic yards of clean sand would be used for beach nourishment. Further, the EPA and the COE entered an Interagency Agreement to provide funds for studies at the proposed site. There still, however, remain significant issues which must be addressed on the project. These issues are divided into three major categories and are detailed below.

1. Biological

On November 9, 1983 the resource agencies met to define the major areas of biological concern. These included assessing the existing fisheries, shellfisheries, nursery, feeding or passage areas of living

resources in adult or juvenile phases and, any interferences with fishing and fish and shellfish culture. Studies by the U.S. Fish and Wildlife Service and Old Dominion University, as well as our own surveys have fairly well defined the existing benthic, shellfish, and fin fishery populations. However, the impacts to the vulnerable larval and juvenile stages of the many ocean spawning species are not well understood. As an example, it is known that the blue crab (Callinectes supidus) spawns at the mouth of the Chesapeake Bay and according to the Draft Supplement, is found as planktonic larvae at the site. Further, it has been shown by Johnson (1982) that the megalopae stage may exhibit extremely patchy distributions. This could lead to substantial mortality of megalopae in the event that dredged material disposal coincided with the location of a high density patch. Similar distributions of larval concentrations may also occur for the croaker (Micropogon undulutus), spot (Leiostomus xanthurus), mackerel (Scomber scombrus) and the window pane flounder (Pseudopluronectes americanus) (Grosslein and Azarovitz, 1982). There is insufficient information in the Supplement to assess the overall impacts to the larval communities. It was not clear in the Supplemental whether the uncompleted studies contracted to Old Dominion University would address this issue. If significant losses are a potential, then mitigation may be required such as limiting the discharge or placing time of year restrictions. Attached is a study completed for the Norfolk Site on this issue.

The Supplement, in paragraphs 49 and 61, discussed sediment transport from the site. It was concluded that there was sufficient energy at the site to suspend and work the sediments, but that the long-term trend was to produce oscillating motion resulting in insigificant net transport of sediments. Therefore, it was concluded that there would be no impacts outside the site and minimal inside, and that recolonization of benthics would occur rather quickly. First, we do not believe there is sufficient data to assure that there is not net transport from the site and that any transport would not be toward beaches or toward areas of higher productivity such as at the mouth of the Bay. Second, if oscillating motion is assured and given sufficient energy to maintain sediments in suspension, the rate of recolonization would be greatly reduced as infaunal communities would be constantly subjected to high turbidity, burial, and to any contaminamts within the dredged material. Further, once particles are suspended in oscillatory flow, the critical value of fluid velocity significantly decreases, requiring only a small fluid velocity to maintain motion (Sleath, 1984). In reviewing the report on impacts from dumping, it was assumed that turbidity and sediment bed instability was a temporary phenomana. As noted above, this may not be the case.

2. Physical

We are concerned with the transport of sediments toward beaches,

resources in adult or juvenile phases and, any interferences with fishing and fish and shellfish culture. Studies by the U.S. Fish and Wildlife Service and Old Dominion University, as well as our own surveys have fairly well defined the existing benthic, shellfish, and fin fishery populations. However, the impacts to the vulnerable larval and juvenile stages of the many ocean spawning species are not well understood. As an example, it is known that the blue crab (Callinectes supidus) spawns at the mouth of the Chesapeake Bay and according to the Draft Supplement, is found as planktonic larvae at the site. Further, it has been shown by Johnson (1982) that the megalopae stage may exhibit extremely patchy distributions. This could lead to substantial mortality of megalopae in the event that dredged material disposal coincided with the location of a high density patch. Similar distributions of larval concentrations may also occur for the croaker (Micropogon undulutus), spot (Leiostomus xanthurus), mackerel (Scomber scombrus) and the window pane flounder (Pseudopluronectes americanus) (Grosslein and Azarovitz, 1982). There is insufficient information in the Supplement to assess the overall impacts to the larval communities. It was not clear in the Supplemental whether the uncompleted studies contracted to Old Dominion University would address this issue. If significant losses are a potential, then mitigation may be required such as limiting the discharge or placing time of year restrictions. Attached is a study completed for the Norfolk Site on this issue.

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2. Physical

We are concerned with the transport of sediments toward beaches,

shorelines, marine sanctuaries; or toward any known geographically limited fishery or shellfishery as defined in Section 228.5(b) of EPA's Ocean Dumping Regulations. While Appendix C of the DEIS contains an overview of the physical processes at the mouth of the Chesapeake Bay and along the coast of Virginia, it may not adequately address the transport of fine grained sand and silt from the site. Figure No. C-2 shows the mean annual current vectors for bottom circulation toward shore along Virginia Beach. While it was noted that the vectors were of weakest magnitude, it was still in an on-shore direction. If transport were to occur, it would be toward one of the east coast's most expensive resort communities. As shown by Sleath (1984), once initial motion has occurred, even the weakest steady current can carry the sediments along. Further, the creation of mounds significantly decreases the energy required for entrainment as opposed to a flat bed of sediments as presently exists.

The configuration of the proposed disposal site as identified on page 64 was not adequately discussed. The disposal site design evaluation of Appendix D provides a detailed explanation of what the minimal size of the site must be. While we concur with the calculation of what the minimum site requirements should be for disposal of 70 MCY we believe that the configuration does not conform to 40 CFR 228.5(d). The configuration may not permit effective monitoring and surveillance. While the configuration conforms to the depth contours, it would be more difficult for a contractor to stay within the site boundaries. Further, there is a possibility of materials from the disposal site being redeposited in the Atlantic Ocean Channel. As an alternative, we would recommend that the site be designed in a uniform rectangular pattern of 13,000 by 22,000 feet. The actual width may be modified based upon the amount the new configuration could hold.

3. Site Management

The DEIS has not addressed regulation of disposal use as provided in 40 CFR Section 228.7. This should include establishing limitations on times of dumping, rates of discharge, locations, if any, within site boundaries, and establishing a disposal site monitoring program. We are concerned with the impacts of dumping on the larval stages of fish and shellfisheries. An analysis must be made on the impacts of varing discharge times and rates as well as time of year restrictions. Management of the site should include mound height and location condition to control the interim and final topography of the site. Further, there should be included in the EIS, a detailed monitoring program developed to assure compliance with Section 227 and to assure adequate surveillance of the dumpers to assure that there are no impacts to fisheries migration especially in larval form and to assure an adequate knowledge of ultimate fate of materials dumped.

In addition to the major areas of concern, we also have three minor

points to make concerning the DEIS. These are as follows:

a. Paragraph 52 - The quality of the materials proposed for dumping should be included as defined in 40 CFR Section 227. This should be included as an Appendix rather than in the body of the EIS as information was already provided in the Channel deepening study.

b. Paragraph 65 - We are presently preparing a separate report on the findings of our studies at the Dam Neck Site. Preliminary indicators are similar to the findings by Old Dominion University. There were no commercial benthic species and the area appeared to have no unique features, either physically or biologically. It should be noted that we do have ship time and contract support to assist the COE in developing any future monitoring program.

c. Paragraph 65(g) Coastal Zone Management - While Virginia does not have an existing CZM program, they have initiated the first phase in its development. As such, they should be contacted and provided the opportunity for comment on the Draft. Due to the proximity to the state of North Carolina and the potential for transport of materials from the disposal site into North Carolina's waters, a consistency determination with North Carolina's Coastal Zone Management Plan must also be made. This would be required prior to site designation.

We hope these comments assist you in fulfilling your NEPA responsibilities. If you have any questions, or if we can be of further assistance, please contact Mr. WIlliam C. Muir of my staff at FTS 597-2541.

Sincerely,

John R. Pomponio, Chief
Environmental Impact & Marine
Policy Branch

Enclosures

## References

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## SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

### Environmental Impact of the Action

LO—Lack of Objections
EPA has no objections to the proposed action as described in the draft impact statement or suggests only minor changes in the proposed action.

EC—Environmental Concerns
EPA has identified environmental impacts associated with the proposed action that should be corrected in order to fully protect the environment.

EO—Environmental Objections
EPA has identified significant environmental impacts associated with the proposed action that should be avoided in order to adequately protect the environment. EPA intends to work with the proposing agency to reduce these impacts.

EU—Environmentally Unsatisfactory
EPA believes that the proposed action is environmentally unsatisfactory because of its potentially harmful effect on the environment. If the potential for unsatisfactory impacts is not corrected at the final EIS stage, the project will be recommended for referral to the CEQ. EPA intends to work with the proposing agency to reduce these impacts.

### Adequacy of the Impact Statement

Category 1—Adequate
The draft impact statement adequately sets forth the environmental impact of the preferred alternative or action and adequately sets forth alternatives that are reasonably available to the project or action.

Category 2—Insufficient Information
The draft EIS does not contain sufficient information to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS which could reduce such environmental impacts of the action. The inadequate information, data, analyses, or discussion should be included in the final EIS.

Category 3—Inadequate
The draft EIS does not adequately assess the potentially significant environmental impacts of the action, or the reviewer has identified new, reasonably available, alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS which should be analyzed in order to reduce the potentially significant environmental impacts. The inadequate information,

Figure 4-1

data, analyses, or discussions are of such a magnitude that they require full public review at a draft stage. This rating constitutes a finding that the draft EIS does not meet the purposes of NEPA and/or the Section 309 review, and thus must be formally revised and made available for public comment in a supplemental or revised draft EIS.

Figure 4-1 (continued)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

MAR 21 1985

Mr. Frank T. Wootton, Jr. P.E.
Chief, Planning Division
Norfolk District, Corps of Engineers
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510-1096

Re: Norfolk Harbor and Channels, Deepening and Disposal, Virginia (DS-COE-D32012-VA)

Dear Mr. Wootton:

This is in further regard to the above referenced project for ocean disposal of dredged materials at the Dam Neck disposal site. Our letter of January 25, 1985 provided comments concerning EPA's responsibilities under Section 309 of the Clean Air Act. However, we have further responsibility under the Marine Protection, Research and Sanctuaries Act to provide final authority over designation and disposal in marine waters. The District has proposed a site currently under interim status as promulgated in 40 CFR Section 228.12. Due to the proposed modification to the site, the increase in utilization, and the fact that interim status was based upon historical use and not the criteria, we consider this as a new site. According to Section 228.4(e)(2), in those cases where a recommended disposal site has not been designated by the Administrator, the COE may select the site, provided it is in accordance with the requirements of Sections 228.5 and 228.6(a). As noted in our comments of January 25, 1984, we have raised several issues concerning compliance with the criteria. If the Regional Administrator determines that the dumping would not meet the criteria, then no dumping may occur unless the Administrator issues a waiver of the criteria as provided in Section 225.4. We will await the Final Supplement and subsequent public notice to make that determination. Attached we have prepared further comments to assist the COE in complying with Sections 228.5 and 228.6(a).

As you are aware, the EPA is currently in the process of designation of the Norfolk disposal site. Designation of this site would provide the Corps with a suitable alternative to the Dam Neck site. Since both sites are within the Corps's Zone of Siting Feasibility, the Corps would be required to provide an adequate justification for use of a non-designated site. It is our current belief that the Norfolk site is environmentally preferrable to Dam Neck for the disposal of large quantities of spoils as needed for the channel deepening. During the review of alternatives and



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options, the Corps should include the site management plan as noted in our January 25, 1985 letter. Indeed, we believe that proper site management could include utilization of both sites to optimize use while limiting impacts.

Last, concerning designation, it is our understanding based upon 40 CFR Section 228.4(c)(1) that the Corps may permit use of the undesignated Dam Neck site by issuance of Dredged Materials permits or Notice of Intent to use the site. The site must then be designated by EPA through promulgation in 40 CFR Part 228. Since designation is based upon the same criteria as required for issuance of permits, we would utilize the COE's EIS to the maximum extent possible, as well as other studies already developed on the site. Therefore, we emphasize the need for the Corps to fully address each item in Section 228.5 and 228.6 so that site designation can be expedited. It should be made clear that site designation would not preclude utilization as allowed in Section 228.4(e)(2), provided there is concurrence by EPA.

It is our intent to work as closely as possible with your staff to provide sites and management necessary to maintain and upgrade the ports in the Hampton Roads area in an environmentally sound manner. If you have any questions concerning site designation, please contact William C. Muir of my staff at FTS 597-2541.

Sincerely,

William J. Hoffman, Chief
Wetlands and Marine Policy Section

Enclosure

cc: NMFS - Oxford
F&WS - Gloucester Point

228.5(c) "If any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in Section 228.5-6, the use of such sites will be terminated as soon as suitable alternatives disposal sites can be designated."

On January 29, 1985 we received a request from the National Marine Fisheries Service requesting that we withdraw interim approval of the Dam Neck on the basis that the criteria were not being met. Upon completion of the Final EIS on this site and the designation documentation, it is our intention to make recommendations to EPA Headquarters on designation which will be consistent with Section 228.5(c).

228.5(d) "The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permits the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study."

As noted in our January 25, 1985 letter, the configuration of the proposed Dam Neck site as identified on page 64 was not adequately discussed. Appendix D must be expanded to present both capacity and configuration requirements.

228.5(e) "EPA, will whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used."

Concerning uses of sites off the continental shelf, we believe that this will be addressed in the ZSF as noted on page 21 of the DS. If the revised ZSF does include areas off the shelf, then a detailed feasibility study would be necessary.

The Dam Neck and Norfolk sites have been historically used and as such should be regarded as candidate sites.

228.6(a)(1) "Geographical position, depth of water, bottom topography and distance from coast."

Page 25 addressed this criteria. In addition, a detailed bathymetric survey chart should be included.

228.6(a)(2) "Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult and juvenile phases."

As noted above, there is a significant fishery and shellfishery at the mouth of the Chesapeake Bay. The DS has not documented the breeding, spawning, and nursery for this area nor adequately assessed the potential impacts to these resources.

228.6(a)(3) "Location in relation to beaches and other amenity areas."

The DS on pages 26-29 presents the shore areas of concern. However, Appendix C does not provide sufficient analysis of the potential impacts of the disposal to the beach areas. Specifically, we are concerned with the transport of fines to the beaches or other amenity areas.

228.6(a)(4) "Types and quantities of wastes proposed to be disposed of, and proposed methods of release, including methods of packing the waste, if any."

In our January 25, 1985 we specifically stated that a detailed analysis of the spoils must be included. We further recommend that BOD and COD be included.

228.6(a)(5) "Feasibility of surveillance and monitoring."

The feasibility was discussed on page 33. However, the site designation should be also include a monitoring plan and a site management strategy.

228.6(a)(6) "Dispersal, horizontal transport and vertical mixing characteristics of the area, including prevailing current direction and velocity."

As noted above, the horizontal transport and ultimate fate of the spoils was not adequately addressed.

228.6(a)(7) "Existing and effects of current and previous discharges and dumping in the area."

While the DS does present a good summary of previous dumping, the effects on biota and the coastal area is meager at best.

Such statements as presented on page 35 "...Because of the broad area over which these materials were dispersed during this period, there are no apparent cumulative effects of these deposits," are not based upon scientific data gathered and analyzed on such things as sediment contamination, charges in benthic community structure or other parameters from which to base these conclusion.

228.6(a)(8) "Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the oceans."

See our comments on 228.5 above.

228.6(a)(9) "The existing water quality and ecology of the site as determined by available data or by trend assessment on baseline surveys."

The recent studies by ODU should adequately address this issue. The DS noted that these studies were not completed as yet.

228.6(a)(10) "Potentiality for the development or recruitment of nuisance species in the disposal site."

Page 55 of the DS only touches on the potential recruitment of nuisance species. To properly respond to this, the final report must address the following concerns. First, the existance of nuisance species in the spoils such as bacteria, virsuses, and amoeba must be identified. Second, the viability of these species surviving at the site must be assessed. Finally, the potential change in community structure within or around the disposal site which would lead to nuissance species must be described. An example would be the organic enrichment of the sediments causing a change from a diverse healthy benthic population to a monotypic community dominated by nuissance species such as polychaetes.

228.6(a)(11) Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.

This was adequately addressed in the DS.

United States Department of the Interior
OFFICE OF THE SECRETARY
MID-ATLANTIC REGION
Custom House, Room 502
Second and Chestnut Streets
Philadelphia, Pennsylvania 19106

January 28, 1985

ER 84/1554

Mr. Frank T. Wootton, Jr.
Chief, Planning Division
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510

Dear Mr. Wootton:

The Department of the Interior has reviewed the Draft Supplement to the Final Environmental Impact Statement (SFEIS) on the Dam Neck Ocean Disposal Site, which is under consideration as part of the Norfolk Harbor and Channels Deepening and Disposal Study.

GENERAL COMMENTS

The Department finds that the draft supplement is inadequate in its description of the resources in the project area, the evaluation of project impacts, and in its documentation of need for the proposed project. The following comments on the document are submitted in accordance with the review required by the National Environmental Policy Act. The U.S. Fish and Wildlife Service will submit recommendations on the project as required by the Fish and Wildlife Coordination Act at a later date.

SPECIFIC COMMENTS

Summary

The discussion of "Areas of Controversy" in Paragraph 1.15 states that the proposed rate of dredged material disposal at the Dam Neck Site is on the same order of magnitude as historical rates. This statement is misleading. While the previous maximum rate of disposal (12 million cubic yards in 1969-1970) is the same as the maximum proposed rate, that previous rate occurred only once and the long-term historical rate is much less (less than 1 mcy per year). Under the present proposal, rates of 7 to 12 mcy per year



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would be maintained over a 3 to 5 year period, which is substantially higher than any historical use. In addition, the proposed placement of 70 mcy is more than 3 times the amount previously placed and encompasses an area 2-1/2 times the size of the existing site. Therefore, the potential impacts of the proposed project are not comparable to those associated with disposal activities that historically occurred at the site.

Need For and Objectives of Action

Based on discussions between the Fish and Wildlife Service and the Corps, we understand that the primary purpose for seeking final designation of the Dam Neck Disposal Site is to provide a more economical site than the Norfolk Disposal Site for new work and future maintenance from the Norfolk Harbor and Channels deepening project. Paragraph 33 of the Appendix states that "these [transportation] costs are not in this case an absolute limiting factor, but will be used in comparing the relative economic merits of alternatives to the Dam Neck Site." However, the SFEIS fails to provide any information on the relative costs of these two disposal sites or how these costs affect the overall cost-benefit ratio of the entire project. The Dam Neck Site was eliminated in 1981 from consideration as an acceptable disposal site for the Norfolk Harbor deepening project because of the important biological resources in the area and the site's proximity to the shoreline. It is apparent that the environmental "costs" of the Dam Neck Site are higher than the Norfolk Disposal Site alternative; however a full public interest review is not possible unless these environmental "costs" can be evaluated in relation to the economic savings associated with the Dam Neck Site. Section 1502.23 of the "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" (40 CFR 1500-1508) states that "If a cost-benefit analysis relevant to the choice among environmentally different alternatives is being considered for the proposed action, it shall be incorporated by reference or appended to the statement as an aid in evaluating the environmental consequences." We maintain that if the Corps chooses a less environmentally acceptable alternative than the Norfolk Disposal Site, the economic savings must be documented.

The SFEIS is unclear as to whether the Dam Neck Site is being proposed for disposal of dredged material other than that from the Thimble Shoal, Cape Henry, and Atlantic Ocean Channels. Paragraph 6 of the Appendix states "In addition, the Dam Neck Ocean Disposal Site could be needed for the disposal of material from Norfolk Harbor. . .if adequate disposal areas in the Norfolk Harbor area were not available." Since the SFEIS states that the

Dam Neck Site is being sized to contain only the 70 million cubic yards of new work and maintenance dredging from the three aforementioned channels, the question must be raised whether the Corps anticipates expanding the Dam Neck Site at some future date., If this is the case, the SFEIS should address this possibility and its impacts.

Alternatives

Section 40 CFR 1502.14 states that the evaluation of alternatives "is the heart of the environmental impact statement" and that the EIS should "present the environmental impact of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public." The SFEIS contains virtually no meaningful comparison of the biological resources and physical processes at the Norfolk Disposal Site and the Dam Neck Site. Such a comparison should be included.

Affected Environment

The environmental studies that were conducted by Old Dominion University (ODU) at the Dam Neck Disposal Site have not been completed and the SFEIS states that they will be presented in a Supplemental Information Report later in 1985. The EIS is to be used as part of the decision making process and 40 CFR 1502.22 requires that relevant information shall be included in the document. Without this information it is impossible to adequately evaluate the impacts of the proposed project or to compare the Dam Neck Site to the Norfolk Disposal Site. We believe that the Corps was premature in issuing the draft SFEIS without the results of the ODU studies and that a revised draft should be issued once this information is available.

Environmental Effects of Disposal

As stated above, it is not possible to fully evaluate the impacts of the proposed project without the results of the biological studies. We believe that the level of evaluation presented in the SFEIS is insufficient to conclude that there will be no significant adverse effects associated with the proposed project. This will be discussed further under our review of the SFEIS appendices.

Appendix - Site Evaluation Study

The following comments are presented in response to the Corps' evaluation of the general and specific selection criteria found at 40 CFR 228.5 and 228.6.

Distance from Beaches and Other Amenities - As we will discuss below, the level of analysis presented in the Appendix is insufficient to support the conclusion that the proposed disposal site will not result in any changes in wave refraction or shoreline erosion. In view of the millions of dollars of private and federal property that are present along the Virginia Beach shoreline, we believe that a detailed evaluation to confirm this statement is warranted. The Department is particularly concerned about any potential effects to our Back Bay National Wildlife Refuge, which is located 3 miles southwest of the disposal site.

Dispersal, Horizontal Transport and Vertical Mixing Characteristics of the Site - The conclusion regarding site stability in Paragraph 61 that, "the Dam Neck Site and surrounding area are a hydraulically stable environment with little potential for significant net movement of dumped dredge material," is apparently based on the levels of analysis of physical processes presented in Appendices C and D. Appendix D evaluates the suitability of the disposal site based on a criterion labeled as the "level of stability" (LS). However, as the report indicates, this LS evaluation is only useful to compare the relative stability of the various design configurations and does not imply a stable condition. Appendix C presents data that is oversimplified and does not accurately describe the physical environment in the vicinity of the proposed disposal site. The statement in Paragraph 59 and in Appendix C that the Dam Neck Site is influenced by a net southward oceanic circulation is not supported by such studies as Johnson (1976), Ludwick (1978) and Boicourt (1981), which indicate that at least the northern portion of the Dam Neck Site is within what appears to be a clockwise gyre at the mouth of the Chesapeake Bay which experiences a net bottom flow toward the north. The evaluation of sediment stability is based entirely on "net annual" and "mean" current directions and velocities, which are inappropriate to predict movement of sediments of the site. For example, Boicourt (1981) found mean velocities of 50 cm/sec over a 5 day period during the summer at a station located just north of the Dam Neck Site. These velocities are more than twice the value Ludwick and Saumsiegle (1976) indicate would move medium-grained sand. Considering that over half of the dredged material to be placed at the Dam Neck Site consists of clays and silts, the stability of the site is extremely questionable. We have appended to our letter the comments of the Virginia Institute of Marine

Science (VIMS) regarding the physical aspects of the disposal site. We believe that the formal analyses recommended by VIMS should be conducted. Indeed, the Fish and Wildlife Service has recommended to the Corps in a meeting of September 15, 1983 and in letters of January 6, 1984 and May 25, 1984 that such studies are necessary to fully evaluate the impacts of the proposed disposal site.

Effects of Previous Disposal - The statement that there have been very limited detectable effects related to previous use of the Dam Neck Site is based on speculation since there were no baseline or ongoing monitoring studies of biological or water quality impacts. Such a statement should, therefore, be qualified. Ludwick and Saumsiegle (1976) indicate that localized wave enhancement of 17% for 12 second waves from the northeast along a portion of the shoreline could be attributed to the Dam Neck disposal mound. Such a change may indicate that more significant impacts could be associated with a larger disposal site.

Interference with Other Uses of the Ocean - Figure 8 and other figures in the document are misleading because they show the dimensions of the existing Dam Neck Disposal Site and not the proposed site. The proposed configuration actually is less than 1 mile from the Atlantic Ocean Channel. This closeness to the channel would appear to compromise navigational safety. Furthermore, it has not been adequately documented that dredged material will not move out of the disposal site and into the channel.

General Criteria - 40 CFR 228.5 places two stringent requirements on the selection of ocean disposal sites. Section 228.5(a) requires that ocean disposal will be permitted "only at sites or in areas selected to minimize interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation" (emphasis added). The Corps appears to interpret the word "fisheries" to mean the act of catching fish. However a fishery is defined as the interaction between populations of fish and their habitat, and their relationship to commercial or recreational fishermen (Everhart et al., 1953). As documented in the SFEIS and Appendix, the Dam Neck area is within the migration route and spawning area of many species of finfish and the blue crab (Callinectes sapidus). The location of a dredged material disposal site has the potential to adversely affect these resources, as indicated by the prohibition in Section 228.5(a). The range of impacts associated with dredged material disposal has been well documented in the literature and includes such effects as interference with finfish respiration, feeding, and

migration; destruction and flocculation of phyto- and zooplankton; and destruction of the benthos. (Tereco, 1976; Morton, 1977; O'Connor et al., 1977; Stern and Stickle, 1978; Allen and Hardy, 1980). Contrary to the statement in the document that benthic recolonization can occur within several months, the fact that sediments at the disposal site will not be stable under most wave conditions indicates that up to 10 square miles of ocean bottom may lose its value as a food source for benthic feeding fish.

Section 228.5(b) requires that disposal sites will be located so that "temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant levels or effects before reaching any. . .geographically limited fishery or shellfishery." As discussed, the term "fishery" applies both to fish and their habitat. The Fish and Wildlife Service, after consultation with the National Marine Fisheries Service, defines the existing fishery within the project area as geographically limited based on two factors. First, the mouth of the Chesapeake Bay and the adjacent nearshore Atlantic Ocean is the spawning and nursery area for the entire Chesapeake Bay population of the blue crab. Although the exact offshore limit of this spawning area is not known, Dr. Arthur Butt (Old Dominion University, pers. comm.) indicates that blue crab zoea larvae have been found in the Dam Neck area at levels similar to those found at the mouth of the Chesapeake Bay. Second, the area is within the major migration route for finfish into and out of the Chesapeake Bay. The offshore extent of this migration corridor is also imprecisely known; however, the fact that commercial fishermen trawl to at least 4 miles off the coast indicates the general boundaries of this zone. Several fish species, including flounder (Paralichthys dentatus), croaker (Micropogonias undulatus), weakfish (Cynoscion regalis) and menhaden (Brevoortia tyrannus) spawn in and utilize the project area as a nursery zone. Increases in turbidity levels and loss of benthic habitat resulting from disposal operations could adversely effect these fisheries, particularly the sensitive early life stages. Studies being conducted by Old Dominion University and Hampton Roads Sanitation District (HRSD) indicate low dissolved oxygen levels in the study area. The disposal of dredged material could increase the biochemical oxygen demand (BOD) and further stress aquatic organisms. The long-term cumulative effects of increased BOD from the disposal operations and the HRSD Atlantic Sewage Treatment Plant outfall are unknown. Since the disposal site is proposed to be located in the zone of geographically limited fisheries, it will be impossible to meet the requirement of 40 CFR 228.5(b).

SUMMARY

The items discussed in our comments should be addressed in the environmental impact statement in order to allow a full evaluation of project alternatives and impacts as required by the National Environmental Policy Act. This information is also necessary for the Fish and Wildlife Service to provide final comments on the project as required by the Fish and Wildlife Coordination Act (FWCA). Due to the inadequacy of the draft SFEIS, we recommend that a revised draft be prepared in accordance with the requirements of 30 CFR 1502.9(a) once the biological studies conducted by Old Dominion University and physical studies recommended by the Virginia Institute of Marine Science have been completed. With respect to the physical studies, we suggest that a meeting between the District and physical scientists at VIMS, ODU and the Coastal Engineering Research Center would be appropriate to fully define the level and method of analysis that is necessary.

Based on the information presented in the SFEIS and Site Evaluation Study, the Department cannot concur with the Corps' conclusions that there will be no significant impacts on biological resources, water quality, or physical processes in the vicinity of the Dam Neck Disposal Site. Furthermore, the Dam Neck Site does not meet the designation criteria set forth in 40 CFR 228.5(a) and (b) and is, therefore, unacceptable as an ocean disposal site. Although the Fish and Wildlife Service will not provide final FWCA comments until the information requested in this letter is available, they have indicated that they intend to maintain the position stated in their draft FWCA report of May 25, 1984. That report recommended the designation and use of the Norfolk Disposal Site.

Unless the issues addressed in this letter are satisfactorily resolved prior to the release of the final SFEIS, the Department will consider referral of this matter to the Council on Environmental Quality in accordance with 40 CFR 1504.

Sincerely,

Anita J. Miller
Regional Environmental Officer

## REFERENCES


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U.S. Department of Transportation
United States Coast Guard

Commander
Fifth Coast Guard District

Federal Building
431 Crawford Street
Portsmouth, VA 23705
Staff Symbol: (MPV)
Phone: (804) 398-6388

16600
18 Jan 1985

Department of the Army
Norfolk District
Corps of Engineers
Planning Division
803 Front Street
Norfolk, Virginia 23510-1096

Dear Sir:

We have reviewed the "Draft Supplement to the Final Environmental Impact Statement for Norfolk Harbor and Channels, Virginia - Deepening and Disposal", and have no comments to this document.

We would like to point out, however, the need for advance notice to the Coast Guard of any actual dredging activity in the "Traffic Separation Scheme", including the "Precautionary Area", traffic lanes, and their approaches. At least five months lead-time is necessary for us to notify the International Maritime Organization of the work involved, and its duration.

Shoud you have any questions on this matter please feel free to call Lieutenant Bill Wetzel at 398-6388.

L. K. Carr

L. K. CARR
By direction

DEPARTMENT OF THE NAVY
COMMANDER NAVAL BASE
NORFOLK, VIRGINIA 23511

IN REPLY REFER TO
6280
Ser N9/
17 JAN 1985

Department of the Army
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Planning Division

Gentlemen:

In response to your letter of 1 December 1984 requesting comments on the Draft Supplement to the Final Environmental Impact Statement for Norfolk Harbor and Channels, Virginia - Deepening and Disposals, the following are provided:

1. At present, no need for suitable material from dredging Norfolk Harbor and Channels exists for use at Sewells Point Naval Complex. However, future construction and operational requirements may result in our request for suitable dredge material for use at the Naval Complex.

2. Alternative disposal plans consider outer harbor dredge material to be disposed in the Chesapeake Bay and at Craney Island. Increased use of these areas for disposal of outer channel dredge material can potentially have an adverse effect on U.S. Navy activities (SFEIS 7-3.01a) and, therefore, should not be considered.

J. W. STOUFFER
DEPUTY

Copy to:
COMLANTNAVFACENGCOM
CO NSC Norfolk
CO PWC Norfolk
CO NAVSTA Norfolk
CO NAS Norfolk

DEPARTMENT OF THE NAVY
FLEET COMBAT TRAINING CENTER, ATLANTIC
DAM NECK, VIRGINIA BEACH, VIRGINIA 23461

11000
Ser 40E4/ 000086
9 Jan 85

From: Commanding Officer, Fleet Combat Training Center, Atlantic
To: Department of the Army, Norfolk District, Corps of Engineers

Subj: NORFOLK HARBOR AND CHANNELS, VIRGINIA - DEEPENING AND DISPOSAL

Ref: (a) Department of the Army ltr of 1 December 1984

1. Per reference (a), the draft supplement to the final environmental impact statement has been reviewed with no comments.

C. H. POLLARD, JR.
By direction

# COMMONWEALTH of VIRGINIA

*Council on the Environment*

KEITH J. BUTTLEMAN
ADMINISTRATOR

903 NINTH STREET OFFICE BUILDING
RICHMOND 23219
804-786-4500

January 28, 1985

Mr. Frank T. Wootton, Jr., P.E.
Chief, Planning Division
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, Virginia 23510

Dear Mr. Wootton:

The Commonwealth of Virginia has completed its review of the Draft Supplement to the Final Environmental Impact Statement for Norfolk Harbor and Channels Deepening and Disposal. The Council on the Environment is responsible for coordinating Virginia's review of federal environmental documents and responding to appropriate federal officials on behalf of the Commonwealth. The following agencies took part in this review:

Commission of Game and Inland Fisheries
Department of Agriculture and Consumer Services
Department of Conservation and Historic Resources
Department of Health
Department of Highways and Transportation
Marine Resources Commission
State Water Control Board
Virginia Institute of Marine Science
Virginia Port Authority
Department of Planning and Budget
(Intergovernmental Review)
Southeastern Virginia Planning District Commission.

We recognize the need to dispose of dredged material from the deepening of Norfolk Harbor and Channels. The provision of a disposal site at Dam Neck would reduce the costs of disposal of materials, inasmuch as it is much closer than the Norfolk Disposal Site. The approach taken by the Corps in this document is likely to improve the chances that additional dredged material will become available for beach nourishment or stockpiling for beach nourishment. This is a beneficial prospect since beach nourishment needs in the area are great, and the ample material that may be suitable for beaches should not be wasted. The document also indicates movement toward a fully coordinated planning approach to the Norfolk Harbor and Channels project and related projects such as the Virginia Beach Hurricane Protection project. This development is also welcome.

We are almost ready to agree with your recommendation that the Dam Neck Interim Site be given final designation as a dredged material disposal site. However, while it is true that the document has addressed the specific and general criteria for ocean disposal site evaluation, we do not think that final conclusions regarding the impact of designation of a greatly expanded site can be drawn at this time. Analyses related to site stability and wave impacts, in particular, need to be completed in order to allow a determination that environmental impacts on shoreline properties and on marine biota will not be unacceptably severe.

First, with respect to shoreline impacts, the proposed Site Plan would reduce depths at the Dam Neck Disposal Site from about 42 feet to 35 feet. This might alter significantly the longshore wave energy distributions. The Saumsiegle report (1976), referenced in the Draft Supplement, recommends restricting the size of the Dam Neck Disposal Site to reduce wave refraction effects and shoreline wave height. Since the site must be enlarged to accommodate the volume of material anticipated from the deepening project, formal consideration of wave refraction effects is needed so that consequences of site enlargement will be fully understood. It should be noted that the understanding of shore response to waves has changed since the Ludwick report on Dam Neck was issued in 1976, and simulation of potential wave conditions is easier now because of advanced computer techniques.

Finally, some biological studies are not in final reportable form. When completed, the biological studies should be integrated with the results of the formal site stability analysis to examine potential impacts on the biota.

The designation of the Dam Neck Disposal area will not affect archaeological resources, the area transportation network, or local and regional plans.

Again, we recommend that the analyses suggested by VIMS and others be accomplished, not just because the potentially affected resources are singularly important, but to allow consideration of ways in which this undertaking may go forward in consonance with resource protection. These additional analyses are important not only for an understanding of potential impacts upon the shoreline and affected biota, but because the shoreline and the affected biota are singularly important in their own right. The mouth of the Chesapeake Bay is a nursery area for blue crab; it is traversed by migratory species which give the Bay and surrounding areas much of their ecological, recreational, and economic

importance. The importance of the Hampton Roads shorelines needs no explanation. If you have questions about these comments, please call Charles Ellis of my staff (786-4500) or Dr. Robert Byrne of VIMS (642-7191).

Thank you for the opportunity to comment. We appreciate the extra time that was granted for this review.

Sincerely,

Keith J. Buttleman

Enclosures

cc: The Honorable Betty J. Diener
Dr. Frank O. Perkins, VIMS
Mr. Norman E. Larsen, MRC
Mr. Leon E. App, DCHR
Ms. LaVern H. Corkran, SWCB
Mr. R. Todd Coyle, VPA
Mr. Arthur L. Collins, Southeastern Virginia PDC
Mr. Bruce J. Larson, VRCA
Mr. K.E. Wilkinson, DHT
Mr. John P. Randolph, CGIF

CHARTERED 1693
COLLEGE OF WILLIAM AND MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE

Gloucester Point, Virginia 23062 Phone (804) 642-2111

January 18, 1985

Mr. Charles H. Ellis, III
Environmental Programs Analyst
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

Reference: Comments on Draft Supplement and Appendix: Dam Neck, Norfolk Harbor and Channels, Deepening and Disposal

Dear Mr. Ellis:

Given the materials in the report we cannot concur with the evaluation of the Corps that the proposed expansion of the Dam Neck site will not have significant adverse environmental effects. Our findings are based on:

1.) The fact that most of the biological studies are incomplete and that preliminary findings are an insufficient basis from which to draw substantive and integrated conclusions.

2.) The opinion that a substantially more complete and sophisticated analysis of site stability is needed before reaching the conclusions drawn, and

3.) The opinion that insufficient attention has been given to the potential impact of altered bathymetry on shoreline wave energy distributions.

Thus our lack of concurrence at this point is rooted in the incompleteness of the Draft rather than disagreement over facts. Our detailed comments on the above are most easily presented in reverse order.

Shoreline Impacts

The Site Plan proposed would alter existing depths from "about 42 feet" to 35 feet. This alteration over the bottom area planned has the potential to significantly alter longshore wave energy distributions. Formal execution of wave refraction analysis is essential given the nature of shoreline use

the benthic community recolonizing the area may differ significantly from the native populations. The relative resource value of the recolonizing community is important since a large area is impacted, about ten square miles.

On the other hand if the material is resuspended and entrained into the water column then the enhanced turbidity may impact biological processes, and the aesthetic aspects of water quality along the recreational beaches. Clearly, these matters are of sufficient importance to require a penetrating analysis of site stability.

What is needed in the analysis of site stability is formulation of the frequency distribution of bottom shear stress as a function of the wave climate and tidal currents. These values may then be coupled with existing sediment entrainment formulations to estimate the sediment dispersion. This procedure is within the state-of-the-art. We thus disagree with the assertion (page C-3) that sediment transport predictions would not be improved by application of more elaborate and sophisticated analysis. The Draft report indicates wave generated currents, on an average annual basis, can move fine sand material 80 to 90 percent of the time in the shallower portion of the site and 50 percent of the time at 45 foot depth. On the basis of vector averaged tidal currents (small) the Draft implies that sediment advection will be very limited. The vector averaging procedure is inappropriate for the case. If averages are to be used at all the root mean square of current speed would be better. Vertical mixing is dismissed because "no data are available." Such information should be incorporated in a wave-current suspended sediment dispersion analysis using estimates from other studies. Specific attention should be given, as well, to wind induced coastal flows.

Biological Studies

Several of the biological and water/sediment quality studies are not yet in final reportable form. When completed the biological studies should be integrated with the results of the more formal analysis of site stability to examine potential impacts on the biota.

Two additional points warrant comment. We submit that the judgement as to the level of monitoring must await the resolution of the questions raised above concerning site stability and resultant bottom characteristics. Also we ask whether a disposal management scheme is to be established such that the very fine grained materials are segregated from those materials which are suitable for future beach nourishment.

# COMMONWEALTH of VIRGINIA

B. C. Leynes, Jr.
Director

Department of Conservation
and Historic Resources

1100 Washington Building
Capitol Square
Richmond, Virginia 23219
(804) 786-2121

January 4, 1985

MEMORANDUM

TO: Charles H. Ellis, III
Environmental Programs Analyst

FROM: Leon E. App, Executive Assistant
DCED/EIS Coordinator

SUBJECT: Norfolk Harbor and Channels, Deepening and Disposal
EIS #625

Our Division of Mineral Resources and the Public Beach Commission have reviewed the above project and comments are as follows:

Mineral Resources - No comment.

Public Beach Commission - See attached.

mmv

Attachment

cc: Dick DeKay
Gary Anderson

xxxxxxxxxxxxxxxxxxxx

Curwin Abbott, Hampton
Benjamin C. Garrett, III
Gloucester

CONSERVATION and DEVELOPMENT of PUBLIC BEACHES

3 January 1985

Mr. Leon App
Department of Conservation
and Economic Development
1100 State Office Building
Richmond, Virginia 23219

Dear Leon:

The following comments concern EIS number 625 which details the Norfolk Harbor and Channels, Deepening and Disposal project. When one reads between the lines one sees a shift in attitude and perspective by the Corps about this project. Although there is some grousing by some federal agencies, the project is necessary and beneficial and should be pursued. The major debate is still what to do with all that "stuff" that comes out of the hole.

The shift to the Dam Neck site has a lot of attractive parts to it. From the perspective of the Commission, emphasis should be given to the alternative uses of suitable material. This is referenced in paragraphs 1.12 and 1.13 on page 4. In particular we are interested in seeing the beach quality material used for beach restoration. This is mentioned in paragraph 2.05 on page 6. We believe this portion of the disposal plan should be given special emphasis. This is reiterated in paragraph 3.0/c on page 8. What the Commission would like to see are the engineering questions involved in this alternative and the associated costs in detail. As a point of discussion, is it feasible to segregate the beach quality material from the other "stuff" so as to create an underwater stockpile in the Dam Neck area? This type of approach has already been recommended to the Norfolk District for beaches inside the Chesapeake Bay mouth. These two reports are listed on the attached bibliography. Preliminary indications are the proposed dredging could yield 8 to 10 million cubic yards of beach quality material. If it were feasible to place 2.5 million on Virginia Beach, that still leaves a large pile of good material. It seems crazy to waste it if it could be stockpiled for future beach use.

Mr. Leon App
Department of Conservation
and Economic Development
1100 State Office Building
Richmond, Virginia 23219



In general we support the option chosen by the Norfolk District. As outlined it has tremendous potential for additional benefits with a little study and planning. Ultimately it makes the proposal that much more attractive to the citizens of the Commonwealth and the local, state and federal government.

In the technical category, we believe the question of the interaction between waves and the proposed "low profile" structure are not well enough covered. The understanding of shore response to waves has changed since 1976 when the Ludwick report on Dam Neck was issued. In addition advanced computer techniques now make it much easier to simulate potential wave conditions. In the interest of reducing or eliminating possible deleterious effects from storm waves refocused by the disposal site, the proposed configuration should be subjected to certain mathematical wave models to predict their impact on the shoreline. It may be possible to do this without much field work by using existing data sets at VIMS, the C.E.R.C. facility at Duck, North Carolina and within the Norfolk District.

More detailed review of this document may yield additional comments which will be forwarded to you. If you have any questions about these comments, please contact me at your convenience.

Sincerely,

Gary L. Anderson
Technical Advisor

GLA:lm

# COMMONWEALTH of VIRGINIA

*Marine Resources Commission*
*P. O. Box 756*
*2401 West Avenue*
*Newport News, Virginia 23607*
*Telephone: 247-2200*

**WILLIAM A. PRUITT**
**Commissioner**

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JOHN M. PHILLIPS
Hampton, Virginia

TED J. WOOL
Virginia Beach, Virginia


January 2, 1985

Mr. Charles H. Ellis, III
Environmental Programs Analyst
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

Dear Charlie:

This responds to your December 5, 1984 request for comments on the Norfolk District U. S. Army Corps of Engineers' draft supplement to the FEIS for Norfolk Harbor Channels, Virginia Deepening and Disposal.

While the purpose of this supplement is ostensibly to address the Dam Neck site as another disposal alternative, this effort appears to represent a major step toward incorporation into the planning process of a suggestion offered in my March 5, 1984 letter to Colonel Hudson (copy attached). I am particularly pleased to note the favorable consideration being given to beach nourishment and stockpiling of suitable materials. I am also encouraged that the wide distribution being given this document can help generate the kind of public discussion which may ultimately be needed to select appropriately among disposal options, some of which are likely to become controversial.

You will note from a review of my previous correspondence that I have consistently urged a fully coordinated planning approach to the Norfolk Harbor and Channels deepening and Hurricane Protection, or beach nourishment needs, in even reasonable proximity to the material generated. This draft supplement is a commendable step in that direction. I have also been concerned, however, that controversies could develop which would make the off-shore disposal option attractive in spite of the high cost to the taxpayer and foreclosure of potentially beneficial uses of the material. Inclusion of the following statement in the abstract of the supplement enforces my concern, "New work and maintenance materials from channels outside Hampton Roads were then, and continue to be, planned for disposal at sea."

In summary, I believe the document under review represents an excellent step toward a thorough review of alternatives and a complete exchange of information among all three levels of government to help assure a selection of disposal options which benefits the greatest number of citizens and offers the highest cost/benefit ratio.

With all good wishes, I am

Sincerely,

Norman E. Larsen
Assistant Commissioner
for Habitat Management

NEL:vld
HM
CC: Mr. William A. Pruitt
Mr. Frank I. Wooten

Attachment

# COMMONWEALTH of VIRGINIA

WILLIAM A. PRUITT
Commissioner
ASSISTANT COMMISSIONERS
ROBERT D. CRAFT
Administration and Finance
ROBERT J. MARKLAND
Law Enforcement
NORMAN E. LARSEN
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IVAN D. MA
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JOHN M. PHILLI
Hampton, Virgi

September 15, 1983

Mr. Charles H. Ellis, III
Environmental Impact Statement Coordinator
Council on the Environment
903 Ninth Street Office Building
Richmond, VA 23219

Dear Charlie:

This constitutes our response to the Draft Environmental Impact Statement and Feasibility Report on the U. S. Army Corps of Engineers Virginia Beach Hurricane and Erosion Protection (Project number 557 dated August 4, 1983).

My principal concern is that there are two major research projects ongoing within the Norfolk District which, because of their intimate relationship, should be closely associated in planning. Yet, from a review of the two feasibility reports, this association is not readily apparent.

I refer specifically to the DEIS currently under discussion and the dredging of the Atlantic Ocean Channel for the proposed 55-foot Norfolk Harbor and Channels Deepening for which a draft feasibility report was issued in September of 1979. Even a casual review of these two documents reveals striking facts which warrant careful comparison.

For example, beach nourishment for hurricane protection will require 2.5 million cubic yards of suitable material initially, with an estimated annual contribution of 200,000 cubic yards. Dredging of the Atlantic Channel will produce 13 million cubic yards of "primarily clean, courser sands" and an estimated 190,000 cubic yards annually. The proposed borrow area for the hurricane protection material is adjacent to the Atlantic Channel.

There is apparently a good deal of local dissatisfaction with the idea that a cost/benefit analysis justifies a major federally supported nourishment project of Virginia Beach, but not further south along the shore where erosion is an equally serious problem. It seems conceivable that by combining the two projects, cost/benefit ratio's may assume a more favorable perspective.

I understand that the Norfolk District is currently examining carefully every conceivable beneficial use of the dredged material to be generated by the Atlantic Channel deepening in order to avoid the cost and foreclosed use of the material by placing it in the open ocean site well offshore as currently planned. We heartily concur with this effort. As a matter of fact, in the nearly five years that the issue of deepening the Baltimore Channel to 50 feet has

been under review, we have steadfastly maintained that maximum beneficial use be made of all suitable material generated by the dredging of those channels in Virginia waters as well .

I further understand that an offshore bar from Cape Henry to the current Dam Neck disposal area and paralleling the beach 2 - 3 miles offshore will be actively and carefully studied. I would urge that equal consideration be given to nourishment of the entire Atlantic shoreline of Virginia if adequate quantities of suitable material can be generated because proximity of this eroding shoreline would not appear to greatly increase the cost.

In summary, the point to be made is that since undertaking the hurricane protection study, two dredging proposals which have the potential for generating vast quantitites of potentially suitable beach nourishment material, have moved closer to approval. In order to minimize cost while maximizing benefits, we strongly endorse combining the complex considerations involved in all of these proposals and subject them to the closest scrutiny. We further encourage every innovative idea associated with beneficial use of the material. Finally, I am of the further opinion that before any of these projects can reach fruition, it will require the finest degree of cooperation and coordination among government agencies at all three levels. Toward that end, I urge an early and extensive, fully coordinated and fully publicized, planning effort. While all three projects will likely be statutorily exempt from our permit requirements as "Congressionally approved navigation and flood control projects," we will expect to follow closely their progress because of our interest in and responsibility for the marine resources of the Commonwealth.

I apologize for the lateness of this response, but I hope the foregoing can nevertheless be incorporated into the ongoing research for these several major and closely related inter-governmental proposals.

With all good wishes, I am

Sincerely,

Norman E. Larsen
Assistant Commissioner for
Environmental Affairs

NEL/slp
EV
CC: Mr. William A. Pruitt

# COMMONWEALTH of VIRGINIA


WILLIAM A. PRUITT
Commissioner
ASSISTANT COMMISSIONERS
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JOHN M. PHILLIPS


March 5, 1984

Colonel Ronald E. Hudson
U. S. Army Corps of Engineers
Norfolk District
803 Front Street
Norfolk, Virginia 23510

Dear Colonel Hudson:

Last September, after reviewing the Draft Environmental Impact Statement on Hurricane and Erosion Protection for the City of Virginia Beach, I forwarded the attached response to the Governor's Council on the Environment. The principal objective of that letter was an attempt to assure that several important large scale proposals in close proximity, and all apparently being actively studied, would be examined collectively and suitably coordinated at all appropriate levels of government.

Specifically, these proposals are: (1) The Virginia Beach Hurricane and Erosion Protection Project; (2) The 55-Foot Thimble Shoals and Atlantic Ocean Channel Deepening; (3) the Dam Neck dredged material site; (4) Development of an offshore bar utilizing dredged material and (5) Designation of the Norfolk Ocean Disposal site.

I understand that significant research effort has been and is currently being expended on studies of the environmental consequences of various aspects of these separate proposals. I appreciate the need to investigate an overwhelming array of environmental questions and endorse the need to continue that effort. Nevertheless, I am of the opinion that social, political and economic factors are equally important and may ultimately dictate the selection among alternatives under consideration. I am concerned, therefore, that there may be an inadequate exchange of information; particularly at State and local levels of government.

At our interagency bi-monthly dredging management meetings, I have repeatedly suggested the formation of an intergovernmental Task Force and a completely open planning process to help assure that unanticipated problems do not cause an "eleventh hour" and unacceptably costly change in plans.

I fully realize that formation of such a forum can offer no guarantees of success, but I also believe that without a process of that kind, our mutual hopes for maximum beneficial use of the material generated at the least public cost may not be realized because of the wide diversity of interests and concerns.

With all good wishes, I am

Sincerely,

Norman E. Larsen
Assistant Commissioner for
Environmental Affairs

NEL/slp
EV
CC: Mr. William A. Pruitt
Ms. Sheila Prindiville
Dr. Frank Perkins
Mr. Richard N. Burton

Council on the Environment

August 4, 1983 PROJECT NUMBER (FEDERAL/[illegible]) #557

NAME OF PROPOSAL: Virginia Beach Hurricane and Erosion Protection

SPONSOR OF PROPOSAL: Army Corps of Engineers

TYPE OF DOCUMENT:

| | |
|---|---|
| ___ | ENVIRONMENTAL ASSESSMENT |
| ___ | PRELIMINARY ENVIRONMENTAL IMPACT STATEMENT |
| XXX | DRAFT ENVIRONMENTAL IMPACT STATEMENT & Feasibility Rep |
| ___ | FINAL ENVIRONMENTAL IMPACT STATEMENT |
| ___ | OTHER ___ |

5. ROUTING OF DOCUMENT:

| | |
|---|---|
| XXX | ENCLOSED |
| *** | SENT DIRECTLY TO YOU BY SPONSORING AGENCY UNDER SEPARATE COVER |
| ___ | TO OBTAIN COPY, PLEASE CONTACT |

AUG 11 1983

MARINE RESOURCES COMMISSION

By ___

6. DOCUMENT REFERRED FOR COMMENT TO:

| | | | |
|---|---|---|---|
| XXX | COMMISSION OF GAME AND INLAND FISHERIES | ___ | STATE CORPORATION COMMISSION |
| ___ | COMMISSION OF OUTDOOR RECREATION | XXX (3) | STATE WATER CONTROL BOARD |
| ___ | DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES | ___ | OFFICE OF EMERGENCY AND ENERGY SERVICES |
| XXX (4) | DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT (Incl. DPR) | XXX | VIRGINIA HISTORIC LANDMARKS COMMISSION |
| XXX (2) | DEPARTMENT OF HEALTH (incl. BSS) | XXX (4) | VIRGINIA INSTITUTE OF MARINE SCIENCE |
| ___ | DEPARTMENT OF HIGHWAYS AND TRANSPORTATION | ___ | VIRGINIA PORT AUTHORITY |
| ___ | DIVISION OF INDUSTRIAL DEVELOPMENT | XXX | VIRGINIA RESEARCH CENTER FOR ARCHAEOLOGY |
| XXX | MARINE RESOURCES COMMISSION | ___ | VIRGINIA SOIL AND WATER CONSERVATION COMMISSION |
| ___ | STATE AIR POLLUTION CONTROL BOARD | *** | PLANNING DISTRICT COMMISSION Southeastern Virginia |
| ___ | CITY OF ___ | XXX | OTHERS Dept. of Planning and Bu -A-95 Office |
| ___ | COUNTY OF ___ | ___ | ___ |

DEADLINE DATE FOR COMMENTS: August 26, 1983

** you cannot meet this deadline, please notify Charlie Ellis at 786-4500 prior to the date ven. Arrangements will be made to extend the date for your review if possible. An agenc vill not be considered to have reviewed a document if no comments are received within the eriod specified. Thank you very much.

8. REVIEW INSTRUCTIONS:

A) Please review the document carefully. If the proposal has been reviewed earlier (e.g., if the current document is a Final EIS), please consider previous comments.

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

C) Use the space below for your comments. If additional space is needed, please attach extra sheets.

Return your comments to:

Charles H. Ellis III
Environmental Programs Analyst
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

Charles H. Ellis III
Environmental Programs Analyst

COMMENTS

The Virginia Port Authority endorses the recommendations contained in the Draft Supplement. The high cost of transporting the dredged material to the Norfolk Disposal Site remains a concern of this agency. The permanent designation of the Dam Neck site for the reception of dredged material is a much preferred alternative. This location will significantly reduce the cost of maintenance dredging and new construction in the port complex. The Norfolk Disposal Site must remain as a designated disposal site.

The study addressed 11 specific criteria and the 5 general criteria for ocean disposal site evaluation for the Dam Neck Ocean Disposal Site and found no significant conflicts or problems with continued use of the site. An expansion of the site to accommodate dredged material would result in no conflicts with the applicable criteria. (continued below).

(SIGNED) R. Todd Coyle (DATE) January 8, 1985

(TITLE) Director of Planning

(AGENCY) Virginia Port Authority

The Virginia Port Authority supports the Norfolk District, Corps of Engineers, recommendation that the Dam Neck Interim Site be given final site designation, with an expanded configuration as proposed.

PLANNING DISTRICT

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# COMMONWEALTH of VIRGINIA

*Virginia Historic Landmarks Commission*

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EXECUTIVE DIRECTOR

RESEARCH CENTER FOR ARCHAEOLOGY

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TELEPHONE: (804) 253-4838

ALAIN C. OUTLAW, Commissioner of Archaeology

JAMES Council on the Environment

December 21, 1984

MEMORANDUM

TO: Charlie Ellis

FROM: Bruce J. Larson, Review & Compliance Coordinator

PROJECT: Norfolk Harbor & Channels, Deepening a Disposal Alternative

LOCATION: Norfolk

[X] An archaeological field survey will not be necessary for this project. If, however, archaeological resources are unexpectedly encountered during construction, the VRCA should be notified immediately.

[ ] Due to the archaeological potential of this location, as well as the project impacts, a Phase I archaeological field survey is necessary. This survey should locate all archaeological resources which may be impacted by the project as it is presently planned. Please find enclosed a list of persons who have expressed an interest in doing contract archaeological work in Virginia. A copy of the resulting report should be forwarded to the VRCA for comment. All necessary archaeological work must be completed, reviewed and approved by this office prior to the commencement of any construction related activities.

[ ] The VRCA has completed its review of the Phase I archaeological survey report on the above project. No further work will be necessary.

COMMENTS:

COUNCIL ON THE ENVIRONMENT
Commonwealth of Virginia

TO: File

FROM: C. Ellis 1/18/85

SUBJECT: Corps of Engineers: Norfolk Harbor and Channels Dredging and Disposal -- Draft Supplement to Final EIS

Game Commission comments on this project were sent directly to the Corps of Engineers, according to Jack Randolph on January 18. Jack indicated that the Commission had urged that upland disposal of dredged material should not interfere with bird nesting sites.

# Southeastern Virginia Planning District Commission

JOHN L. ROWE, JR. ..... CHAIRMAN
W. B. OWEN ..... VICE CHAIRMAN
MEYERA E. OBERNDORF ..... TREASURER

16 KOGER EXECUTIVE CENTER • SUITE 100
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ARTHUR L. COLLINS • EXEC. DIR/SECY.


December 5, 1984

Mr. Frank T. Wootton, Jr., P.E.
Chief, Planning Division
Norfolk District, Corps of Engineers
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510

Re: EIS-Norfolk Harbor & Channels, Virginia - Deepening and Disposal (WAW:12/WAW:34)

Dear Mr. Wootton:

Pursuant to your request of December 1, 1984, the staff of the Southeastern Virginia Planning District Commission has reviewed the Corps of Engineers' Draft Supplement to the Final Environmental Impact Statement and Appendix: Dam Neck Ocean Disposal Site, Site Evaluation Study. That supplement is a portion of the report of the COE on the Norfolk Harbor and Channels, Virginia - Deepening and Disposal project. The SVPDC staff previously reviewed an environmental assessment and proposed Finding of No Significant Impact on the Dam Neck Disposal Site in May 1984.

As we have indicated on a number of occasions, the Norfolk Harbor project appears to be generally consistent with local and regional plans. We generally agree, based on the data contained in the Environmental Impact Assessment and supplements, that no significant adverse environmental impact should occur because of project implementation. The SVPDC staff believes that two steps should be taken by the COE to insure that any potential adverse impacts are mitigated. They include:

1. During disposal operation at the Dam Neck site, water quality should be monitored to insure that the disposal operation does not have a synergistic impact when combined with the impacts of the Hampton Roads Sanitation District Atlantic Wastewater Treatment Plant discharge.

2. Disposal operations should be scheduled so as to avoid potential conflict with recreation and commercial fishing vessels during the peak fishing seasons.

We are pleased to see that continuing evaluation by the Norfolk District has indicated the feasibility of ocean disposal of additional material from the Norfolk Harbor and Channels Project. We hope that the COE will continue evaluating dredging and disposal options as they may affect the Norfolk inner harbor and in particular the Southern Branch of the Elizabeth River. This evaluation should be conducted within the framework of the Comprehensive Water Quality Management Plan for the Elizabeth River recommended by the HRWQA, SVPDC, and State Water Control Board. Preparation of that plan will begin in the near future.

We appreciate the opportunity to review this document and hope that our comments will be of assistance to you in finalizing the Norfolk Harbor project. If you have any questions, please do not hesitate to call.

Sincerely,

Arthur L. Collins
Executive Director/Secretary

JMC:ve

cc: Mr. Charles H. Ellis, III
Council on the Environment

CHARTERED 1693
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Gloucester Point, Virginia 23062

Phone (804) 642-2111

January 18, 1985

Mr. Charles H. Ellis, III
Environmental Programs Analyst
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

Reference: Comments on Draft Supplement and Appendix: Dam Neck, Norfolk Harbor and Channels, Deepening and Disposal

Dear Mr. Ellis:

Given the materials in the report we cannot concur with the evaluation of the Corps that the proposed expansion of the Dam Neck site will not have significant adverse environmental effects. Our findings are based on:

1.) The fact that most of the biological studies are incomplete and that preliminary findings are an insufficient basis from which to draw substantive and integrated conclusions.

2.) The opinion that a substantially more complete and sophisticated analysis of site stability is needed before reaching the conclusions drawn, and

3.) The opinion that insufficient attention has been given to the potential impact of altered bathymetry on shoreline wave energy distributions.

Thus our lack of concurrence at this point is rooted in the incompleteness of the Draft rather than disagreement over facts. Our detailed comments on the above are most easily presented in reverse order.

Shoreline Impacts

The Site Plan proposed would alter existing depths from "about 42 feet" to 35 feet. This alteration over the bottom area planned has the potential to significantly alter longshore wave energy distributions. Formal execution of wave refraction analysis is essential given the nature of shoreline use

and value. These analyses should include wave periods up to 14 secs. and directions ranging from north to south with particular emphasis to the northeast and east. These are particularly important since storm waves from these directions are associated with surge elevations rendering shoreline properties particularly vulnerable. Saumsiegle (1976), referenced in the Draft, also notes that wave refraction diagrams for the 1974 condition indicate local shoreline wave height enhancement of 17% for twelve second waves from the northeast. As well, that report recommends restricting the size of the site so that refraction effects are reduced. We recognize that the site expansion is necessary to accommodate the project volumes. Given this, formal consideration of wave refraction effects is needed.

Site Stability

Our concern about site stability is ultimately focused on potential impacts on the biota. We note that Table 5 (page 38) of the Draft indicates that approximately 4 mcy of maintenance dredged material from Thimble Shoals Channel was placed at Dam Neck between June 1970 and November 1982. Of this approximately 2.8 mcy was placed between June 1970 and December 1974. Presumably a significant fraction of this amount was silt and clay material from the section west of the Chesapeake Bay Bridge-Tunnel. Saumsiegle (1976) includes 68 sediment analyses for Dam Neck samples of 1973, 1974 and 1975 (Corps) as well as those he secured in spring 1974. What is striking from these analyses is the very low levels of the silt/clay fraction in those sediments identified as dredged material. The average silt/clay content of samples identified as native sediments is about 6% by weight whereas that for material identified as dredged material is less than 1% by weight. The apparent absence of the silt/clay fraction raises the following questions:

1.) Was the mud fraction lost in the dredging process because of economical loading?

2.) If the mud fraction was placed in the disposal site was it lost due to short term dispersion processes or lost due to longer term entrainment by waves and currents?

The significance of these questions is that if the mud fraction was lost via previous economical loading then the proposed disposal of "predominately clays and silts" from Thimble Shoals Channel (para. 53, Draft) represents new conditions which need to be addressed in examination of site stability. If the material is stable at the site then the grain size characteristics may differ significantly from the native sediments and

the benthic community recolonizing the area may differ significantly from the native populations. The relative resource value of the recolonizing community is important since a large area is impacted, about ten square miles.

On the other hand if the material is resuspended and entrained into the water column then the enhanced turbidity may impact biological processes, and the aesthetic aspects of water quality along the recreational beaches. Clearly, these matters are of sufficient importance to require a penetrating analysis of site stability.

What is needed in the analysis of site stability is formulation of the frequency distribution of bottom shear stress as a function of the wave climate and tidal currents. These values may then be coupled with existing sediment entrainment formulations to estimate the sediment dispersion. This procedure is within the state-of-the-art. We thus disagree with the assertion (page C-3) that sediment transport predictions would not be improved by application of more elaborate and sophisticated analysis. The Draft report indicates wave generated currents, on an average annual basis, can move fine sand material 80 to 90 percent of the time in the shallower portion of the site and 50 percent of the time at 45 foot depth. On the basis of vector averaged tidal currents (small) the Draft implies that sediment advection will be very limited. The vector averaging procedure is inappropriate for the case. If averages are to be used at all the root mean square of current speed would be better. Vertical mixing is dismissed because "no data are available." Such information should be incorporated in a wave-current suspended sediment dispersion analysis using estimates from other studies. Specific attention should be given, as well, to wind induced coastal flows.

Biological Studies

Several of the biological and water/sediment quality studies are not yet in final reportable form. When completed the biological studies should be integrated with the results of the more formal analysis of site stability to examine potential impacts on the biota.

Two additional points warrant comment. We submit that the judgement as to the level of monitoring must await the resolution of the questions raised above concerning site stability and resultant bottom characteristics. Also we ask whether a disposal management scheme is to be established such that the very fine grained materials are segregated from those materials which are suitable for future beach nourishment.

While fully cognizant of the important economic benefits derived from use of the Dam Neck site we feel that the questions we have raised need to be resolved so that the living marine, and shoreline recreational, resources are not subject to significant risk by such action. We will be happy to discuss further our comments with you. Dr. Robert Byrne has been designated as our coordinator (804/642-7191).

Sincerely yours,

Frank O. Perkins
Dean/Director

RJB:adl

Commonwealth of Virginia

# HAMPTON ROADS SANITATION DISTRICT

JAMES R. BORBERG, P.E.
GENERAL MANAGER

CARL COURTRIGHT, P.E.
DIR. OF INTERCEPTOR SYSTEMS

ROBERT J. FOLEY, CPA
DIR. OF FINANCE & ADMINISTRATION

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January 3, 1985

Mr. Frank T. Wooton
Chief, Planning Division
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, Virginia 23510

Re: Draft Supplement to the Final Environmental Impact Statement for Norfolk Harbor and Channels, Virginia - Deepening and Disposal

Dear Sir:

I would like to offer the following comments concerning depressed dissolved oxygen concentrations on the nearshore continental shelf region off Virginia Beach.

As early as 1973 low dissolved oxygen concentrations were recorded in the vicinity of your Dam Neck disposal area and our proposed outfall location. These values were reported by Hydroscience as part of the Environmental Assessment for our Atlantic Wastewater Treatment Plant (ATP). Our concerns about the effects of reopening the Dam Neck disposal area were expressed to the Corps in early 1981 (see enclosed letters).

Since 1978, we have conducted an environmental monitoring program off Virginia Beach. Our initial review of data obtained prior to the operation of our ATP (enclosed Figures 1-4) indicates ambient conditions of depressed, bottom-water dissolved oxygen concentrations during the late summer months. Spring, fall and winter data show high dissolved oxygen concentrations throughout the water column (data not included). Low concentrations appear to be widespread and not confined to either your disposal site or our proposed outfall location. Data collected after operation of the ATP began show conditions to be essentially unchanged (Figures 5-6).

Data collected by Old Dominion University for your report concurs with our data (Figures 7-12). Discussions of ODU's results occur on Pages B-2 and 3 of your report. This discussion implies dissolved oxygen depression due to our outfall, which has not been demonstrated. Also, the coordinates used to locate Stations A and 23 were preliminary estimates of the outfall site and do not reflect its actual location. Only Station 23 is located in the immediate vicinity of the outfall. Furthermore, statements asserting that depressions occurred at inshore stations, and in particular the vicinity of our outfall, are misleading considering the limited area investigated by ODU (only four of thirteen stations were located inshore) and in view of data gathered prior to the startup of our plant.

Since available data indicates that our discharge does not cause a depression of dissolved oxygen, the statements implied in your report on Page 59, par. 79 and Page B-3, par. B.05 are not supported by the available facts. In order that the report not be misleading, revisions should be made to support the findings that low dissolved oxygen concentrations in the bottom waters off Virginia Beach occur naturally and are not suppressed due to the presence of our outfall.

Very truly yours,

James R. Borberg
General Manager

JRB/amb
Enclosures

April 13, 1981

Colonel Douglas L. Haller
Corps of Engineers
District Engineer
Norfolk District
803 Front Street
Norfolk, Virginia 23510

Re: Thimble Shoal Channel
Proposed Dredging

Dear Sir:

With respect to your Public Notice dated March 30, 1981,concerning dredging operations in the Thimble Shoal Channel, I would like to offer comments concerning the dredge spoil area in the Atlantic Ocean off Dam Neck.

Monitoring was performed in the Atlantic Ocean in the vicinity of the Dam Neck disposal area during the summer of 1973 as part of the Environmental Assessment for our Atlantic Wastewater Treatment Plant. This monitoring effort showed extremely low dissolved oxygen levels (less than 4 mg/l) and high sediment oxygen demand (approximately 1.7 gms/$m^2$/day) in the disposal area. We have continued to monitor this area and have determined that the effects of the dredge spoil were no longer present when construction of the plant started. This data indicates that the effects of disposing dredge spoil are probably of relatively short duration.

If this spoil area is reopened and it causes a depression in the oxygen in the area of our outfall, the State Water Control Board may require some modification of our treatment process. The funding of such a modification must be considered as part of the cost of the dredging project and cannot be considered an obligation of the Hampton Roads Sanitation District.

If desired, we will provide copies of our monitoring data.

Very truly yours

James R. Borberg
General Manager

tlm

June 23, 1981

Mr. Douglas L. Haller
Colonel, Corps of Engineers
District Engineer
Norfolk District
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510

Dear Colonel Haller:

In response to your letter dated May 15, 1981, I would like to offer further clarification of our concerns about the disposal of dredge spoils at the Dam Neck site. The initial water quality monitoring for the 201 Facilities Plan for the Atlantic Treatment Plant found low oxygen levels and elevated sediment oxygen demands around the Dam Neck disposal area in 1973. Because of low oxygen levels, the State Water Control Board was considering additional treatment requirements because of the discharge of effluent to waters which did not meet water quality standards. Additional monitoring was required which began in 1975. The latter monitoring found no oxygen problems. Coincidentally, the disposal site was apparently not used between 1973 and 1975. Our concerns over the start-up of spoil disposal at the Dam Neck site is centered around the potential oxygen deficit which might occur. This could once again create a condition which may result in the State Water Control Board requiring the District to upgrade treatment if the receiving water does not meet water quality standards for dissolved oxygen.

If your actions degrade the receiving waters, we believe that the Army Corps of Engineers has a clear legal obligation to pay for any upgrade that is required of the District. The potential costs of this upgrade should be considered when a cost analysis is performed between the Dam Neck site and the Ocean disposal site.

As an additional point of clarification, the District did notify the Corps of water quality problems in the application for the dredge permit. The data package sent with the application contained the 1975 Hydroscience report which discusses the dissolved oxygen problems found in the 1975 monitoring data. However, I would like to stress that water quality problems associated with your disposal operations is not connected with our dredging operations. Our dredging for the outfall will not adversely impact on your disposal operations. However, your disposal operations may adversely affect water quality which may impact on our NPDES discharge permit for the plant operations. We recognize your right to discharge spoil in this area provided that your operations do not violate water quality.

Sincerely,

James R. Borberg
General Manager

jps/NEL

cc: SVPDC
SWCB - TRO

bc: General Manager

Figure 1. July 8-9, 1981
Bottom Water D.O. (mg/l)

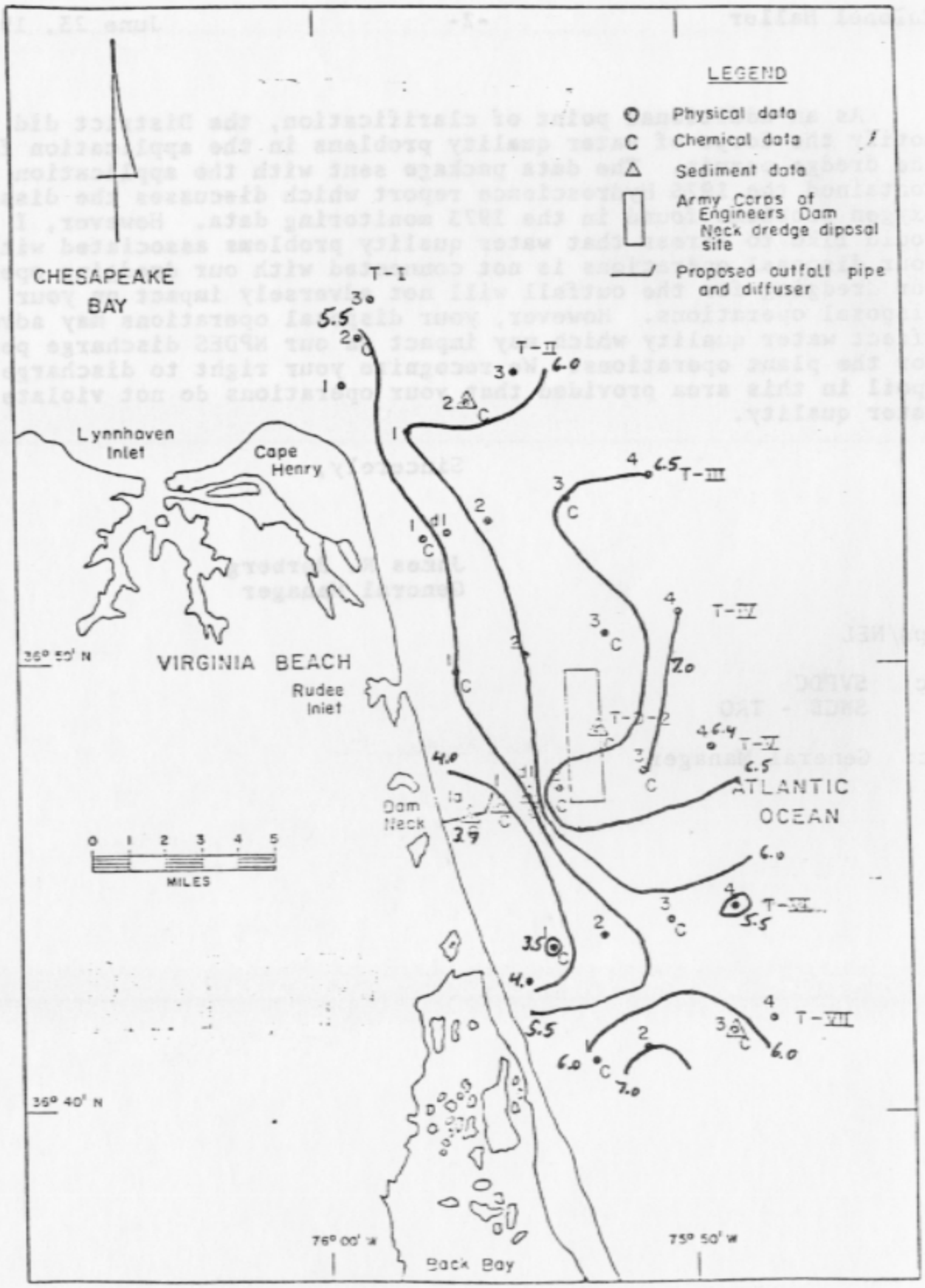


Figure 1. Location of water quality and benthic sampling stations on the nearshore continental shelf off Virginia Beach, Virginia from 1978 to 1980.

Figure 2. Aug. 1, 1981
Bottom Water D.O. (mg/l)

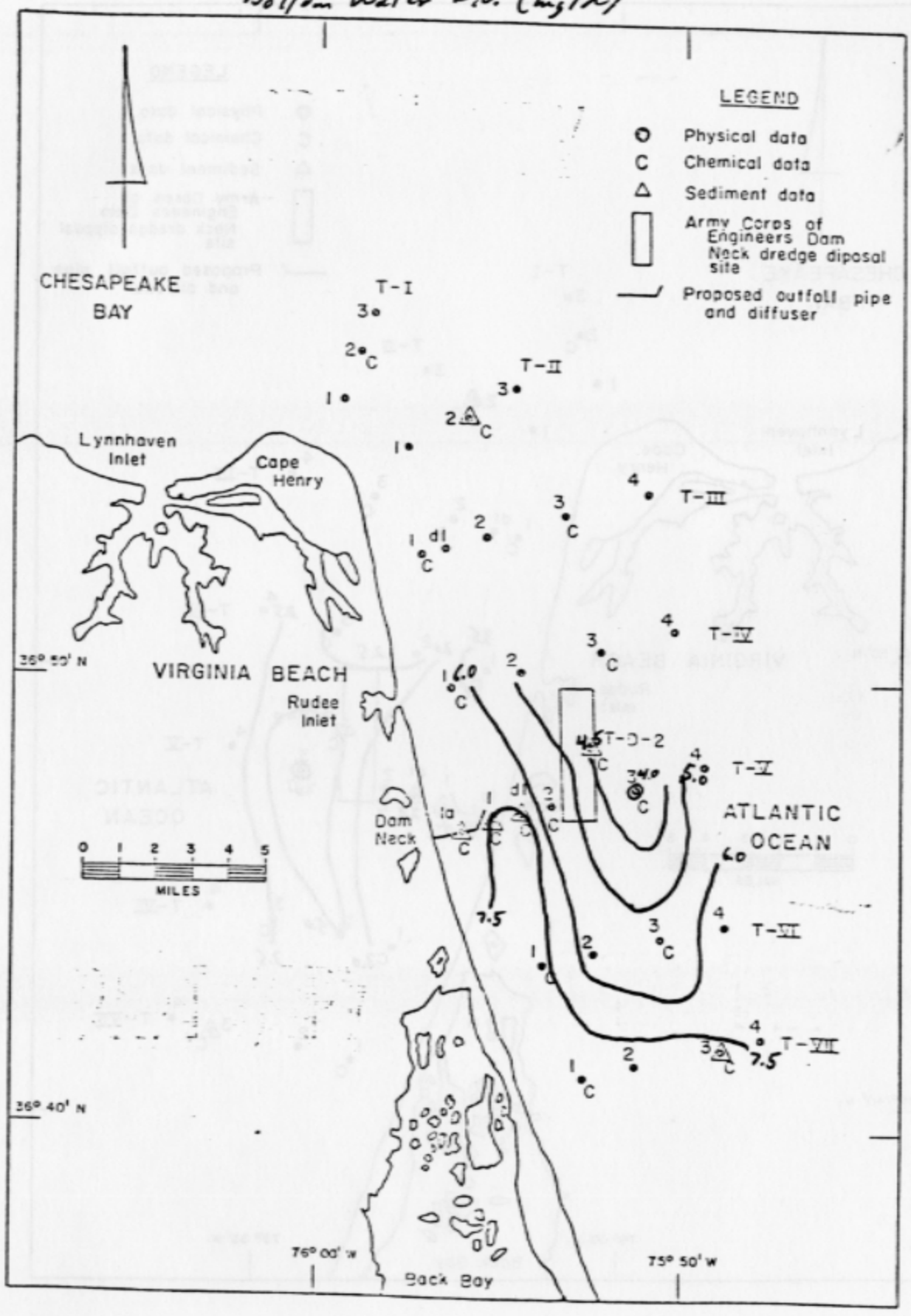


Figure 1. Location of water quality and benthic sampling stations on the nearshore continental shelf off Virginia Beach, Virginia from 1978 to 1980.

Figure 3. Aug. 10, 1981
Bottom Water D.O. (mg/l)

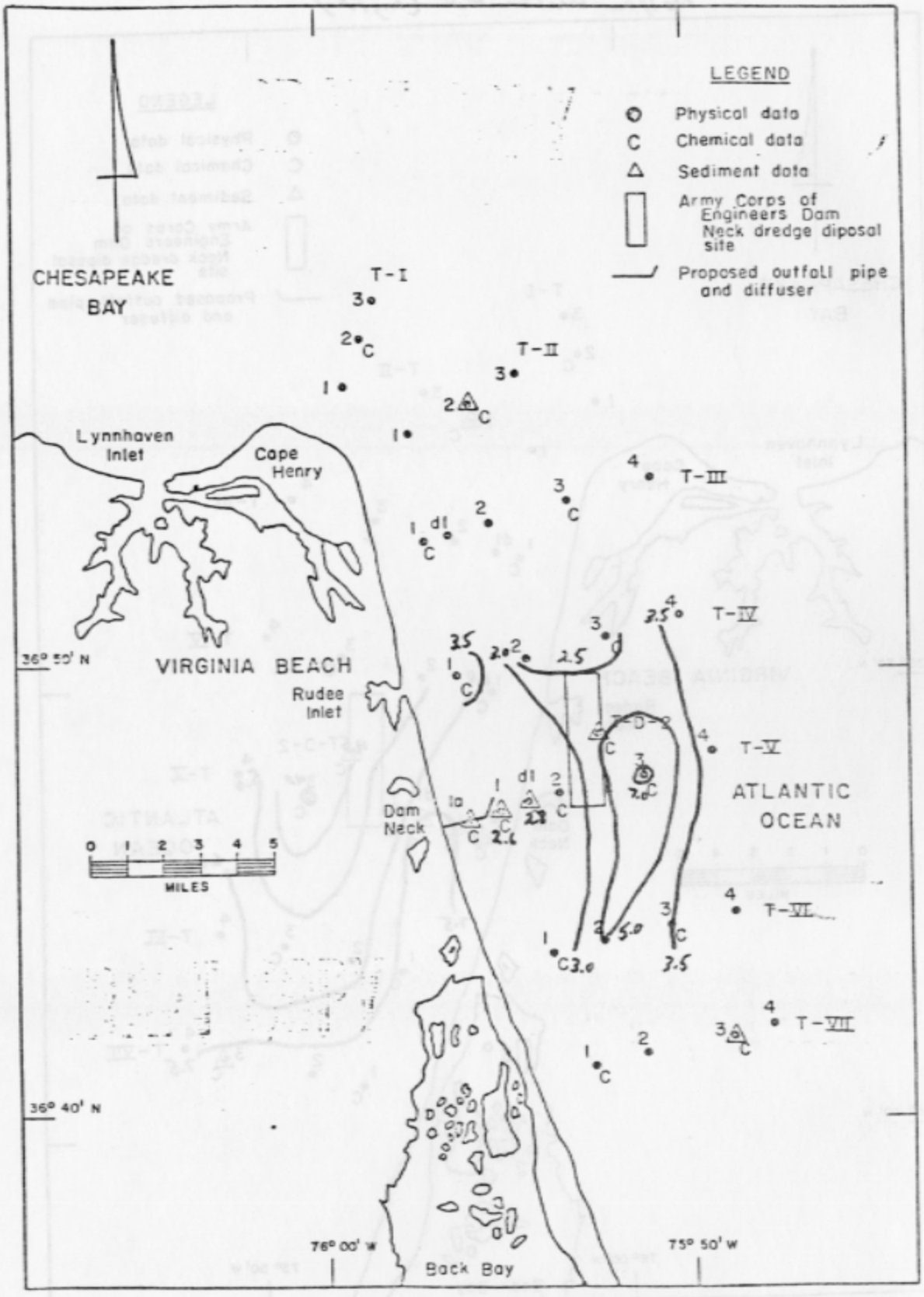


Figure 1. Location of water quality and benthic sampling stations on the nearshore continental shelf off Virginia Beach, Virginia from 1978 to 1980.

Figure 4. August 2+4, 1982
Bottom Water D.O. (mg/l)

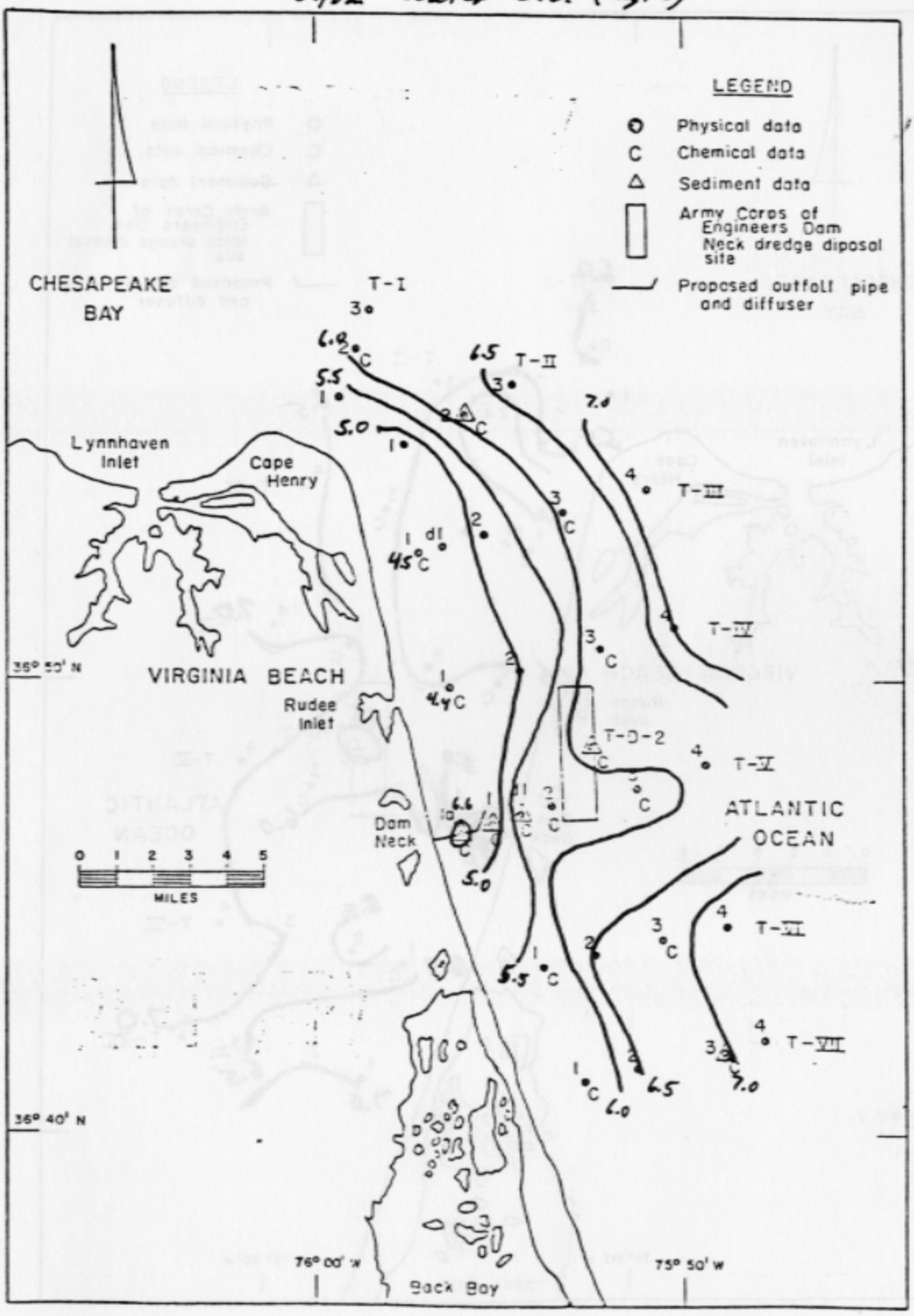


Figure 1. Location of water quality and benthic sampling stations on the nearshore continental shelf off Virginia Beach, Virginia from 1978 to 1980.

Figure 5. Aug. 13+15, 1984 Bottom Water D.O. (mg/l)

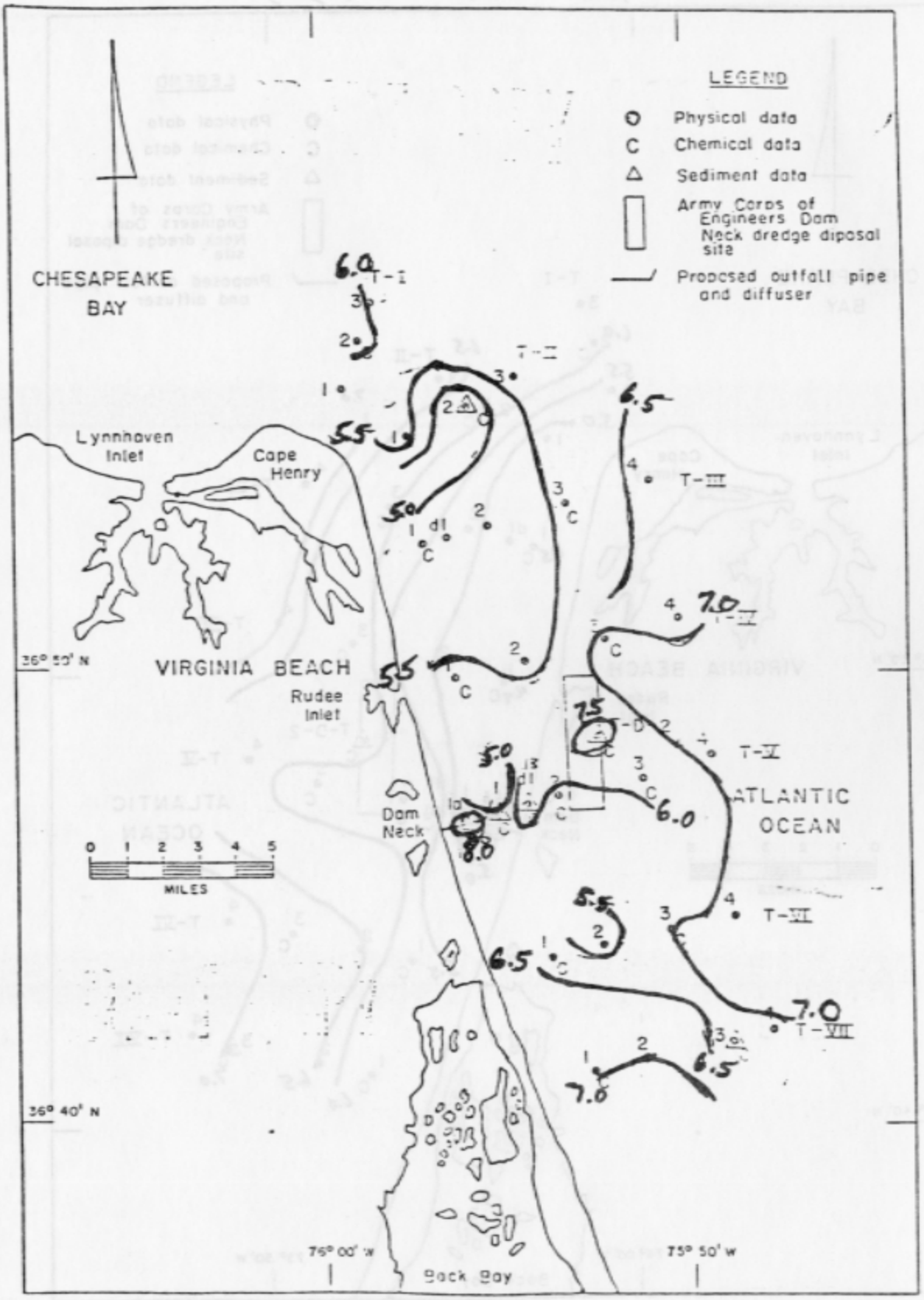


Figure 1. Location of water quality and benthic sampling stations on the nearshore continental shelf off Virginia Beach, Virginia from 1978 to 1980.

Figure 6. Sept. 20+21, 1984 Bottom Water D.O. (mg/l)

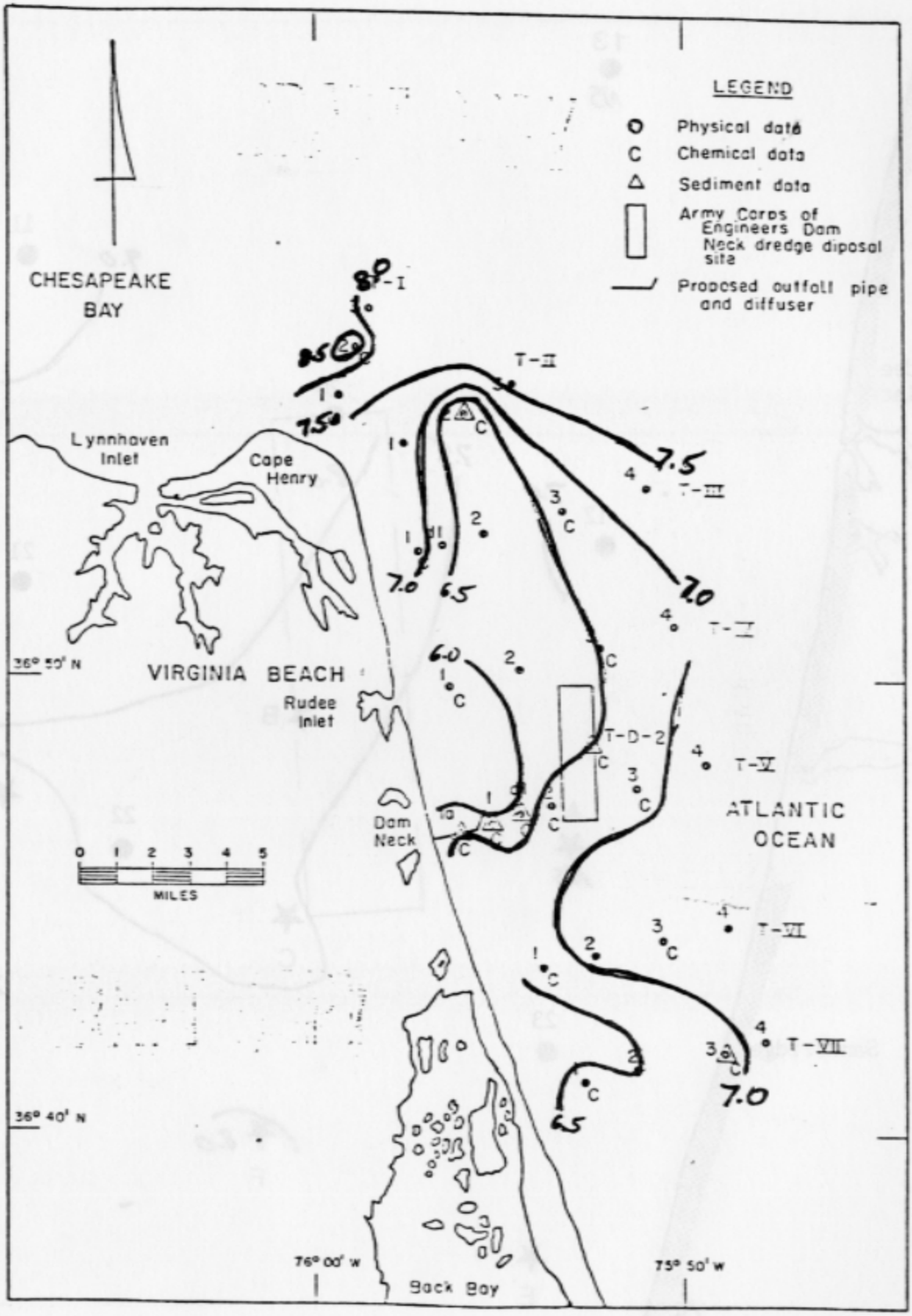


Figure 1. Location of water quality and benthic sampling stations on the nearshore continental shelf off Virginia Beach, Virginia from 1978 to 1980.

Figure 7. Bottom D.O. - ODU July 11, 1984 mg/l

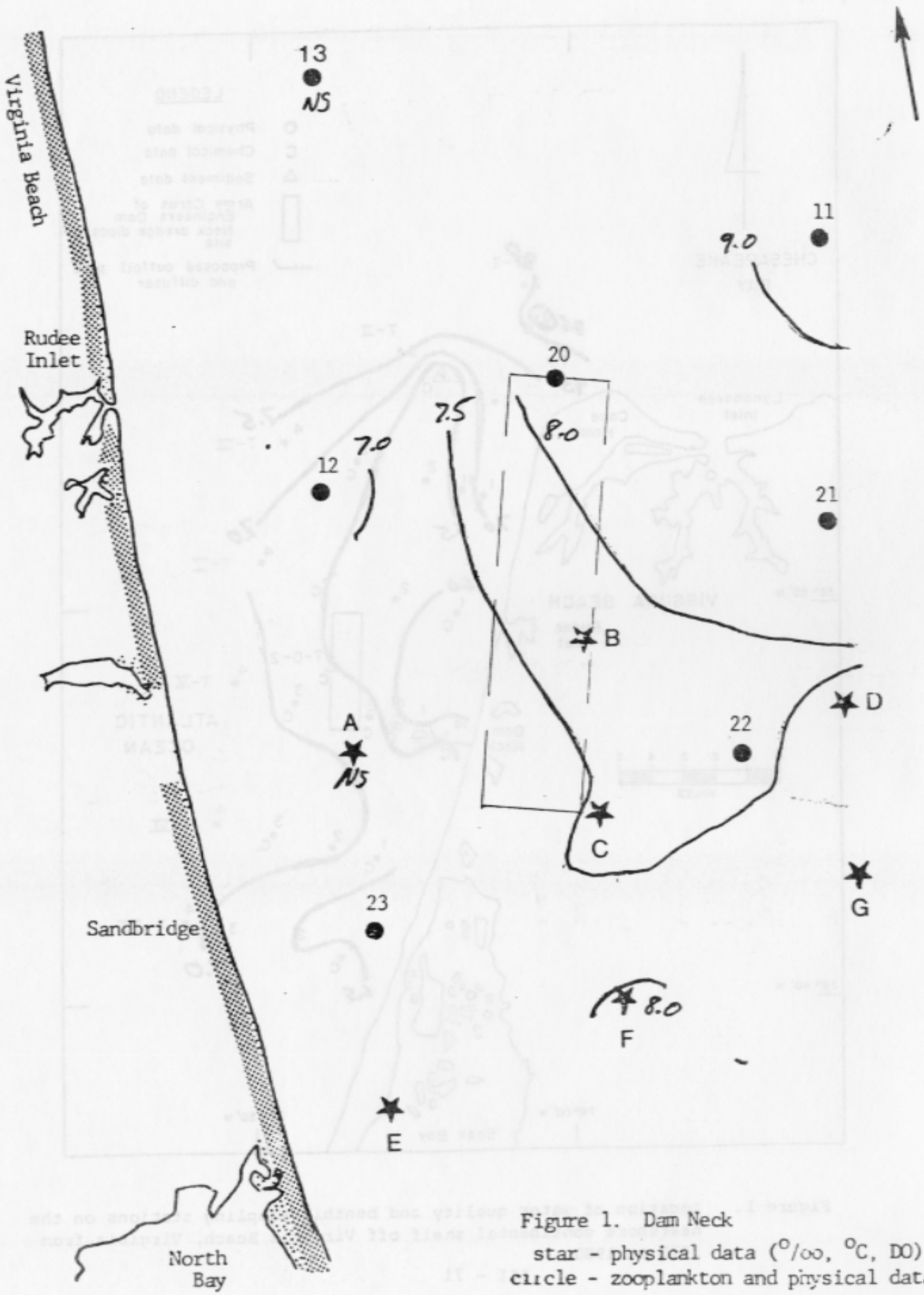


Figure 1. Dam Neck
star - physical data (°/oo, °C, DO)
circle - zooplankton and physical data

Figure 8. Bottom D.O. - ooo July 26, 1984 mg/l

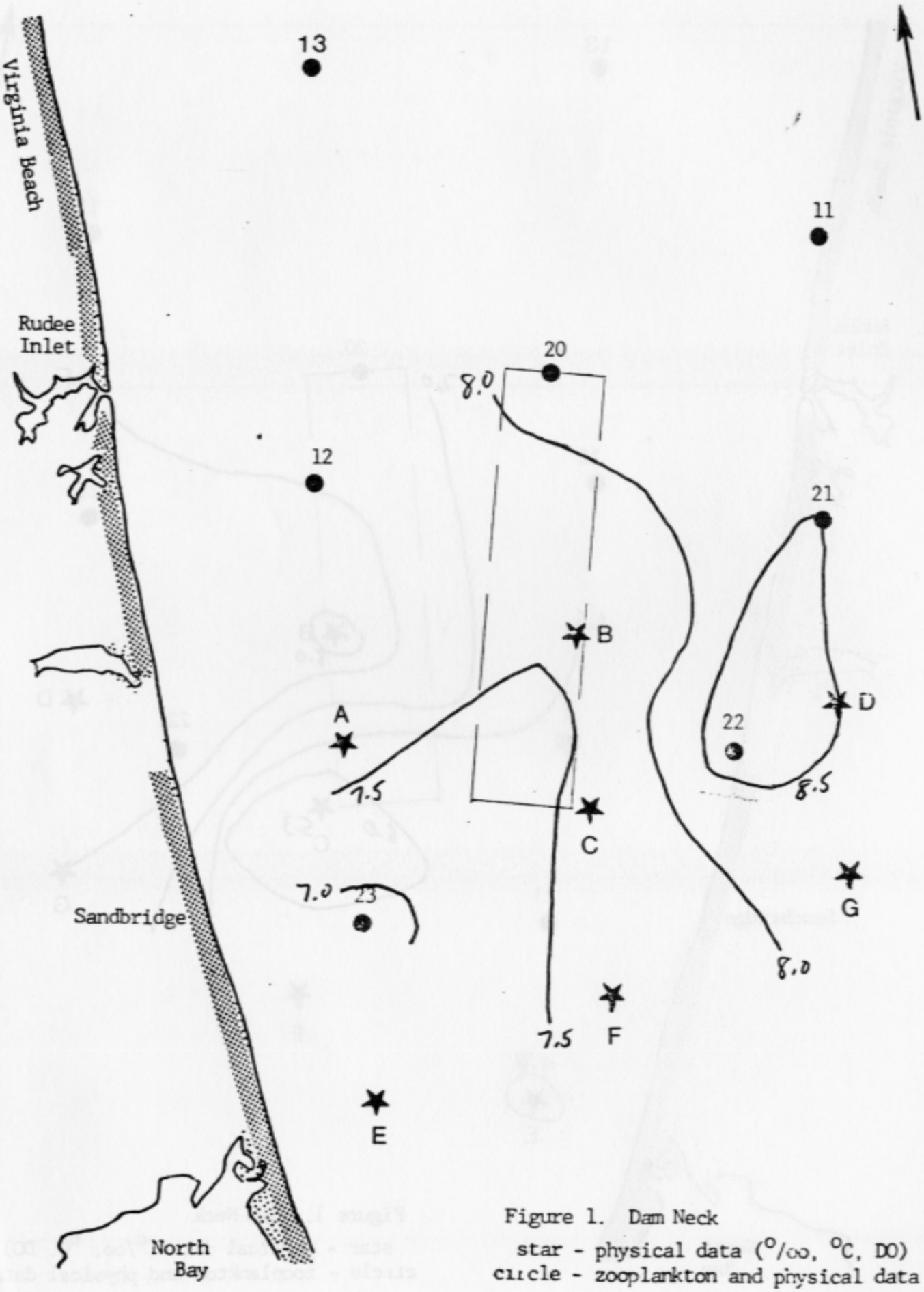


Figure 1. Dam Neck

star - physical data (°/oo, °C, DO)

circle - zooplankton and physical data

Figure 9. Bottom D.O. - 000 Aug. 1, 1984 mg/l

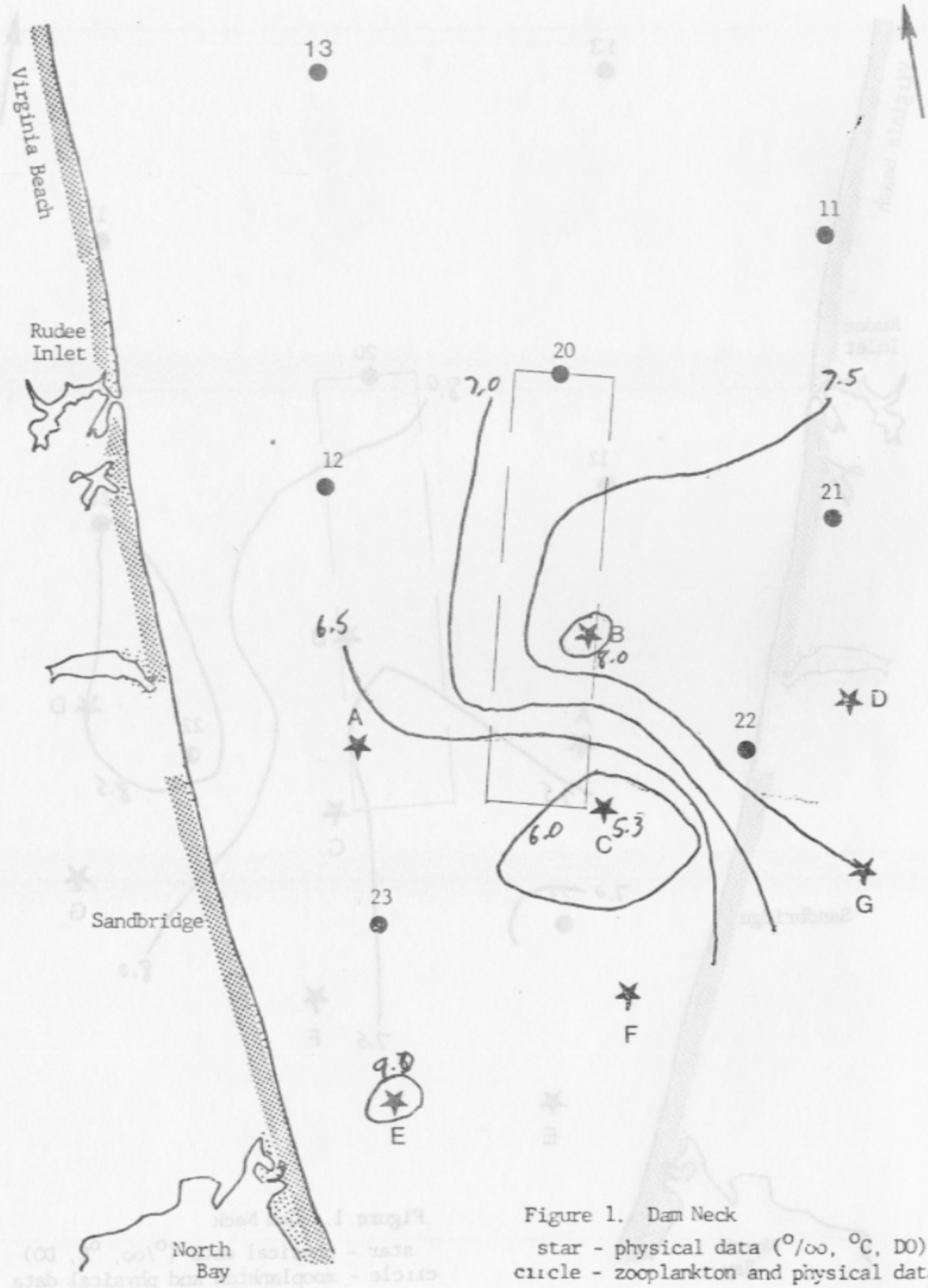


Figure 1. Dam Neck

star - physical data ($^{o}/_{oo}$, $^{o}$C, DO)

circle - zooplankton and physical data

Figure 10. Bottom D.O. - ODU Aug 21, 1984 mg/l

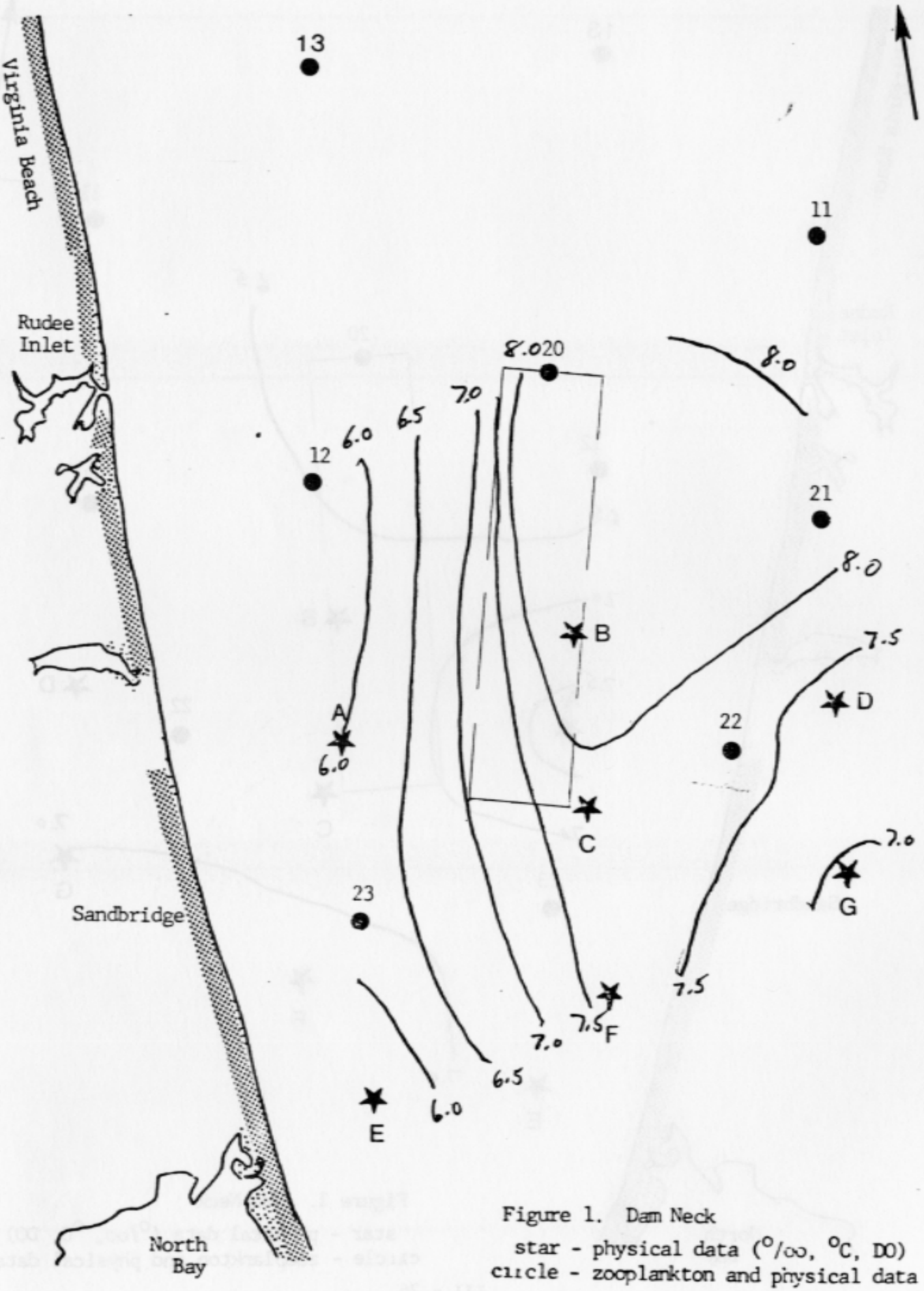


Figure 1. Dam Neck

star - physical data (°/oo, °C, DO)
circle - zooplankton and physical data

Figure 11. Bottom D.O. - ODU Sept. 21, 1984 mg/l

Figure 1. Dam Neck

star - physical data (°/oo, °C, DO)
circle - zooplankton and physical data

Figure 12. Bottom D.O. - ODU Sept. 26, 1984 mg/L

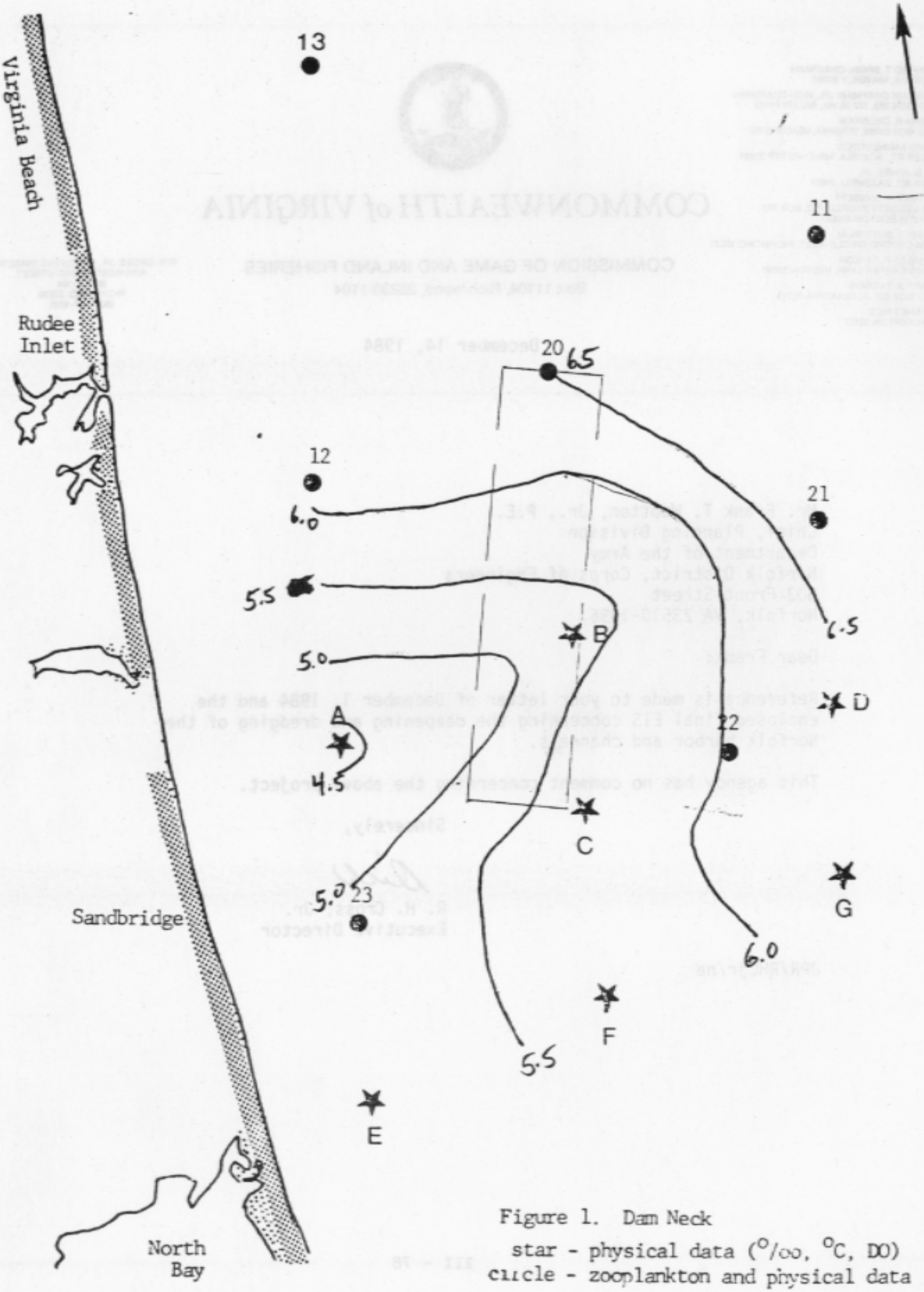


Figure 1. Dam Neck

star - physical data (°/oo, °C, DO)
circle - zooplankton and physical data

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# COMMONWEALTH of VIRGINIA

COMMISSION OF GAME AND INLAND FISHERIES
Box 11104, Richmond, 23230-1104

R.H. CROSS, JR., EXECUTIVE DIRECTOR
4010 WEST BROAD STREET
BOX 11104
RICHMOND, 23230
(804) 257-1000

December 14, 1984

Mr. Frank T. Wootton, Jr., P.E.
Chief, Planning Division
Department of the Army
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Dear Frank:

Reference is made to your letter of December 1, 1984 and the enclosed final EIS concerning the deepening and dredging of the Norfolk harbor and channels.

This agency has no comment concerning the above project.

Sincerely,

Dick

R. H. Cross, Jr.
Executive Director

JPR/RHCjr/na



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# COMMONWEALTH of VIRGINIA

S. MASON CARBAUGH
COMMISSIONER

DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES
Planning and Development
P. O. Box 1163, Richmond, Virginia 23209

BERKWOOD M. FARMER, Ph.D.
DIRECTOR AND
CHIEF ECONOMIST

December 18, 1984

Mr. Frank T. Wootton, Jr., P.E.
Chief, Planning Division
Department of the Army
Norfolk Dist. - Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Dear Mr. Wootton:

This is in response to a list of addressees dated December 1, 1984.

Strictly from the standpoint of agricultural production, I can see no concerns that require consideration for input to the Final Environmental Impact Statement and the Dam Neck Ocean Disposal Site Evaluation Study regarding Norfolk Harbor and Channels, Virginia, Deepening and Disposal.

Sincerely,

Earl A. Finch

Earl A. Finch
Agricultural Resource Development Specialist

EAF:bmc

HAROLD C. KING, COMMISSIONER
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DEPARTMENT OF HIGHWAYS & TRANSPORTATION
1221 EAST BROAD STREET
RICHMOND, 23219

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ASSISTANT CHIEF ENGINEER
SALLY H. COOPER
DIRECTOR OF RAIL AND PUBLIC TRANSPORTATION
J. G. RIPLEY
DIRECTOR OF PLANNING AND PROGRAMMING

January 16, 1984

Draft Supplement to the Final EIS
for Norfolk Harbor and Channels, Virginia
Deepening and Disposal

Mr. Frank T. Wooton, Jr., P.E.
Chief, Planning Division
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Dear Mr. Wooton:

We have reviewed this document and determined that the proposed methods for disposing of dredged material would have no effect on the area transportation network.

We look forward to reviewing the Final Supplement and apprecaite the opportunity to review this material.

Sincerely,

H. C. King, Commissioner

cc: Mr. Charles Ellis, III
Va. Council on the Environment

# City of Virginia Beach

January 2, 1985

Mr. Frank T. Wootton, Jr., P.E.
Chief, Planning Division
U. S. Army Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Dear Mr. Wootton:

Thank you for sending a copy of the Draft Supplement to the Final Environmental Impact Statement for Norfolk Harbor and Channels, Virginia - Deepening and Disposal for review. The review has been completed and there are no comments.

Very truly yours,

Thomas H. Muehlenbeck
City Manager

THM/DRT/jh

cc: C. Oral Lambert, Jr.
D. R. Trueblood

City of Norfolk
Office of the City Manager

January 17, 1985

Mr. Frank T. Wootton, Jr. P. E.
Chief, Planning Division
Department of the Army
Norfolk District Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Dear Mr. Wootton:

Thank you for the opportunity to review and offer comments on the "Draft Supplement to the Final Environmental Impact Statement for Norfolk Harbor and Channels, Virginia Deepening and Disposal." The listed disposal areas appear adequate for the described dredge spoil.

According to the draft, about five million cubic yards of beach quality sand will be generated within the project. This material is suitable for replenishment of Norfolk's erosional beaches as identified in the Willoughby and Vicinity Study by the Corps of Engineers. At your convenience, a discussion would be appreciated regarding beneficial uses of this portion of the project that are consistent with federal requirements.

If there are any questions, please advise.

Sincerely,

Ronald W. Massie
Asst. City Manager
for Programs

cc: Mr. Norman E. Larsen,
Virginia Marine Resources Commission



1101 City Hall Building • Norfolk, Virginia 23501 • (804) 441-2471

1052

# Chesapeake Bay Foundation

"Environmental Defense - Environmental Education - Land Preservation"

11 South 12th Street, Suite 314 • Richmond, Virginia 23219 • (804) 780-1392

January 25, 1985

Colonel Claude D. Boyd, III
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510

Re: Draft Supplement to FEIS, Dam Neck Disposal Site, Norfolk Harbor and Channels, Virginia, Deepening and Disposal Study

Dear Colonel Boyd:

The Chesapeake Bay Foundation (CBF) has reviewed the above referenced Draft Supplement on the proposed Dam Neck Disposal Site. Because of the proximity of the Dam Neck Site to the mouth of the Bay, CBF is concerned about the potential impact of an expanded use of this site on important Bay resources. We therefore submit the following comments.

1. The Dam Neck Disposal Site is located within the migration route and spawning area of a number of finfish including flounder, croaker, and weakfish. The mouth of the Bay and adjacent nearshore Atlantic Ocean is also the spawning and nursery area for the blue crab. Although the Site Evaluation identifies the biological resources in the area, there is no evaluation of the potential impact of dredged material disposal on these resources.

2. The Site Evaluation states that there have been limited detectable effects related to the previous use of the Dam Neck Site. There is no indication, however, that this statement is supported by baseline or ongoing monitoring studies of water quality and/or biological impacts. Also, the proposed rate of disposal (7-12 mcy/yr) is significantly higher than the long term historical disposal rate at this site. A finding of no adverse impact from previous disposal at this site is not a sound basis for determining the potential impact of the proposed project.

3. The Virginia Institute of Marine Science (VIMS) has reviewed the SFEIS and Site Evaluation Study and believes that the evaluation of the physical aspects of the disposal site is inadequate (see Attachment). CBF believes that the conduct and analysis of the studies recommended by VIMS would enable the Corps to perform a more complete evaluation of the proposed disposal site.



Annapolis Office: 162 Prince George Street • "The Church" • Annapolis, Maryland 21401 • (301) 268-8816

4. The SFEIS does not include a comparison of the biological resources and physical processes at the Dam Neck Site and the Norfolk Disposal Site alternatives. Since the evaluation of alternatives is a major component of an EIS, such a comparison should be included.

5. The SFEIS and the Site Evaluation often refer to incomplete or preliminary biological and water quality studies. Conclusions regarding the potential environmental impact of a project should not be based on incomplete or preliminary information. CBF believes that the Corps should not have issued the SFEIS until these studies were completed and a more substantive evaluation could be made.

In summary, CBF believes that there is insufficient information in this SFEIS to support a conclusion of no significant adverse environmental impact.

Respectfully submitted,

Jolene E. Chinchilli/jec

Jolene E. Chinchilli
Senior Scientist

jec/jag
attachment

ENVIRONMENTAL DEFENSE FUND
Virginia Office

January 25, 1985

Mr. Frank T. Wootton, Jr.
Chief, Planning Division
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510

Dear Mr. Wootton:

The Environmental Defense Fund has conducted a review of the Draft Supplement to the Final Environmental Impact Statement (SFEIS) on the Dam Neck Ocean Disposal Site.

We would like to point out that the amount of proposed dredge material is three times the amount of material disposed of at the Dam Neck Site in the past. We consider this to be a significant change which does not allow the direct comparisons between the impacts of the proposed project and impacts of past disposal at the Dam Neck Site. Overall, we feel that the analyses of key components of the document are insufficient to support the conclusion that there will be no significant environmental impacts associated with the use of the Dam Neck Disposal Site.

Specifically, the following areas require further and/or more sophisticated analysis:

1. Cost/Benefit Analysis - The Corps has failed to document the cost/benefit analysis used to evaluate the decision to select the Dam Neck Disposal Site over the Norfolk Disposal Site. This analysis is required under Section 1502.23 of the Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500-1508). The cost/benefit analysis should include a comparison of the environmental costs and transportation costs, of using the Dam Neck Site as opposed to alternative disposal sites.

2. A comparison of the biological resources and physical processes at the Dam Neck Disposal Site and the Norfolk Disposal Site should be included.

3. Insufficient data has been collected to evaluate the environmental impacts of the use of the Dam Neck Site and to come to the broad conclusion that there will be no significant impacts. The results of the Old Dominion University studies have



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not been included, but will be included in a Supplemental Information Report issued later this year. Because the information from these studies is critical to the evaluation of the proposed site and comparisons with the Norfolk Disposal Site, the studies should have been included in the SFEIS for review. It is difficult to understand how the SFEIS could be sent out for review without the studies to support the document's conclusions. It was inappropriate to issue the SFEIS without all supporting documents.

4. The analysis provided on the stability of the Dam Neck Disposal Site is insufficient to support the assertion that the site is stable. We refer you to the January 18, 1985 letter of Dr. Frank Perkins of the Virginia Institute of Marine Science to the Council on the Environment in which this point is discussed at length. (Copy enclosed.)

5. Insufficient attention is given to the impact of the proposed site on the shoreline wave energy distributions. Once again we refer you to Dr. Perkin's letter. Considering the value of the shoreline property which could be affected by the disposal site, a detailed analysis should be included on the impact on wave refraction and shoreline erosion.

6. A more detailed analysis should be included on the effect of the proposed site on the migratory pathways at the mouth of the Chesapeake Bay and the impact of the proposed site on blue crab nursery areas.

Sincerely yours,

Madeline Grulich

Madeline Grulich
Science Associate

Enclosure

**Great Lakes Dredge & Dock Company**

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GRATLAK OGO

January 2, 1984

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

Attn: NAOPL-R
(Mr. R. Muller)

Dear Sir:

We at Great Lakes Dredge & Dock Company are interested, and would appreciate your sending us the draft supplement to the "Environmental Impact Statement for Norfolk Harbor and Channels, Virginia Deepening and Disposal", as it becomes available.

Thank you for your attention.

Sincerely,

GREAT LAKES DREDGE & DOCK COMPANY

Andy Johnson

AWJ/jw