REPORT OF THE
VIRGINIA INSTITUTE OF MARINE SCIENCE ON

Beneficial Uses of Dredged Materials in Hampton Roads, Virginia

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 16

COMMONWEALTH OF VIRGINIA
RICHMOND
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PREFACE

This report is submitted pursuant to House Joint Resolution No. 150 of the 1992 Session of the General Assembly:

HOUSE JOINT RESOLUTION NO. 150

Requesting the Virginia Institute of Marine Science to conduct a study on the alternate uses and application of dredged spoils from the Hampton Roads Harbor.

***WHEREAS**, the 1991 Session of the General Assembly passed House Bill 1478, which prohibited the expansion of Craney Island and directed the appropriate state agencies to investigate and study the cost and availability of beneficial uses of dredged materials; and*

***WHEREAS**, such investigation and study should occur before disposal capacity is met; now, therefore, be it*

***RESOLVED** by the House of Delegates, the Senate concurring, That the Virginia Institute of Marine Science (VIMS) be requested to conduct a study on the alternative uses and applications of dredged spoils from the Hampton Roads Harbor, including environmental, economic and social impacts of any alternative.*

***VIMS** shall be assisted by Old Dominion University, the State Water Control Board, the Virginia Port Authority and the Virginia Marine Resources Commission.*

***VIMS** shall submit its findings and recommendations to the Governor and the 1993 Session of the General Assembly in accordance with the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.*

Acknowledgements. The report was prepared by Robert J. Byrne with the assistance of other staff of the Virginia Institute of Marine Science; Thomas Barnard, James Colvocoresses, Robert Diaz, C. Scott Hardaway, Carl Hershner, Carl Hobbs, Robert Huggett, Roger Mann, Maynard Nichols, Robert Orth, Linda Schaffner and Richard Wetzel. Thomas Barnard prepared the section on regulatory processes. Important assistance was also provided by Raymond W. Alden, III and Robin L. Bedenbaugh of Old Dominion University; Robert R. Merhige, III and Stephen A. Curtis of the Virginia Port Authority; Robert W. Grabb of the Marine Resources Commission; John Gill of the U.S. Fish and Wildlife Service; and Edward Christoffers of the National Marine Fisheries Service. Craig Seltzer, Samuel McGee and Marian Huber of the Norfolk District, Corps of Engineers provided assistance throughout the study and their help is thankfully acknowledged.

In many respects this report reflects the efforts of the Beneficial Uses Workgroup, an interagency group formed in 1990 by the Corps of Engineers in partnership with the Virginia Port Authority.

Corps of Engineers reports provided much of the background material for the study. Particularly important source materials were, General Design Memorandum 1, Norfolk Harbor and Channels, Virginia, June 1986, and Norfolk Harbor and Channels, Virginia: Long-term Disposal (Inner Harbor), Draft Information Report, June 1990.

Grateful acknowledgement is due to Diane Perry for assistance in all phases of report preparation, and to the VIMS Publications Center and Art and Reproduction Center for their efforts.

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EXECUTIVE SUMMARY

SCOPE OF STUDY. In keeping with the understood legislative intent this report addresses those uses of dredged materials wherein benefits may accrue to living estuarine and/or waterfowl resources, and to beach nourishment with suitable material. Specifically, focus was placed on habitat modification or creation through utilization of dredged material from Hampton Roads Harbor in association with the current project to deepen and maintain the shipping channels.

BACKGROUND. The Norfolk Harbor and Channels Project, authorized by the U. S. Congress in 1986 (Public Law 99-662), enables a sequenced deepening of the approach and inner harbor channels in order to ensure current and future competitiveness of the Commonwealth's port system in Hampton Roads. With construction of an outbound channel of 50 foot depth, the first phase of the project has been completed. Completion of additional project elements will depend upon port needs and, most significantly, upon provision for disposal areas for the material dredged.

Within the Inner Harbor (the channel network inside the Hampton Roads Bridge Tunnel) the total project will generate, over 50 years, about 250 million cubic yards of dredged material. Of this amount about 26 million cubic yards is due to construction of deeper channels and anchorages. Most of the material will derive from maintenance of the project depth. To date, materials dredged from the inner harbor have been placed in the Craney Island Disposal Area, a 2,500 acre site in the Hampton Roads contiguous to the City of Portsmouth. That site is projected to be filled by 1997. In 1990, the Corps of Engineers proposed expansion of Craney Island as the most economical means to provide a long-term (50 years) general use disposal area for the Hampton Roads. In 1991, the General Assembly passed House Bill 1478 (Code 62.1-132-20) prohibiting the expenditure of state funds to expand the capacity of Craney Island. That option precluded, the requirement remains with the Commonwealth to provide suitable disposal area(s). Meanwhile, the Corps of Engineers is investigating means to extend the useful life of Craney Island via geotechnical methods and/or administrative processes to restrict use of the site to contaminated materials which are unsuitable for ocean disposal. Ocean disposal, a more costly option, is available for disposition of those materials deemed suitable.

BENEFICIAL USES OF DREDGED MATERIALS. Based upon initiatives taken by the Corps of Engineers in 1971 there is increased recognition that dredged materials may have environmentally beneficial uses. Within the past three years several federal environmental advisory/management agencies have joined with the Corps of Engineers in agreements to encourage and enable various marine habitat restoration goals using dredged materials. Several such projects have been completed or are pending in the Maryland portion of the Chesapeake Bay.

In 1990 the Corps of Engineers, in partnership with the Virginia Port Authority, initiated an interagency workgroup to examine beneficial use options for materials dredged from the inner harbor. Several options have been proposed and reviewed as to feasibility which include creation of islands for wetland and waterfowl habitat, oyster bar restoration, and fisheries habitat enhancement. This report has utilized those interim findings.

Disposal of dredged materials in the estuarine and marine environment always involves tradeoffs in natural resource values. Therefore, beneficial uses of dredged material must be pursued within the framework of carefully defined resource management goals, rather than as incidental benefits accrued as part of a solution to a disposal dilemma.

While there is potential for environmentally positive uses of dredged material for habitat creation or modification, there remains considerable uncertainty as to whether created habitat functions in all respects as its natural counterpart. This uncertainty should not discourage pursuit of beneficial uses, but it does caution against presumed success. Only through properly documented projects will the uncertainty be reduced.

CONCLUSIONS AND RECOMMENDATIONS.

1. Need for Commonwealth Program in Long-Range Dredged Material Management Planning. Over the long-term there could be substantial benefits to the Commonwealth in environmentally beneficial uses of dredged material. The issue must be addressed on a long-term, Commonwealth-wide basis. The issue is substantially broader than the question of coping with the disposal of materials from Hampton Roads. Options for beneficial use of dredged material from navigation projects should be considered in the context of a long-term dredged material management plan. Long-term planning is required because the analysis of alternatives is time consuming, and should a candidate beneficial use option emerge, the administrative processing time for consideration under Federal programs is substantial.

   While the Corps of Engineers routinely operates with extended planning and analysis for project development and maintenance, the Commonwealth resource management and advisory agencies do not operate along comparable time-lines. Rather, these agencies work with the Corps on a consultative basis in the later stages of planning, generally after a subset of disposal alternatives have been determined. In order for the Commonwealth to take better advantage of the potential of beneficial uses of dredged material, the appropriate state agencies need to engage in long-range planning.

   RECOMMENDATION: The appropriate resource management, advisory, and economic development agencies of Virginia should join together to draft a long-term dredged material management plan, which includes consideration of beneficial uses, for subsequent review by the Executive and the Legislative branches. Elements considered in the draft plan should include:

   a. Establishment of goals, objectives, and mechanisms for long-term dredged material planning for Federal navigation projects in the Commonwealth.

   b. Identification of resource management goals and objectives which can be supported by appropriate beneficial use and general impact mitigation strategies.

   c. Determination of strategies for effective interagency cooperation between state, federal and local governments in program implementation.

d. Initiation of a generic evaluation framework to guide review of specific projects with respect to management objectives and resource trade-offs associated with beneficial uses of dredged material.

e. Examination of potential funding mechanisms to meet non-Federal cost sharing requirements for beneficial uses.

f. Examination of potential State policy issues.

g. Determination of additional agency resources required to execute a long-term dredged material management program.

2. Limitations of Beneficial Uses for Inner Harbor Dredged Materials. Beneficial uses of dredged material for habitat creation or modification should not be viewed as a strategy to replace ocean disposal or to significantly relieve the pressure for a confined disposal site for Inner Harbor dredged materials. However, habitat creation could serve in a limited way to augment these means of disposal. This view of limited application is held because:

a. Within the inner harbor approximately 250 million cubic yards of dredged material will be generated over a 50 year term. Of the beneficial use options reviewed, creation of islands for varied wetland and/or waterfowl habitat utilizes the largest volume of dredged material per unit area. Conservatively, a 1,000 acre island would utilize about 16 million cubic yards. There are a limited number of suitable sites, a number insufficient to accommodate the volume of material to be generated.

b. Construction of an island for creation of wetland and waterfowl habitat necessitates constructing dikes with sandy material in order to contain the fine-grained silts and clays pumped to fill the site. The channels and anchorages to be dredged in the inner harbor contain a limited supply of suitable dike material. This further constrains the number and scale of such habitat creation. While additional sand material could be obtained from borrow sites external of the channels, additional costs and resource trade-offs at the borrow site would come into play.

c. The cost of habitat development which requires multiple or special handling is significantly greater than ocean disposal, even if the site is within a distance equivalent to the ocean disposal site. Preliminary cost analysis by the Corps of Engineers for island habitat creation indicates a cost factor of about 1.5 to 2 relative to ocean disposal at the Dam Neck Ocean Disposal Site. Those estimates exclude costs associated with planning studies, the cost ramifications of potential seasonal disposal restrictions which could be imposed, and post-disposal shaping of the habitat, planting, and monitoring. Comparisons with the somewhat more distant Norfolk Disposal Site, yet to be designated, would presumably be somewhat more favorable.

RECOMMENDATION: In spite of the limitations noted, it is recommended that evaluations continue on the more promising options for habitat creation or modification. Viewed over the long-term such applications could be an important testing ground to evaluate the utility of such beneficial uses. Of the beneficial use options reviewed, three emerge as candidates for further evaluation:

- Development of islands in the lower James River-Hampton Roads for varied wetland and/or waterfowl habitat.

- Development of oyster reef habitat in the lower James River, and

- Application of dredged material, in thin layers, for benthic habitat enhancement for target finfish species in the lowermost portion of the Chesapeake Bay.

i. Island Creation for Wetland/Waterfowl Habitat

   - **Adjacent to Ragged Island Wildlife Management Area.** This site has received initial screening by the Beneficial Uses Workgroup. Substantial further evaluations will be required. Construction at this site would expand the scale of existing habitat, and with suitable design could reduce ongoing shoreline erosion.

   - **Adjacent to West Side Craney Island.** While the site may have potential for habitat development, the first step necessary is a determination whether such development would violate the intent of House Bill No. 1478. Substantial further evaluations will be required to assess resource tradeoffs and on potential impacts on flow patterns in the Hampton Roads-lower James River.

ii. Oyster Reef Habitat in the Lower James River. The oyster beds of the lower James River have been critically important to the Virginia oyster industry. Restoration of the oyster stocks is a critical need. Evaluation of a pilot-scale oyster reef restoration project is warranted. Site evaluation should be undertaken in the vicinity of Wreck Shoal-Point of Shoals. Relief created with sandy dredged material should be covered with shell cultch for oyster settlement. While the site should be held as a no-harvest sanctuary, the larvae generated from oysters spawning at the site would support the oyster bottoms open to harvest.

iii. Benthic Habitat Enhancement with Thin Layer Application of Dredged Material. Such application is not recommended within the areas of the Inner Harbor or lower James River. However, sites within the southernmost sector of the Chesapeake Bay should be evaluated as to whether dredged materials from the Thimble Shoals Channel or the Inner Harbor channels would be suitable to achieve enhancement of the benthic habitat with respect to targeted finfish species. This strategy is not to be construed as endorsement of open-water disposal. Rather, it is intended as an experimental pursuit to assess the potential as a limited strategy.

I. Scope of Study

Pursuant to the request advanced in House Joint Resolution No. 150 by the 1992 General Assembly *(See Preface)*, this report addresses beneficial uses of dredged material associated with the deepening of navigation channels in Hampton Roads Harbor and subsequent project maintenance. Particular focus is placed on material derived from channels in the Inner Harbor, that portion of the waterway system west of the Hampton Roads Bridge Tunnel *(Figure 1)*. However, issues associated with long-term disposal of dredged materials must be viewed in the context of the entire Norfolk Harbor and Channels project, particularly as they relate to placement of material at ocean sites and the need for contained sites to accommodate materials unsuitable for ocean disposal. Moreover, issues associated with maintenance of navigation channels extend throughout the Commonwealth and the general issue of placement of dredged material must be viewed as a perpetual challenge.

The Corps of Engineers defines beneficial uses of dredged material as, "All productive and positive uses of dredged material, which cover broad use categories ranging from fish and wildlife habitat development, to human recreation, to industrial/commercial uses" *[1]*. Examples include:

- Beach nourishment, shoreline stabilization and erosion control,
- Habitat development or manipulation for aquatic and upland biota,
- Various reclamation projects such as port and industrial development.

Indeed, a review of past disposal activities in Virginia would provide illustrations of the above examples. Moreover, it is Commonwealth policy that priority consideration should be given to use of suitable dredged materials (sand) for nourishment of beaches *(Code of Virginia, 10-1-704)*.

In keeping with the understood legislative intent, this report considers a more restrictive definition of beneficial uses of dredged material. In addition to beach nourishment, focus is placed on those uses from which benefits may accrue to living marine resources. Thus, particular attention is given to habitat development and manipulation.

II. Port of Hampton Roads

A. Economic Impact. As the Commonwealth's greatest port complex, Hampton Roads plays a crucial role in the local and state economy. The Port is the largest export center for coal in the United States with rail shipments from Virginia, West Virginia, Kentucky and Tennessee. With respect to United States waterborne foreign commerce, the tonnage handled in 1990 at Hampton Roads exceeded any other port in the United States *[2]*. Using employment, payroll and tax revenues resulting from industries that are required at the port or attracted to the port as measures of economic impact, a recent study *[3]* found the total economic impact of the Port in 1988 resulted in about 112,000 jobs, payroll of $2,262 million, and state tax revenues of $260 million.

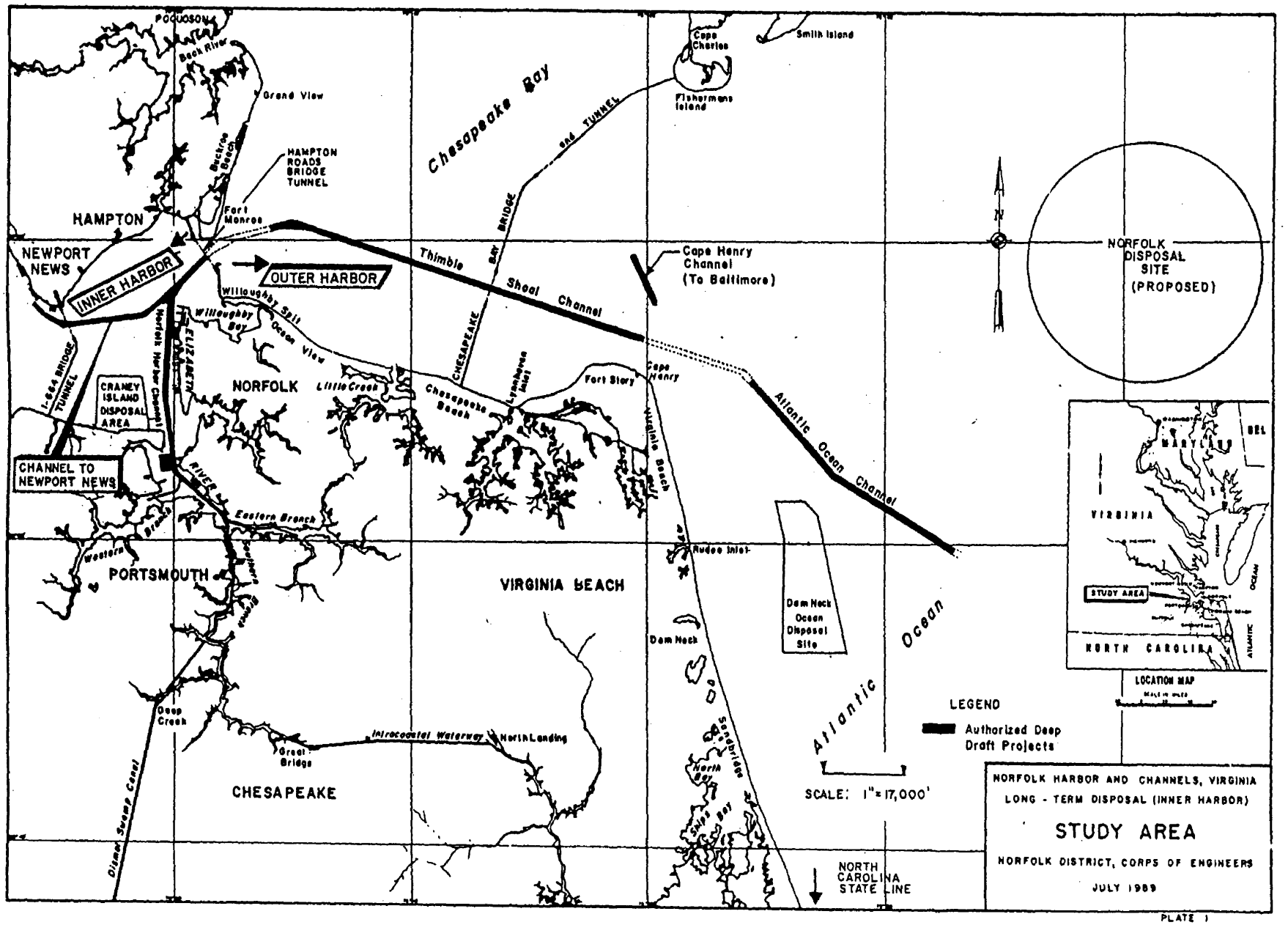

FIGURE 1. Norfolk Harbor and Channels, Virginia, with disposal areas. Reproduced from Reference 5. Figure scale, 1 inch equals approximately 30,200 feet.

The growth of the Hampton Roads port complex is linked to the ability to maintain adequate water depths in the waterways servicing the port facilities. Ships, particularly bulk carriers, have become larger in response to lower, per unit, transportation costs *[4]*. Consequently, there has been a continuing pressure for deeper access channels.

B. Brief History of Dredging and Disposal in Hampton Roads. The earliest federally sponsored dredging, in 1876, authorized channel deepening in the southern and eastern branches of the Elizabeth River *[5,6]*. More generalized deepening to 40 foot depth of the access channels, including Thimble Shoals Channel, was authorized during the period 1917-1927. In 1965, channel deepening to 45 foot depth was authorized for the Thimble Shoals, Newport News, and the Norfolk Harbor Channels *(Figure 1)* with somewhat lesser depths within the Elizabeth River.

Earlier disposal practices included placement of dredged material within Hampton Roads, the lower James River and within the southernmost Chesapeake Bay. During the period of about 1920 to 1939 substantial volumes of dredged material were placed, unconfined, in the immediate vicinity of Craney Island. Construction of a contained site at Craney Island was authorized in 1946. The earliest utilization of ocean disposal occurred in the 1950s. Use of the Dam Neck Ocean Disposal Site began during 1967 with the deepening of the Thimble Shoals Channel to 45 feet.

III. Norfolk Harbor and Channels Project, Deepening to Fifty-five Feet

A. Authorization and Description. The Water Resources Development Act of 1986 (Public Law 99-662) authorized deepening the channels leading to, and within, the Hampton Roads port complex. Project authorization includes, in addition to various anchorages, the following channel elements (see *Figure 1* for locations):

Channel	Channel Depth	
	Current Status	Authorized
Atlantic Ocean Channel	Undredged	60 Feet
Thimble Shoals Channel	50/45 Feet	55 Feet
Norfolk Harbor Channel	50/45 Feet	55 Feet
Channel to Newport News	50 Feet	55 Feet
Elizabeth River and		
Lower Southern Branch	40 Feet	45 Feet
Middle Southern Branch	35 Feet	40 Feet
Upper Southern Branch	35 Feet	35 Feet

The project is planned as sequential elements. The first element, 50 foot depth outbound channels in Thimble Shoals and Norfolk Harbor and 50 foot depth, full width, in Newport News Channels, has been completed. Subsequent elements are construction of outbound channels to 55 foot depth followed by 50 foot and 55 foot inbound channels.

B. Cost-sharing. In May , 1986, the Commonwealth entered into a Local Cooperation Agreement with the Department of the Army for participation in cost-sharing. The agreement covers project costs for the construction of the 50 foot outbound lanes of the Thimble Shoal and Norfolk Harbor Channels and full width deepening of the Newport News Channel. Costs to the Commonwealth include 50 percent of the new construction plus 50 percent of incremental cost of maintenance over that of the 45 foot depth. To this end the General Assembly of Virginia appropriated $26 million dollars effective 1 July 1986.

IV. Dredged Material Disposal Requirements

A. Responsibility. Under the Water Resources Development Act of 1986 the local project sponsor is responsible for the provision of suitable disposal areas. The Army Corps of Engineers performs the required engineering and other studies, and determines the lowest cost disposal option which determines the basis for cost-sharing negotiations. The cost of construction of a contained disposal site is the responsibility of the non-Federal sponsor. Two disposal sites have been utilized in construction of the first phase of the current deepening project, Dam Neck Ocean Disposal Site (DNODS) and Craney Island Disposal Area (CIDA), a general purpose contained site *(Figure 1).* In addition, the Corps of Engineers has requested designation of another ocean disposal area, the Norfolk Disposal Site.

B. Current and Pending Disposal Sites.

1. Norfolk Disposal Site (Pending). The Norfolk District requested the U. S. Environmental Protection Agency to designate this site for suitable material from the Norfolk Harbor and Channel Project. The site *(Figure 1)* is located about 45 miles from Craney Island and is approximately 50 square nautical miles in area. That request was based upon an extensive set of investigations and an Environmental Impact Statement.

2. Dam Neck Ocean Disposal Site (DNODS). DNODS, a site 37 miles from Craney Island, has been used since 1967 for new and maintenance work in the Thimble Shoals and Cape Henry Channel. In 1977, the EPA provided interim site designation and final EPA designation in March, 1988. In contrast to the Norfolk Disposal Site several federal and state environmental resource agencies have expressed continuing concerns regarding the use of DNODS for disposal of very fine-grained sediment (silts and clays) from portions of the Thimble Shoals and Inner Harbor channels. These concerns address questions of sediment stability, water quality and potential disruption of spawning, nursery, and migration of important finfish and crabs in the Baymouth region *[7].* The U.S. Environmental Protection Agency, Region III, has conducted monitoring studies during the period 1986 to 1992. The Corps of Engineers estimates the remaining (1990) DNODS capacity, as designated, to be about 63 million cubic yards (MCY).

3. Craney Island Disposal Area (CIDA)

a. History. Authorized by the River and Harbor Act of 1946, construction of the Craney Island Disposal Area began in 1954 and closure of dikes was completed in early 1957 *[5]*. As originally authorized, the area of CIDA was some 2,500 acres *(Figure 1)* with a compound levee at elevation to 18 feet above mean low water (MLW). The expected disposal life was estimated at 20 years with a capacity of 96 million cubic yards (MCY) at 18 feet elevation. With compaction of the underlying marine clays that capacity has been exceeded. By 1980 about 130 MCY of material had been deposited with an average fill elevation of about 15 feet mean low water (MLW).

Recognizing the limited remaining life of CIDA, the Norfolk District, in 1979, initiated studies for a disposal management plan to extend its useful life. Based upon a projection of 5 MCY per year of maintenance dredging that study estimated a limited life of 19 years (from 1980) without steps to increase capacity. With the management plan proposed and the same projected annual disposal of 5 MCY the lifetime could be increased by 17 years. The management plan included compartmentalization of the retention area to accelerate consolidation and raising the internal dikes to +30 feet MLW. The plan was fully implemented in late 1984.

Based upon the experience gained from management plan implementation between 1984 and 1987 the CIDA lifetime was revised downward with the estimate that the site will be filled to 30 foot elevation by the year 2000. The life expectancy was further reduced by placement in CIDA of some 6 MCY of material from deepening the 50 foot outbound channels of the inner harbor. A 1989 Corps of Engineers report *[5]* estimates the CIDA will be filled by 1997.

Between 1957 and August 1987 (prior to the current channel deepening project) approximately 167 MCY of dredged material have been placed into CIDA. The sources of materials are distributed as follows:

	Volume (MCY)	**%Total**
Corps of Engineers		
Navigation Channels	120.4	72
Other Federal Interests	23.1	14
State and Commercial Interests	23.3	14
	166.8	100

Due to compaction of underlying strata, and implementation of a disposal management plan, the capacity and useful life of CIDA has very substantially exceeded the original design estimates of 96 MCY and 20 years (ca 1977).

b. Current Status and Projected Life of Craney Island Disposal Area. As noted above, the current operational estimate is that CIDA will be filled by year 1997 to 2000 depending upon usage rates. The Corps of Engineers is currently investigating means to further ex-

tend CIDA useful life. One means under evaluation is the use of vertical drains placed through the deposited dredged materials and into the underlying strata to further dewater and consolidate the deposits. Also under consideration is a proposal to limit CIDA use to only those materials unsuitable for ocean disposal. The Corps investigations are evaluating both the capacity and environmental issues involved with restricted use. The initial results of these studies will be available in 1993 *[8]*.

C. **Alternative Disposal Plans Considered by Corps of Engineers.** Recognizing the finite useful life of CIDA both the Corps of Engineers and agencies of the Commonwealth have, over the past twenty years, investigated alternatives. Various options have most recently been examined by the Corps in conjunction with planning the current deepening project. Using a planning time-frame of fifty years, the Corps *[6]* examined:

1. Within the Inner Harbor
    a. Increasing the elevation of Craney Island
    b. Extraction of material from Craney Island
    c. Expanding the area of Craney Island
    d. Contained sites in Willoughby Bay, on Hampton Flats, and on Ragged Island
    e. Disposal alongside of channels
2. Contained Sites in Chesapeake Bay
    a. Horseshoe Shoal area off Buckroe Beach
    b. Ocean View
    c. Eastward of Chesapeake Bay Bridge-Tunnel
3. Inland Sites
    a. Suffolk (Dismal Swamp)
    b. Abandoned borrow pits by truck haul
    c. Abandoned mining site by rail haul
4. Ocean Sites (with use of the existing CIDA for Unsuitable Material)
    a. Dam Neck Ocean Disposal Site
    b. Norfolk Disposal Site
    c. Pipeline to sea

d. Capping unsuitable material at sea

Based upon combinations of environmental, construction feasibility, and cost factors, and significant resistance from the various localities, expansion of the Craney Island site was found to be the least cost alternative.

Corps policy is to use the least costly, environmentally acceptable alternate for Federal projects. It is the least cost plan which is used by the Corps in determining non-Federal cost-sharing should the local sponsor opt for a more costly alternative.

The Corps advanced six plans for expansion of Craney Island which involved either northward, westward expansion or combinations of the two. The plan ultimately recommended involved northward and westward expansion of 2,500 acres to provide a site sufficient to service the 50 year requirement for the inner harbor *(Figure 2)*.

In 1991, the Virginia General Assembly passed House Bill No. 1478 (Code 62.1-132.20, Appendix 1) which prohibits expenditures of state funds for expansion of Craney Island.

D. Need for Contained Disposal Area for Contaminated Dredged Material. Under the current regulatory framework, dredged materials are classified as to whether they pose a significant threat to aquatic organisms in open ocean disposal areas. The materials deemed unsuitable for ocean disposal require disposal in a contained site. The criteria for ocean disposal suitability are established by the EPA and Corps of Engineers. The criteria should be expected to vary through time as more meaningful test protocols are developed. Virtually all large ports, including Hampton Roads, contain contaminated sediment in the dredged materials *[9]*. The requirement for contained disposal area (s) must be viewed as perpetual.

In 1977, the U.S. EPA and the Army Corps of Engineers developed a manual, "Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters *[10]* for use in the implementation of Section 103 of Public Law 92-532, the Marine Protection, Research and Sanctuaries Act of 1972. The manual contains technical guidance on chemical, physical, and biological procedures to determine the acceptability of dredged material for ocean disposal.

During the period 1979-1983 studies of the inner harbor channels were conducted by Old Dominion University for the Norfolk District, Corps of Engineers, in accordance with the above referenced manual. Based upon these the Corps has estimated that about 18 percent (4.67 MCY) of the new work in the Inner Harbor would require contained disposal. These materials are in the Elizabeth River and/or Southern Branch. About 8.2 percent of the projected 50 year maintenance work (17.7 MCY) are projected to require contained disposal. Retrospective application of the study results by the Corps permitted estimation of the amount of material placed into CIDA that was unsuitable for ocean disposal. Approximately 8.2 percent (3.7 MCY) of the material placed during 1978 through 1987 was unsuitable for ocean disposal. These materials were derived from the channels of the Elizabeth River system. It is important to note that materials from the New-

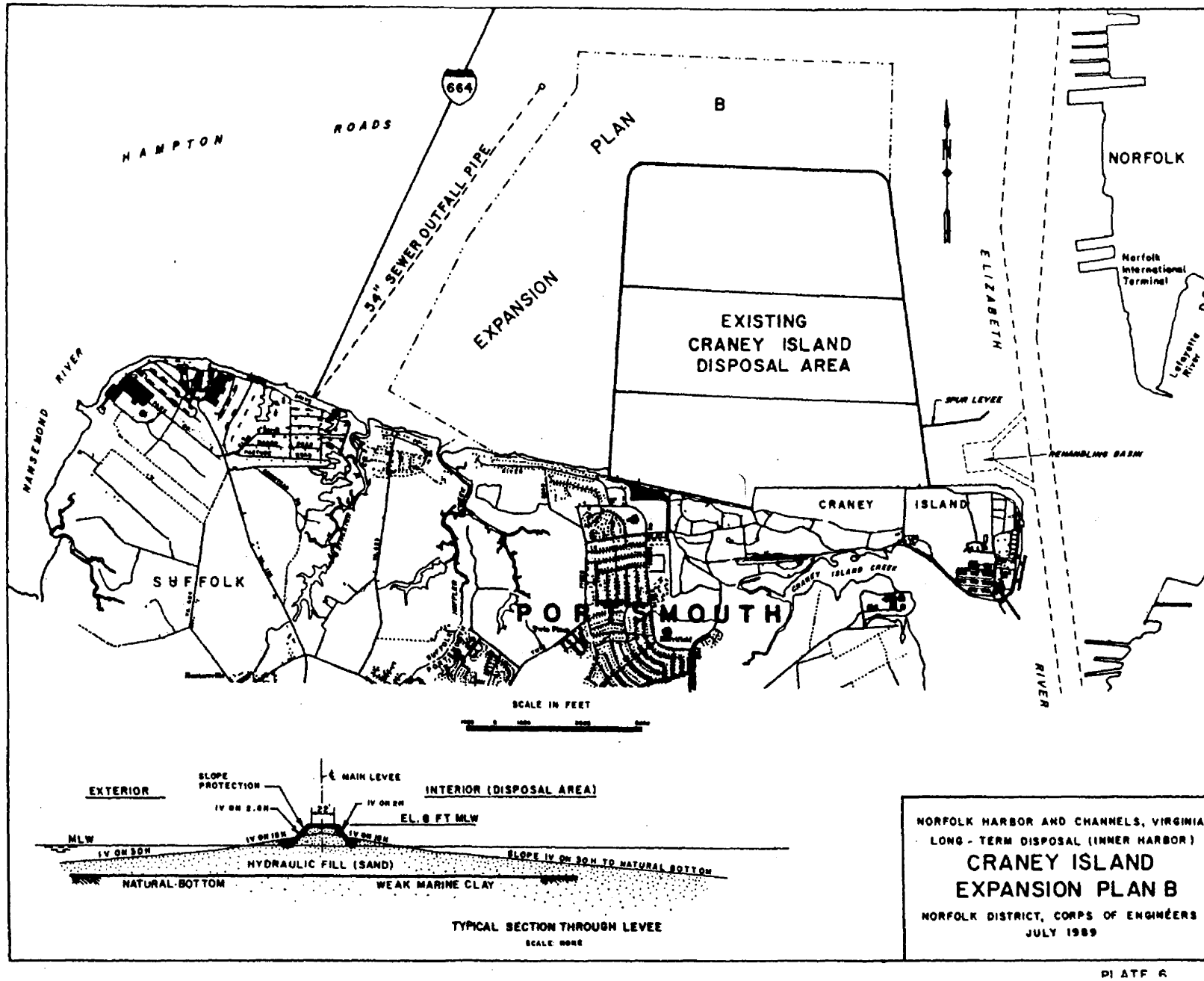

FIGURE 2. Craney Island Expansion Plan B. Reproduced from Referenc

port News Channel and the Norfolk Harbor Channel were found suitable for ocean disposal.

In 1991 the EPA and Corps of Engineers issued a revision of the 1977 Manual entitled "Evaluation of Dredged Material Proposed for Ocean Disposal,

Testing Manual" *[11]*. The procedures and criteria of the revised manual are generally viewed as more comprehensive than the earlier requirements. Additional investigations in accordance with the revised manual will be conducted in 1994 with results expected in 1995-1996 *[12]*. The results of these investigations will determine the revisions of the current projections of dredged material volumes that require confined disposal.

The above referenced testing manual addresses ocean disposal; that is, disposal external of the Chesapeake Bay. The EPA and Corps of Engineers also have under development and review, a manual that pertains to inland waters which would include the Chesapeake Bay and fresh waters. Application of these procedures and criteria will likely further condition open water disposal in the Chesapeake Bay and tributaries.

V. Beneficial Use of Dredged Material

A. National Level. Although the coinage of the term "beneficial use" is relatively recent, the utilization of dredged material for construction purposes has been common practice for many decades, particularly as fill material in land reclamation for port and industrial development. Such was the case in the historical development of the Hampton Roads area *[13]*.

Increased recognition of the ecological value of many open water areas historically used as disposal sites has constrained former disposal practice such that increasing innovation is required in managing disposal activity. Under the Congressional authority of the River and Harbors Act of 1970, the U.S. Army Engineer Waterways Experiment Station (WES) initiated the Dredged Material Research Program (DMRP). This program included wide-ranging studies to gain a more definitive understanding of the environmental impact associated with dredging and disposal, and to develop new or improved dredged material disposal practices *[14]*. The DMRP gave considerable attention to habitat development and other potential productive uses.

Use of suitable dredged materials for beach nourishment was formally promulgated at the federal level in Section 933 of the Water Resources Development Act of 1976 (PL 94-587). Upon request of a state, such utilization is authorized if deemed in the public interest. In such cases the state is required to pay 50 percent of the increased cost associated with project modification.

Section 1135 of the Water Resources Development Act (WRDA) of 1986 (PL99-662) and extension under WRDA 1990 (see Appendix 2) allows the Army Corps of Engineers to modify the operation or maintenance of existing dredging projects for "the purposes of improving the quality of the environment in the public interest." Local sponsors are required to provide 25 percent of the project modification costs.

In 1989, the U. S. Departments of Interior and Army formed a cooperative agreement addressing waterfowl habitat conservation. Particular attention is given to opportunities for Corps of Engineers civil works projects to advance the goals of the North American Waterfowl Management Plan.

In 1991 a cooperative agreement was finalized between the National Oceanic and Atmospheric Administration (NOAA) and the Department of the Army (DOA) for a program to restore and create fish habitat *(Appendix 3)*. Although not restricted to habitat development using dredged materials, those opportunities are expressly recognized. The cooperative agreement resulted from a pilot study at six sites, four of which involved dredged material *[15]*. Two sites were in Maryland, one involving oyster bar restoration and the other, creation of topography for submerged aquatic vegetation.

Additional beneficial use authorization was recently passed in the Water Resource Development Act of 1992. Title II, Section 204 (Appendix 4) authorizes projects for the protection, restoration, and creation of aquatic and ecologically related habitats, including wetlands in connection with authorized construction, operation and maintenance of navigation projects. Non-Federal interests are required to provide 25 percent of the construction cost, and 100 percent of operation and maintenance costs. Appropriations not to exceed $15 million dollars annually were authorized. No funds were appropriated for fiscal year 1993.

Section 204 (1992) differs from Section 1135 (1986) in that applicability of Section 204 is not restricted to existing projects. Moreover, Section 204 specifically references aquatic and ecologically related habitats.

B. Chesapeake Bay. One of the Chesapeake Bay Program goals is habitat restoration and enhancement. Policies have been adopted for the protection and enhancement of submerged aquatic vegetation and wetlands. More recently, the Bay Program Living Resources Subcommittee has embarked upon development of an Aquatic Reef Habitat Plan to address enhancement of oyster habitat. Selected dredged materials may have a role in oyster reef restoration.

In addition to such baywide efforts, both Maryland and Virginia have participated in projects involving beneficial use of dredged material.

1. Maryland. In 1991 the Governor's Task Force on Dredged Material Management *[16]* submitted its report and recommendations on actions to meet both short and long-term needs. It was recommended that beneficial uses, including beach nourishment and habitat development, should be a high priority. With respect to habitat development, four recent or ongoing projects are particularly noteworthy:

    - Black Duck Habitat at Bodkin Island. Bodkin Island, in Eastern Bay, was a significant black duck brood and nesting area. In 1847, the island area was 50 acres; by 1984 it had been reduced to less than one acre due to wave erosion *[17]*. Using 45,000 to 60,000 cubic yards (CY) of dredged material from the Chester River project, the island is to be enlarged to approximately 5 acres. The design includes a combination of upland bird nesting

habitat, intertidal wetlands and tidal pools, all contained within an armored berm. This project is being undertaken under Section 1135 of PL-99-662.

- Poplar Island Waterfowl and Wetlands Habitat. An island enlargement of about 1,000 acres with about 7 million cubic yards disposal capacity has been proposed by the U.S. Fish and Wildlife Service. Poplar Island in 1846 was about 750 acres in size. Wind-wave erosion has reduced the area to about 125 acres. The project, with armored dikes, would protect and enlarge the habitat for migratory waterfowl as well as create intertidal wetlands. The project is proposed as an alternate to open water disposal for materials from the Baltimore Harbor project.

Two pilot projects were completed under the NOAA-DOA cooperative agreement pilot studies *[15]*.

- Slaughter Creek Oyster Reef Rehabilitation. In 1987 approximately 14,000 CY of dredged material was emplaced on 2 acres of unproductive oyster bottom. The bottom elevation was raised 3 feet and capped with 2,200 CY of oyster shell.

- Twitch Cove (Smith Island) Submerged Aquatic Vegetation Habitat. Dredge material from channel maintenance was utilized to elevate the seafloor by three feet to achieve a depth where light penetration through the water column would support growth of submerged aquatic vegetation. The site was then planted with eelgrass to augment natural colonization.

2. Virginia. The Corps of Engineers Norfolk District includes evaluation for potential beneficial uses of dredged material in its civil works project. In addition to beach nourishment such applications have included stock piling at upland sites for construction purposes and landfill cover, and oyster ground, bird habitat, and wetland creation on the seaside of the Eastern Shore peninsula *[18]*. The principal beneficial use of dredged material in the lower Bay has been application of suitable materials for beach nourishment projects which include:

   - In 1975 approximately 450,000 CY of sand, extracted from the eastern portion of Thimble Shoals Channel, was stockpiled at Fort Story for truck haul to Virginia Beach.

   - Ongoing maintenance of Lynnhaven Inlet Channel provides sand which is stockpiled locally for truck haul to Virginia Beach.

   - In 1985 approximately 500,000 CY of suitable material from dredging at Pier 12 of the Norfolk Naval Base was applied to Willoughby Spit. Other suitable material from dredging Pretty Lake was applied to East Ocean View.

   In 1987 the Commonwealth (Code of Virginia 10.1-704) provided policy that beaches of the Commonwealth should have priority consideration

for dredged material that is suitable for beach nourishment as determined by the Secretary of Natural Resources.

Other past applications of dredged material include placement of sand from Newport News Channel for Craney Island dike stabilization, and the use of sand material from Thimble Shoals Channel for island construction of Interstate 664 Bridge-Tunnel.

As part of the Army Corps of Engineers Dredged Material Research Program an experimental island wetland habitat was developed in 1975 in the James River at Windmill Point *[19]*. After construction of a containment dike with sand from a subaqueous borrow site, a 20 acre habitat was created with fine-grained material from the navigation channel to Richmond. The island was rapidly colonized with freshwater marsh plant species. The perimeter dikes were not armored and much of the island has since eroded.

C. **Interagency WorkGroup on Beneficial Uses Study for Lower Bay Dredged Material**. In autumn of 1990 the U.S. Army Corps of Engineers, Norfolk District, initiated investigations of beneficial uses as part of a long-term dredged material management plan with the Virginia Port Authority as cost-sharing partner. The particular challenges raised by the limited disposal capacity at Craney Island were recognized, as was the general need to treat dredged material as a potential resource. This ongoing project has as its objectives, 1) to review the applicability of various beneficial use strategies, 2) to select, from preliminary screening, a subset of the most feasible alternatives, and 3) to consider construction of one or more demonstration sites following necessary preconstruction evaluations and/or studies.

An interagency workgroup comprised of representatives from Federal and Commonwealth environmental management and advisory agencies was formed to advance potential strategies and participate in the screening. In a series of three workgroup meetings, various beneficial use options have been suggested which were then further reviewed by the Corps and/or the U.S. Fish and Wildlife Service *[20, 21, 22]*. Options under consideration are:

- Creation of islands with mixed wetland and upland habitat at a number of sites in the lower Bay and tributaries
- Wetlands restoration/creation and shoreline stabilization
- Oyster bar restoration in the James River
- Fish reef and underwater berms
- Application of a thin layer of dredged material where such action may increase the benthic resource value of the substrate to target finfish species
- Partial filling of a deep trough located to the east of the Hampton Roads Bridge Tunnel

The option screening process has incorporated several decision elements:

- Construction feasibility
- Consistency with resource needs as identified in the Chesapeake Bay Agreements
- Location with respect to economic hauling distance established by the Corps of Engineers *(Figure 3).*
- "Fatal flaw" analyses

The economic hauling distance is essentially the mileage equivalent to the distance from the inner harbor to the Dam Neck Ocean Disposal Site, currently the only designated ocean disposal site. This criterion was invoked because hauling material to greater distances would likely be more costly than disposal at the currently designated ocean site. The analysis applies the questions: 1) would significant natural resources be directly or indirectly impacted, and 2) do current policies or attitudes concerning potential impacts to commercial fishery or recreation values render the proposition untenable. Thus, the "fatal flaw" analysis has been a pragmatic, ad hoc, application of contemporary natural resource management policy and opinion. The options have not been cast against specific Commonwealth resource management objectives that might be supported by the beneficial use of dredged material.

Wetland-Upland Habitat

Following preliminary screening of several candidate sites for wetland-upland habitat by the U. S. Fish and Wildlife Service, four sites in the James River were raised as candidates that might be constructed from materials suitable for ocean disposal:

- Area adjoining the west side of Craney Island.

The concept has been to create a wetland fringe. This prospect is held in abeyance until it is determined whether such action might violate the requirements of House Bill 1478(1991) with respect to increasing the capacity of Craney Island.

- Habitat Island adjacent to Mulberry Island.

The concept is to create an island with varied habitat characteristics offshore of Mulberry Island, an area of predominantly tidal marsh. This site was deemed unsuitable because, 1) much of the near shore bottom is charted as public (Baylor Grounds) or private leased oyster grounds, 2) the area is one of the few remaining productive oyster ground areas in the James River, and 3) the site is relatively distant from the Inner Harbor, the source of the dredged material.

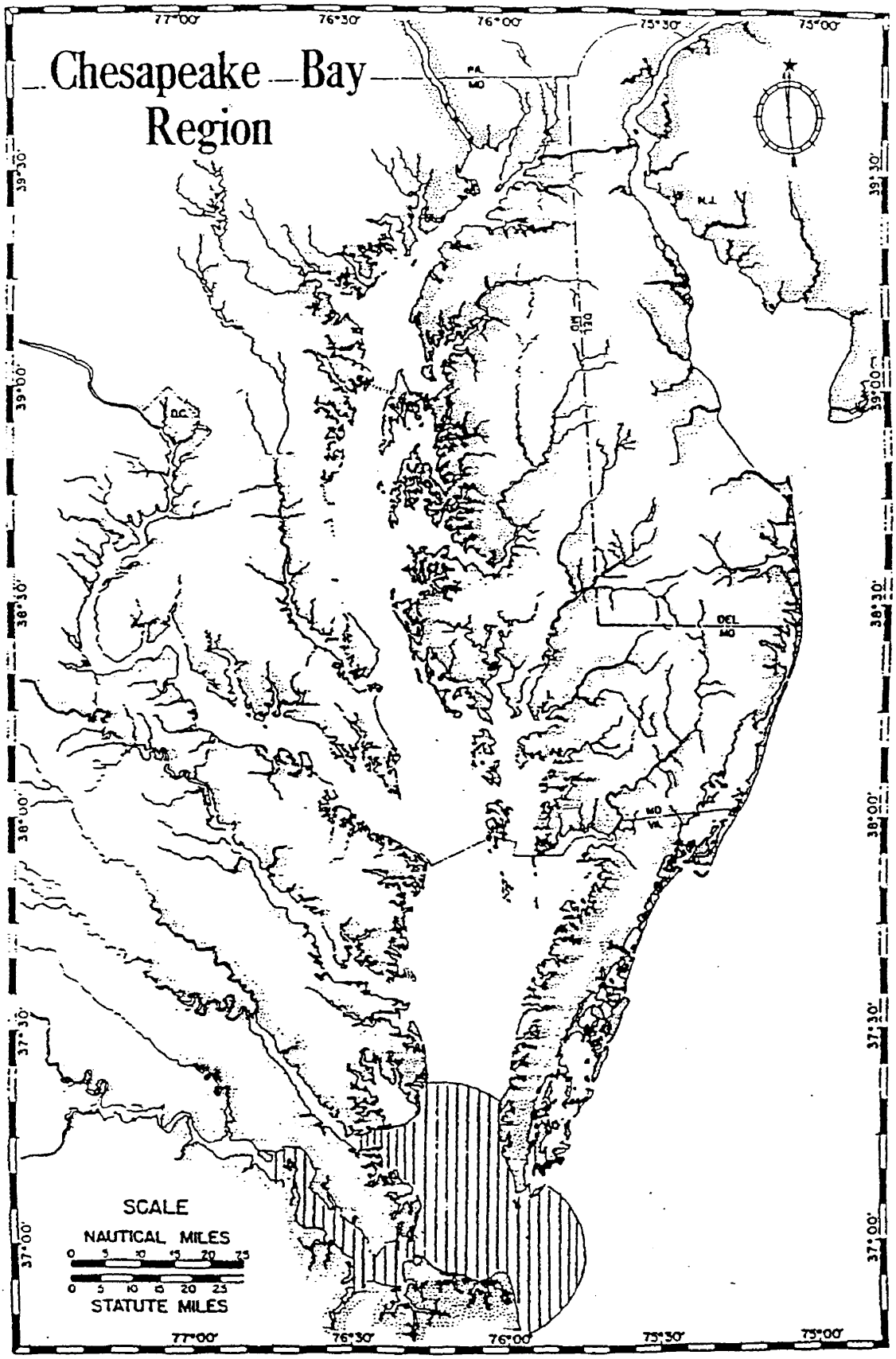

FIGURE 3. Economic Hauling Distance Boundary. Reproduced from Reference 21.

- Habitat island adjacent to Hog Island Wildlife Management Area (WMA)

The Hog Island WMA is managed principally for migrating waterfowl and other wetland dependent species. One of several potential benefits could be protection of the presently eroding shoreline. However, there is concern that conflicts would arise with commercial and recreational fishing interests. Moreover, the site is located at the limit of the Corps of Engineers designated economic hauling distance.

- Habitat island adjacent to Ragged Island WMA.

The Applied Marine Research Laboratory (AMRL) of Old Dominion University has proposed a mixed habitat/erosion control project composed of five islands (870 acres) with the channelward berm protected by riprap *[23]*. After initial consolidation, the contained material would be shaped and planted to create various habitat types, tidal and nontidal wetlands, shallow water ponds and various upland habitats. This project is discussed further in Section VI, C, 2.

Oyster Bar Restoration.

In the absence of harvesting, natural oyster bars grow vertically as larvae from successive years settle and grow, and eventually bury the older oysters. Bathymetric maps of the James River in the 1870s indicated oyster "reefs" which were exposed at low water *(Figure 4)*. Decades of harvesting activity with the consequent loss of shell material have resulted in the virtual elimination of these features. Restoration of natural oyster habitat has been endorsed by the Blue Ribbon Oyster Panel of Virginia and by the Chesapeake Bay Program.

Reconstruction of oyster reef substrate using dredged materials requires application of granular material (sand) to form a steep mound which then is covered with shell to stabilize the topography and to induce natural oyster settlement. At present there are few productive areas in the James River due to incursions of prevalent oyster diseases. However, this option for beneficial use is worthy of further evaluation, particularly in the areas with lower disease mortalities.

Fishery Reefs. The Virginia Marine Resources Commission has, since 1974, conducted an Artificial Reef Program to enhance recreational fishing within the lower Bay and Bay-mouth regions. In addition to sunken vessels, concrete igloo-like structures have been emplaced. Encrusting biota on surfaces of the reef structure serve as food for smaller fish which in turn attract larger predators. Dredged materials fail to provide comparable attributes and are thus unsuitable for this use.

"Thin-Layer" Application of Dredged Material. The fauna living within and on the bottom sediments (the benthic community) are a crucial component of the aquatic food chain as they directly and indirectly serve as food sources for finfish and crustaceans. The species composition, abundance, and diversity within the benthic community are controlled to a significant degree by sediment grain size characteristics, salinity, and water depth. Re-

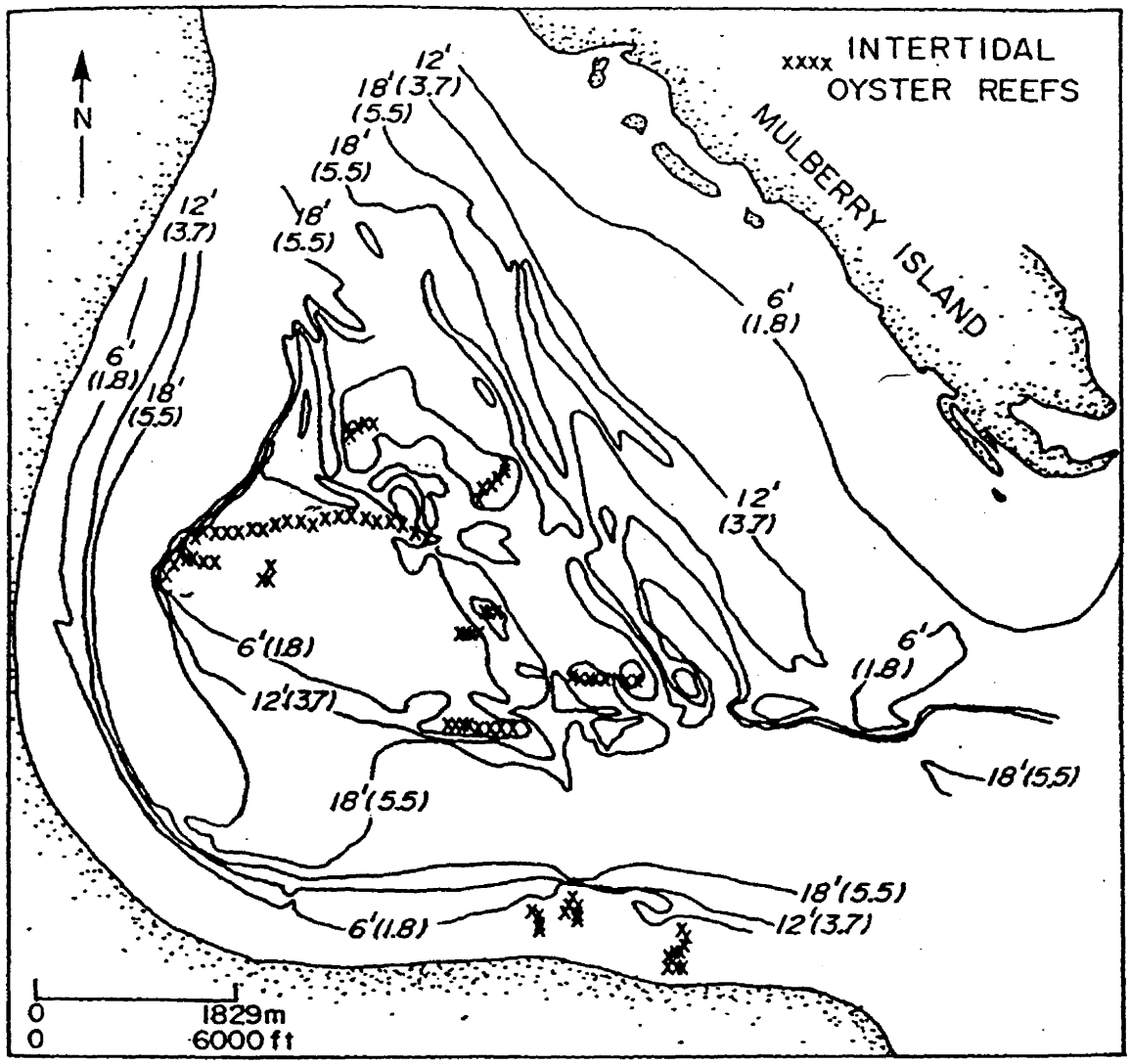

FIGURE 4. Intertidal Oyster Reefs, Wreck Shoal and Burwell Bay, James River, 1870. Based on U.S.C.S. Sheet No. 1179A. Depth contours in feet (meters). Reproduced from Reference 24.

source values differ between various benthic communities and within a given benthic community depending upon the level of ecological succession.

Given a clear resource management objective with respect to identifying the target population(s) (usually finfish or crabs) to be supported, dredged material might be used to enhance benthic resource value by changing the characteristics of the sediment or by mimicking a natural disturbance to induce early successional stages. Two alternative strategies pertain:

- Matching sediment materials. This strategy applies when the sediment characteristics of the dredged material closely match those of the native sediments. Although application of the dredged material smothers the *in situ* fauna, during early re-colonization many more individuals occupy the substrate which increases, at that time, the habitat value to the target fisheries population. Within a few years the original community would become re-established. In this strategy the "benefit" is short-lived. Successive thin layer applications may reinstill the benefit. However, this approach is limited since significant depth changes are not desirable. This application should not be interpreted to mean designation of an unlimited open-water disposal strategy.

- Changing substrate characteristics. The characteristics of the native sediment may be changed by application of dissimilar sediment materials. By careful selection of the contrasting materials, the resultant benthic community could be managed to provide an enhanced habitat value to support selected target populations.

The strategies noted above focus on direct food chain-support role of the benthos. However, the benthos has additional roles in ecosystem function which may condition beneficial use strategies. For example, benthic nutrient cycling characteristics should be considered when benthic resource value is evaluated. It is to be noted that these strategies must be considered as experimental in nature. The Corps of Engineers advises (1992) that until such demonstration projects have been thoroughly documented they must be considered as "potential" beneficial uses *[25]*.

A "thin-layer" site was considered on Horseshoe Shoal parallel to the Thimble Shoal Channel. The site (4 nautical miles by 1 nautical mile with 1 foot fill depth) was envisioned to accommodate about 4 million cubic yards (MCY) of Thimble Shoals Channel dredged material. Due to uncertainties regarding the ability to achieve a uniform layer, and potential disruption of the crab fishery, the proposition has been dropped from further consideration.

Deep Trough-Partial Filling. Eastward of the Hampton Roads Bridge-Tunnel, the approach to the Inner Harbor is a deep channel. A channel of approximately 1.67 million square yards has depths of 90 feet or more. One proposal under consideration is to deposit about 5 MCY of Inner Harbor material which would fill the hole to minus 82 ft. depth *[22]*.

Hydrodynamic modeling studies are being conducted by the Corps of Engineers to evaluate whether the material would be subject to scour and transported into the adjacent channels which are maintained at project depths.

As well, evaluations will be required as to potential effects on salinity patterns within the lower James River. This option accrues no known environmental benefits.

VI. Analysis of Beneficial Use Options in Inner Harbor and Lower Bay

A. Decision Processes - Resource Tradeoffs. All dredged material emplacement results in modification to existing habitats. Such emplacement may result in an incidental biological value for selected species. However, the new habitat may be of less value than the displaced habitat. Thus, habitat development or modification always involves tradeoffs in resource values. As noted by

Lunz *et al [26]*, "The general ecological management objective of habitat development with dredged material would be to maintain or increase the distribution, abundance, and/or biomass of target animal populations and their support populations. Support populations may be plants, animals or both." The identification of target populations must be guided by ecological principles. Such target populations may be selected on the basis of their status of regional commercial, recreational, or ecological significance. In many cases of habitat development target species are the plant and animal populations which support the resources at higher levels in the food chain.

In the formulation of resource management policy guiding habitat development attention must be given to the physical and biological factors extant in local settings. Estuaries, in particular, are characterized by appreciable gradients in physical, chemical, and biological characteristics. Consequently, similar habitats in different parts of an estuary may have significantly different resource values relative to a given habitat development objective. Additional major factors which must be considered in evaluating displaced and developed habitats include *[26]*:

1. Extent of the existing habitat. Within a given zone of an estuary certain types of habitats may cover a small area. Displacement of such limited habitats which may be critical to non-target and support resources should be avoided. For example, submerged aquatic vegetation, being light dependent, is able to grow only in shallow water (two meters or less). Within the Chesapeake Bay and tributaries this depth zone is limited.

2. Successional sequence of developed habitat. After final emplacement of dredged material additional time is required before biological benefits accrue. Moreover, the biological benefits may change over time due to successional changes as the system ages. The planning strategy must take into account which successional stage is targeted and the value of that stage relative to the displaced habitat.

3. Functional characteristics of existing and planned habitats. While a developed habitat may have the physical appearance of a natural system it may not function like a natural system. Planning for a developed habitat should incorporate current scientific understanding to maximize the likelihood of achieving intended function. The physical scale of the habitat developed may also influence functional effectiveness.

For example, a number of wetland development projects have been undertaken but relatively few have been documented to function as "natural systems". Thus, habitat development requires careful planning and design, post installation studies and monitoring to determine whether functional objectives are achieved. Ecological modeling will play an increasingly significant role in such planning and evaluation processes.

4. Cumulative Effects. One of the most challenging questions facing ecosystem analysts is how much of a given natural habitat is needed in an aquatic ecosystem to achieve optimum conditions. For many aquatic habitats this question cannot be answered with certainty. The question naturally follows as to how much new, developed habitat is sufficient to support the identified target species. While not easily answered, the question must be posed. As noted by Lunz *et al [26]*, "Managers and environmental planners need to evaluate existing information and fill in gaps before habitat development becomes a routine choice of dredged material disposal."

Options for beneficial uses of dredged material should be considered in the context of a long-term dredged material management plan. Long-term planning is required because the analysis of alternatives is time consuming and, should a candidate beneficial use option emerge that is appropriate for consideration under the aforementioned Federal programs, substantial time is needed for administrative processing. The Corps of Engineers submits its funding requests for channel maintenance projects two or more years ahead of planned operation. Thus, an alternatives analysis initiated five years before planned operation would likely be required. Projects involving new construction require still longer lead times.

While the Corps of Engineers routinely operates with extended planning and analysis for project development and maintenance, the Commonwealth resource management and advisory agencies do not operate along comparable time-lines. Rather, these agencies work with the Corps on a consultative basis in the later stages of planning, generally after a subset of disposal alternatives have been determined.

In order for the Commonwealth to take better advantage of the potential of beneficial uses of dredged materials, the appropriate state agencies need to engage in long-term planning. Four important steps need to be taken:

1. There needs to be a determination whether additional policy is required to utilize dredged material for aquatic habitat development or modification. Current Commonwealth policy is limited to the use of suitable dredged material for beach nourishment.

2. Resource management goals and objectives which might be supported by appropriate beneficial use strategies must be identified and articulated.

3. A mechanism for long-term planning involving beneficial uses of dredged material needs to be established.

4. A generic decision-making framework needs to be formalized. Each navigation project could then be evaluated in a consistent manner with regard to case specific resource-tradeoff issues.

With such planning elements in place, the Commonwealth could then form a more comprehensive partnership with the Corps of Engineers for systematic evaluation of potential beneficial uses which are consistent with Commonwealth resource management objectives.

B. **Characteristics of Inner Harbor Dredged Materials; Limitations for Beneficial Uses.** Of the approximately 250 million cubic yards (MCY) of dredged material generated from completion of the inner harbor most, about 225 MCY, would be derived from channel maintenance. Over the 50 year project planning period, (1990-2040) average annual maintenance is expected to exceed 4 MCY. Most of the material removed through channel maintenance is fine-grained sediment (silt and clay). The volume of sandy material is relatively small. Of the Inner Harbor channels, only the Newport News Channel contains significant volumes of sand. Completion to the project design depth (57 feet, 55 feet plus 2 feet margin) would provide a total of approximately 1.7 MCY. Overdredging to 70 feet would provide approximately 6 MCY. Aside from the Newport News Channel, other channel segments would provide relatively small volumes of sandy materials.

The characteristics of the dredged material impose some limitations on the types and scale of beneficial use for habitat development or modification. To create an island for varied wetland and waterfowl habitat necessitates construction of dikes with sandy material to contain the fine-grained silts and clay pumped into the site. The relatively limited volumes of sandy materials available constrains the number and/or scale of such habitat construction. While additional sand material could be obtained from borrow sites external of the channels, additional costs and resource tradeoffs at the borrow site would come into play.

C. **Options.** In all of the options discussed below, the dredged material is assumed to be that deemed suitable for ocean disposal (i.e., not contaminated).

1. Beach Nourishment. Within the entirety of the 55 foot project three channel segments will yield substantial amounts of sandy materials. They are the Atlantic Ocean Channel, the eastern most portion of the Thimble Shoals Channel, and the Channel to Newport News. Other segments contain smaller pockets of suitable material. The Corps of Engineers has conducted several studies *[27]* with respect to utilization of materials from the Atlantic Ocean Channel for beach nourishment in the City of Virginia Beach, and for materials from the eastern section of Thimble Shoals Channel on the beaches of the Cities of Norfolk and Hampton.

   The Channel to Newport News would yield approximately 1.7 MCY of sandy materials when completed to a depth of 57 feet and up to 6 MCY if overdredged to a depth of 70 feet. Corps of Engineers evaluation of the material indicates the sand materials are too fine for beach nourish-

ment. However,the material is suitable for construction of dikes for containment of fill.

2. Island Creation for Wetland/Waterfowl Habitat. Over the past century appreciable wetland and waterfowl habitat has been lost through natural erosion processes. The use of dredged material for replacement habitat has substantial potential. However, there are significant issues associated with such development. In particular, resource tradeoffs involving the displaced habitat need to be fully assessed. Also, while some types of habitat structure may be successfully shaped, there remains substantive debate whether or when all of the functional aspects of such habitats are achieved.

   Two design aspects warrant particular attention. Such habitats should be constructed either in proximity to similar natural habitat to achieve scale affects, or be of such substantial scale to fully realize potential habitat objectives. Secondly, the constructed habitat should be protected from erosive forces by armoring the dikes or berms exposed to wave and/or tidal current forces.

   Subaqueous bottoms are the property of the Commonwealth. The Code of Virginia (28.2-1201A) also provides that "All islands which rise by natural or artificial causes from lands which are in common under 28.2-1200 shall remain in public ownership and continue as a common."

   Application to James River/Hampton Roads. Based upon the current levels of analysis two candidate sites emerge for further evaluation.

   - Habitat expansion at Ragged Island as proposed by ODU offers several clear benefits. First, the project is proposed to be constructed adjacent to an existing state-managed resource area, and to be eventually incorporated into that managed resource area. Secondly, the project is of such substantial scale and in such close proximity to an existing managed natural resource area that likelihood of the project achieving desired habitat objectives is improved. Thirdly, the project is not only designed to protect itself from erosive forces, but to protect the remaining natural shoreline of the adjacent management area as well. However, as originally proposed at 870 acres *(Figure 5)*, there is substantial excursion onto public oyster grounds (Baylor Grounds). Due to prevalence of oyster diseases, there is no commercial oyster production from these beds. It may be possible to include new oyster beds in the project design. Nonetheless, Article II. Section 3, of the Constitution of Virginia reserves to the General Assembly the authority to remove bottom areas from Baylor Grounds. The project layout, as proposed, extends an appreciable distance over the shallow flank of the river. This extension may significantly interrupt the lower James River circulation thought to control oyster larvae transport. Three-dimensional hydrodynamic modeling must be utilized to examine the appropriate design of the site.

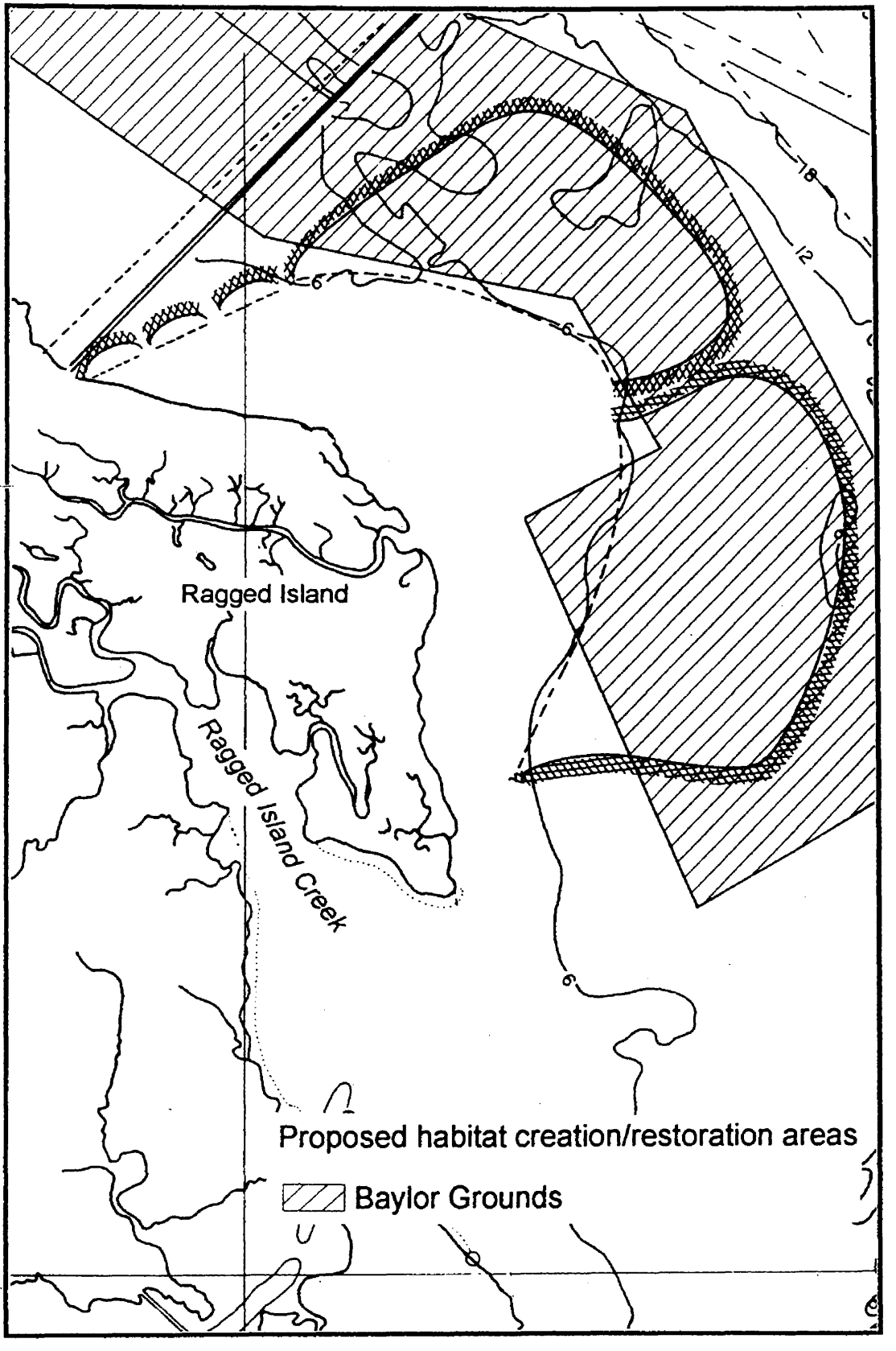

FIGURE 5. Proposed Habitat Creation Area Off Ragged Island, James River. Reproduced from Reference 23.

- The area west of, and adjacent to, Craney Island should also be viewed as a viable site for habitat development. Preliminary evaluation suggests the benthic resource tradeoffs may be acceptable. However, an interpretation of law arising from House Bill 1478 *(Code 62.1-132.20)* will be required to determine whether such habitat development would violate legislative intent. Even with a permissive interpretation, several additional steps will be required in the environmental evaluation. These include a more comprehensive analysis of the resource tradeoffs, and three-dimensional hydrodynamic modeling to determine whether such habitat development would adversely impact the circulation of the lower James River. It must also be determined whether waterfowl attracted to the habitat would be adversely exposed to contaminated sediment placed on Craney Island, an area likely to be incorporated in their range of utilization.

3. Oyster Bar Restoration. In the past, natural oyster reefs were widespread throughout the Chesapeake Bay and tributaries. Over several centuries of harvesting these reefs have been depleted. In more recent decades the prevalence of oyster diseases, combined with continued harvest, and perhaps degraded water quality, has further depleted the oyster stocks. In addition to any commercial significance oyster reefs have important roles in the function of the estuarine system. In sufficient numbers, oysters may be significant in maintenance of water quality due to filter feeding with resultant removal of material in the water column, which may also achieve a favorable shift in the planktonic food chain *[28]*. Moreover, the faunal assemblage associated with the oyster reef may be important as spawning, nursery and feeding habitat for species supporting finfish and crabs. Recognizing the ecological significance of oyster reefs the Chesapeake Bay Program Executive Council recommended the development of an Aquatic Reef Habitat Plan. Suitable dredged material can be used for oyster reef development when a cap of oyster shell is added to provide a substrate suitable for oyster larvae settlement.

   James River Application. Restoration of the James River oyster populations is crucial. Given the current prevalence of oyster diseases the most logical location for development of oyster reefs from dredged materials is in the vicinity of Wreck Shoal and Point of Shoals where infection levels are lower than downriver areas. Developed reefs should be treated as sanctuary areas since the goal is to restore natural habitat. Although not open to harvest, such reefs would serve as sources of larvae to those areas open to harvest. Pending demonstrated success with the initial efforts and reduction in disease intensity, additional reefs could be developed downriver.

4. Submerged Aquatic Vegetation Habitat (SAV).

   SAV is dependent upon water column light penetration for photosynthesis. Under current water quality conditions suitable light penetration is limited to less than two meters (mean low water) during the growing season. Thus, SAV habitat is limited to relatively shallow water. SAV habitat area could be increased by filling selected areas to appropriate

depth. This has recently been demonstrated by a pilot study in Maryland *[15]*.

James River Application. In decades past there were substantial SAV beds in the lower James River. At present only a small bed remains on Hampton Flats. The reason for this limitation is not clear although ambient turbidity is probably implicated. In the absence of restoration in the existing habitat, construction of additional habitat area is not recommended.

5. Application of Dredged Materials to Enhance Benthic Habitat.

   The conceptual framework for benthic habitat modification is discussed in Section V. This strategy is not deemed suitable within the Lower James River or Inner Harbor area due to space restrictions and the potential impacts on oyster beds of the Lower James.

   However, there are areas within the lower Chesapeake Bay where this strategy may have limited potential. Further evaluation is warranted.

6. Creation of Shoals for Fisheries Enhancement.

   Fishes tend to congregate around structures and bottom areas with topographic relief. Under suitable circumstances dredged materials could be used to create topography. In 1988 a massive dredged material mound of fine-grained sediments was constructed near Mobile Bay, Alabama. The site covered 2.5 square miles with elevation up to 20 feet. Post-disposal studies indicated rapid colonization by a diverse benthic fauna which provided a forage base for local fish populations *[29]*.

   The southern portion of the Chesapeake Bay has substantial sand shoal topography. The southern portion of the Bay has moderately strong tidal currents and experiences significant wave action from the Bay mouth and within the bay. These hydrodynamic forces constantly shape and remold the shoals. Most of the dredged materials from the Inner Harbor and Thimble Shoals Channel are soft, fine-grained sediments. Such materials would be more susceptible to erosion and resuspension. Given the likely physical instability and the fact that there already is substantial bottom topography, the creation of additional topography is contraindicated.

7. Filling Deep Holes. While this option does not satisfy the conditions of beneficial uses as defined in this report, the option is discussed because of potential adverse impacts to the ecosystem, particularly as deep topography may be seasonally important finfish habitat. Deep holes are known to provide critical winter habitat for striped bass, white perch and other species in the less saline portions of the Bay and tributaries *[30]*. The significance of deeper topography in the more saline portions of the Bay is poorly understood due to the paucity of finfish survey data in the deep holes. However, it is well documented that fish congregate around structures and topographic relief features. Deep water habitat is highly limited in the Virginia portion of the Bay

and tributaries *(Figure 6)*. Given what is known about finfish utilization of deep water habitat in less saline portions of the Bay and tributaries, and what remains unknown about utilization of deep water habitat in the higher salinity areas, placement of dredged materials in deep holes should be discouraged.

D. Cost Estimates. The cost estimates presented herein were prepared by the Army Corps of Engineers, Norfolk District for the aforementioned Beneficial Uses Workgroup *[20]*. Since the scenarios treated have not been subjected to an advanced design and engineering analysis the estimates must be considered as very preliminary. Nevertheless, the Corps of Engineers indicates that the estimates are useful for cost comparisons between the various beneficial use scenarios and disposal at Dam Neck Ocean Disposal Site (the only designated ocean disposal site), which is the only alternative given the limited remaining capacity of Craney Island.

Dredging and disposal costs are determined by a number of factors. Distance to the disposal site is a significant factor as is the accessibility of the site. Since mobilization and demobilization costs are significant, the size (volume) of the project is a substantive factor. Disposal operations that require multiple handling of the dredged material or other special handling are more costly. For the purposes of these estimates, the Corps of Engineers used a bucket dredge with scow hauling when disposal distance and site characteristics precluded use of hopper dredge or direct hydraulic pipeline discharge.

Table 1 portrays estimated costs of the beneficial use options discussed in Section V. While dollar values are shown they are included only to establish the order of magnitude of expected cost. However, the cost ratios which compare "beneficial use" options to ocean disposal are particularly relevant. Because of the requirements of multiple or special handling involved with habitat creation such as wetland/upland islands, the costs are substantially greater than ocean disposal. In the case of island habitat the cost per acre is appropriately cast as the incremental cost between ocean disposal and habitat creation rather than the full cost. For the case of island creation adjacent to Ragged Island the relative values are $118K per acre for 1025 acres, $135K per acre for 200 acres, and $220K per acre for 50 acres.

Several factors could influence more refined estimates. Advanced engineering processes may change the storage capacity of the islands, thereby changing the individual storage capacities, and the comparative scale costs.

Relative to other habitat creation or modification "thin layer" application to enhance benthic resource value has a near neutral cost ratio. This case reflects the opportunity to use a short distance hydraulic pipeline discharge. Cases involving greater distances would exhibit a less favorable cost ratio.

Only in the case of disposal in the deep trough east of the Hampton Road Bridge Tunnel does the cost ratio reflect disposal at less cost than ocean disposal. As noted earlier this option offers no known environmental benefit. The option is "beneficial" only with respect to cost.

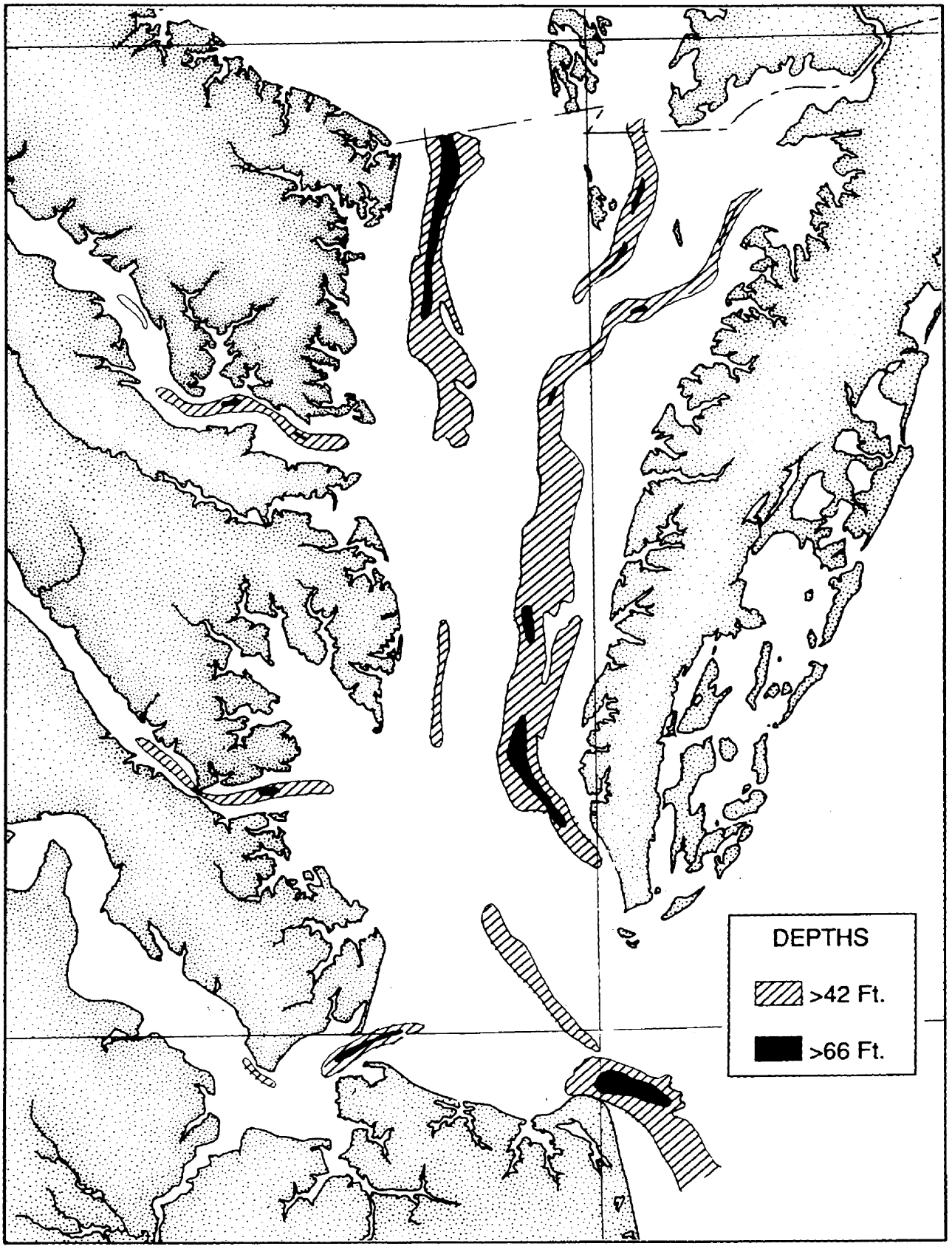

FIGURE 6. Deep Water Areas (Excluding Navigation Channels) Within the Lower Chesapeake Bay and Tributaries.

TABLE 1: COST COMPARISONS BETWEEN BENEFICIAL USE OPTIONS AND DISPOSAL AT DAM NECK OCEAN DISPOSAL SITE

(Based on Army Corpos of Engineers Estimates)

OPTION	LOCATION	MATERIAL VOLUME (MCY)	OPTION COST	OPTION COST PER CY	DNODS COST PER CY	+ PER CY COST RATIO
1025 Acre Island	Ragged Island	16.3	*$243,230,000	$14.92	$ 7.51	2.0
200 Acre Island	Ragged Island	5.7	*$ 69,784,000	$12.35	$ 7.50	1.6
50 Acre Island	Ragged Island	1.9	*$ 25,252,000	$13.47	$ 7.50	1.8
46 Acre Wetland	Mulberry Island	0.34	$ 5,356,000	$15.57	$ 7.60	2.0
8 Acre Oyster Reef	Point of Shoals	0.03	**$ 344,000	$22.68	$16.61	1.4
Thin Layer 3443 Acres	Thimble Shoals	5.5	$ 45,375,000	$ 8.25	$ 7.29	1.1
Fish Habitat 2 Berms 0.8 Acre	Lower Bay	0.009	***$ 125,000	$14.50	$ 7.82	1.8
Disposal in Deep Trough	East of Hampton Roads Bridge Tunnel	5.1	$ 34,784,000	$ 6.82	$ 7.75	0.9

\+ COST RATIO = $\frac{\text{Alternate Disposal Option}}{\text{Disposal Cost at DNODS}}$ DNOS = Dam Neck Ocean Disposal Site

* Cost includes riprap, excludes costs of shaping habitat, planting at habitat, and monitoring costs.

** Estimate based on option as part of larger dredging project; cost reflects equipment limitations.

*** Estimate based on option as part of larger dredging project.

The cost estimates presented in *Table 1* do not include costs associated with site planning studies or those of post-disposal shaping of the habitat, planting, and monitoring. As well, cost factors would likely increase if there were seasonal disposal restrictions imposed.

Finally, it is noteworthy that the cost comparisons are cast in terms of ocean disposal at the Dam Neck Ocean Disposal Site. Comparisons with disposal at the, somewhat more distant, Norfolk Disposal Site would presumably be more favorable.

E. Funding Mechanisms for Beneficial Uses. Ultimately, the distribution of costs for beneficial uses of dredged materials would be determined by negotiation between the Corps of Engineers and the Virginia Port Authority via local cost-sharing agreements. In particular, an interpretation of Section 1135 of WRDA 1986 (PL99-662) as amended will be required as it pertains to the discussed beneficial use projects associated with the Norfolk Harbors and Channels Project *[31]*. It appears that Section 204 of WRDA 1992 would apply since it is not restricted to projects existing at the time of enactment. Another avenue for funding larger beneficial use projects is by project specific authorization in civil works program legislation.

F. Regulatory Process. Any of the envisioned scenarios for beneficial use of dredged material will undergo environmental review mandated by federal, state and local law. The degree of scrutiny and the governmental levels involved will be a function of the size and scope of the proposal as well as the number and type of aquatic resources expected to be adversely affected. The degree of scrutiny can be predicted to be high under almost any scenario involving the James River because of the multiple uses practiced in the river and the wide-ranging unique resources involved.

The James River receives multiple waste loads from sewage treatment plants, thermal effluents, point source industrial effluents and significant dredging disruptions due to the presence of numerous shipping channels, military bases and shipping terminals including coal and container cargo.

At the same time, the James supports summer crab pot fisheries, a significant commercial hard clam fishery, the oyster seed beds, public oyster grounds (Baylor) and private leases, significant sports and commercial fin fisheries, spawning grounds for various estuarine organisms and a number of rare and endangered birds, turtles and other species. Large areas of vegetated and nonvegetated wetlands (mud flats) occupy the lateral margins of the river and its tributaries. This multiplicity of factors will make any environmental review quite complicated, sensitive, and time-consuming.

Once a plan or plans are developed for a beneficial use scenario, the first step will be the development of an Environmental Assessment (EA) and/or Environmental Impact Statement (EIS) as required under the National Environmental Policy Act (NEPA) which includes consideration of economics, alternatives, and impacts of not doing the project. Depending on the scope and significance of the natural resources impacted, much time may be required in conducting studies to determine the degree of significance and methods of impact avoidance. The first step in the process involves a scop-

ing procedure wherein all regulatory and advisory agencies, as well as the general public, define the type and scope of information necessary and the issues involved with the proposal. Once the studies are completed and required information has been collected, a draft Environmental Assessment or Impact Statement is produced and circulated for comment. These comments are collected and incorporated into the draft document which is circulated as a Final Draft. This then becomes the primary decision-making and informational tool in the permit review process involving the three basic levels of government (See *Figure 7* which incorporates the proposed Department of Environmental Quality).

Federal permit review is carried out under the authority of Section 404 of the Clean Water Act, as amended, Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA), and the Fish and Wildlife Coordination Act. The latter requires the sponsoring agency to give equal weight to environmental issues and mandates coordination with the National Marine Fisheries Service (NMFS), the Fish and Wildlife Service (F&WS), and other federal agencies as well as state resource and advisory agencies. Section 404 involves evaluation of dredging and filling operations in navigable waters of the United States, including wetlands. A Section 404(b)(1) evaluation is performed to assess the water quality related impacts associated with dredging and filling. Section 103 of MPRSA specifies that all proposed operations involving the transportation and dumping of dredged material into ocean waters have to be evaluated to determine the potential environmental impact of such activities. Also invoked at this point are the provisions of the Endangered Species Acts (state and federal) and the Marine Protection, Research and Sanctuaries Act. This review will involve a practicable alternatives analysis, wetlands and other special aquatic site review, mitigation-compensation review and water quality impact assessment. Also analyzed are impacts to human health, aquatic life and wildlife, and in addition, aquatic ecosystem diversity, productivity and stability. Consideration is also mandated for historical, recreation, aesthetic and economic values of the aquatic system.

Concurrent to the Section 404 review, the state and local review process takes place, involving as many as four permits or certifications. If the proposal is federally sponsored, a local wetlands permit may be required if tidal wetlands are involved. Additionally, a permit is required for encroachment on state-owned subaqueous land which entails a full public interest review by the Virginia Marine Resources Commission staff, with the assistance of the Virginia Institute of Marine Science, and final action taken at public hearing by the VMRC commissioners. The Virginia Water Protection Permit involves review of water quality impacts by the staff of the Water Control Board to include non-tidal wetlands impacts. This permit serves the same function and enhances the effectiveness of the 401 Certification delegated under the Clean Water Act. The fourth state action required for federally sponsored projects involves a Federal Consistency determination to ensure that the proposal is consistent with Virginia's Coastal Resources Management Plan. This determination is made within the proposed Department of Environmental Quality, assuming current agency responsibilities are maintained.

GENERALIZED ENVIRONMENTAL REVIEW PROCESS

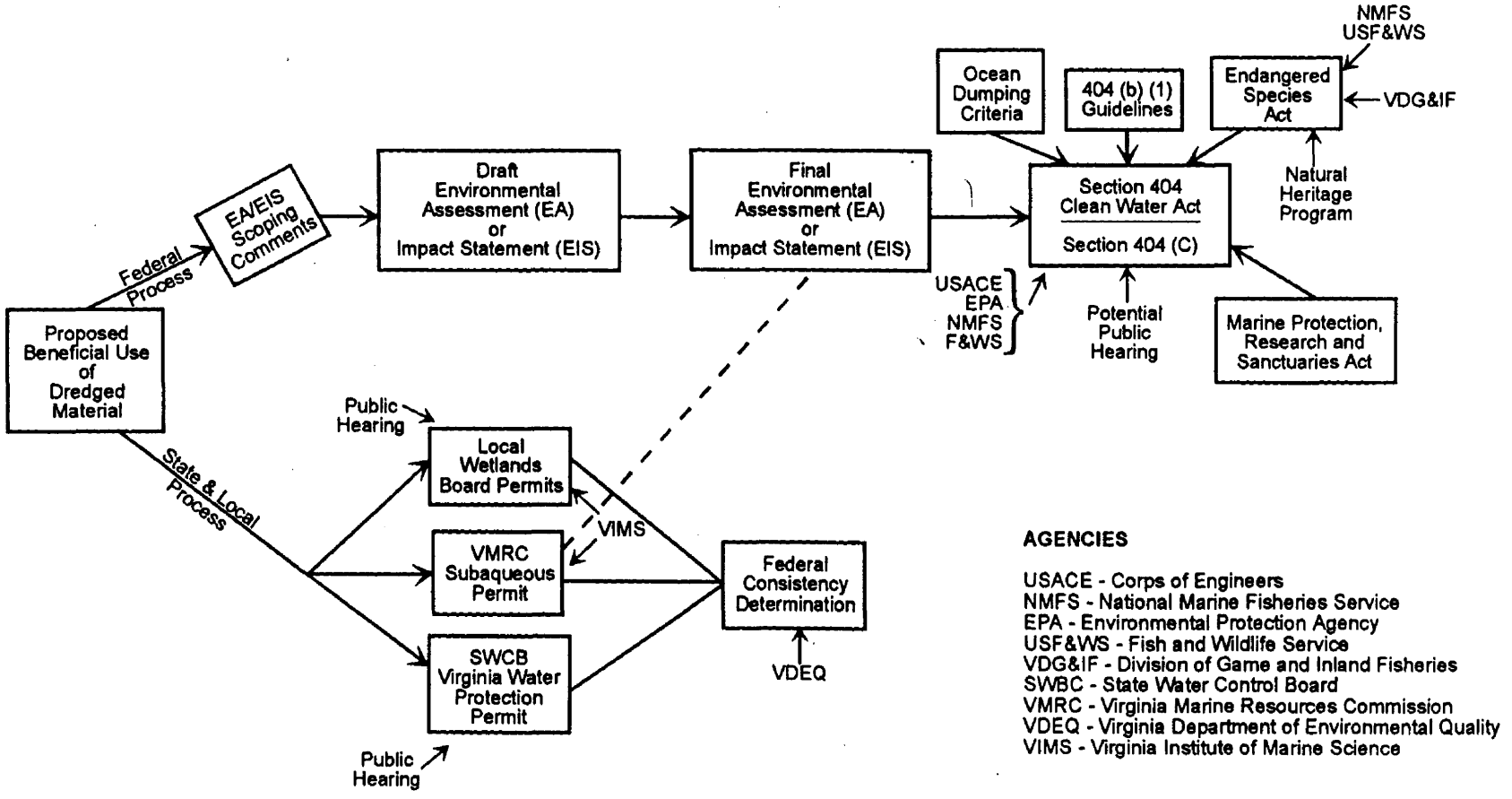

FIGURE 7. Generalized Environmental Review Process.

Once all permits and certificates have been issued the proposal may proceed. It should be noted that failure to receive any one of the approvals dooms the proposal; all are required. Each permit may also include its own modifications and permit conditions intended to minimize adverse environmental impacts.

VII. Conclusions and Recommendations

A. **Need for Commonwealth Program in Long-Range Dredged Material Management Planning.** Over the long-term there could be substantial benefits to the Commonwealth in environmentally beneficial uses of dredged material. The issue must be addressed on a long-term, Commonwealth-wide basis. The issue is substantially broader than the question of coping with the disposal of materials from Hampton Roads. Options for beneficial use of dredged material from navigation projects should be considered in the context of a long-term dredged material management plan. Long-term planning is required because the analysis of alternatives is time consuming, and should a candidate beneficial use option emerge, the administrative processing time for consideration under Federal programs is substantial.

While the Corps of Engineers routinely operates with extended planning and analysis for project development and maintenance, the Commonwealth resource management and advisory agencies do not operate along comparable time-lines. Rather, these agencies work with the Corps on a consultative basis in the later stages of planning, generally after a subset of disposal alternatives have been determined. In order for the Commonwealth to take better advantage of the potential of beneficial uses of dredged material, the appropriate state agencies need to engage in long-range planning.

RECOMMENDATION: The appropriate resource management, advisory, and economic development agencies of Virginia should join together to draft a long-term dredged material management plan, which includes consideration of beneficial uses, for subsequent review by the Executive and the Legislative branches. Elements considered in the draft plan should include:

a. Establishment of goals, objectives, and mechanisms for long-term dredged material planning for Federal navigation projects in the Commonwealth.

b. Identification of resource management goals and objectives which can be supported by appropriate beneficial use and general impact mitigation strategies.

c. Determination of strategies for effective interagency cooperation between state, federal and local governments in program implementation.

d. Initiation of a generic evaluation framework to guide review of specific projects with respect to management objectives and resource trade-offs associated with beneficial uses of dredged material.

e. Examination of potential funding mechanisms to meet non-Federal cost sharing requirements for beneficial uses.

f. Examination of potential state policy issues.

g. Determination of additional agency resources required to execute a long-term dredged material management program.

B. Limitations of Beneficial Uses for Inner Harbor Dredged Materials. Beneficial uses of dredged material for habitat creation or modification should not be viewed as a strategy to replace ocean disposal or to significantly relieve the pressure for a confined disposal site. However, limited habitat creation could serve to augment these means of disposal. This view of limited application is held because:

1. Within the Inner Harbor approximately 250 million cubic yards of dredged material will be generated over a 50 year term. Of the beneficial use options reviewed, creation of islands for varied wetland and/or waterfowl utilizes the largest volume of dredged material per unit area. A 1,000 acre island would utilize about 16 to 20 million cubic yards. There are a limited number of suitable sites, a number insufficient to accommodate the volume of material generated.

2. Creation of an island for varied wetland and waterfowl habitat necessitates construction of dikes with sandy material in order to contain the fine-grained silts and clays pumped to fill the site. The channels and anchorages to be dredged in the inner harbor contain a very limited supply of suitable dike material. This further constrains the number and scale of such habitat creation. While additional sand material could be obtained from borrow sites external of the channels, additional costs and resource tradeoffs at the borrow site would come into play.

3. The cost of habitat development which requires multiple or special handling is significantly greater than ocean disposal, even if the site is within a distance equivalent to the ocean disposal site. Preliminary cost analysis by the Corps of Engineers for island habitat creation indicates a negative cost factor of about 1.5 to 2 compared to disposal at the Dam Neck Ocean Disposal Site. Comparisons with disposal at the somewhat more distant Norfolk Disposal Site, yet to be designated, would presumably be somewhat more favorable. Those estimates exclude costs associated with pre-construction planning or post-disposal shaping of the habitat, planting, and monitoring. Costs would also likely increase if seasonal disposal restrictions were imposed.

RECOMMENDATION: In spite of the limitations noted, it is recommended that evaluations continue on the most promising options for habitat creation or modification. Viewed over the long-term such applications could be an important testing ground to demonstrate the utility of such beneficial uses. Of the beneficial use options reviewed, three emerge as candidates for further evaluation:

- Development of islands in the lower James -Hampton Roads for accrued wetland and/or waterfowl habitat.

- Development of oyster reef habitat in the lower James River, and

- Application of dredged material, in a thin layer, for benthic habitat enhancement for target finfish species in the lowermost portion of the Chesapeake Bay.

1. **Island Creation for Wetland/Waterfowl Habitat**

   a. Adjacent to Ragged Island Wildlife Management Area. This site has received initial screening by the Beneficial Uses Workgroup. Construction at this site would expand the scale of existing habitat, and with suitable design could reduce ongoing shoreline erosion. Substantial further evaluation will be required, including:

      - Evaluation of resource tradeoffs. This requires field studies of the existing benthic community, and design of the intended habitat,

      - Three-dimensional hydrodynamic modeling analysis of the potential influence of various configurations on the flow patterns in the lower James River,

      - Determination of site management,

      - Engineering analysis and refined cost estimation,

      - Planning and design of monitoring studies to evaluate functional response.

   b. **Adjacent to West Side of Craney Island**. While the site may have potential for habitat development, the first step necessary is a determination whether such development would violate the intent of House Bill No. 1478. Pending that outcome, the same elements noted above pertain to the evaluation required.

2. **Oyster Reef Habitat in the Lower James River**. The oyster beds of the lower James River have been critically important to the Virginia oyster industry. Restoration of the oyster stocks is a critical need. Evaluation of a pilot-scale oyster reef restoration project is warranted. Site evaluation should be undertaken in the vicinity of Wreck Shoal-Point of Shoals. Relief created with sandy dredged material should be covered with shell cultch for oyster settlement. While the site should be held as a no-harvest sanctuary, the larvae generated from the site will support the oyster bottoms open to harvest. Elements in further evaluation include:

   - Strategies to minimize impacts on active oyster grounds,

   - Studies of potential influence on larval transport patterns,

   - Assessment of benthic resource tradeoffs,

- Detailed engineering analysis and cost estimation,

- Planning and design of monitoring studies to assess functional objectives.

3. **Benthic Habitat Enhancement Using Dredged Material.** This recommendation should not be interpreted as conventional open water disposal. Rather, what is intended is a pilot-scale test as to the potential benefit of limited, "thin layer", application for benthic resource enhancement. Such application is not recommended within the areas of the Inner Harbor or lower James River. However, sites within the southernmost sector of the Chesapeake Bay should be evaluated as to whether dredged materials from the Thimble Shoals Channel or the Inner Harbor channels would be suitable to achieve enhancement of the benthic habitat with respect to targeted finfish species.

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APPENDIX 1

CHAPTER 686

An Act to amend the Code of Virginia by adding a section numbered 62.1-132.20, relating to the Craney Island Disposal Area.

[H 1478]

Approved April 3, 1991

Be it enacted by the General Assembly of Virginia:

1. That the Code of Virginia is amended by adding a section numbered 62.1-132.20 as follows:

§ *62.1-132.20. Craney Island Disposal Area.--*

A. No agency of the Commonwealth, including the Virginia Port Authority, shall have the authority to expand the Craney Island Disposal Area northward or westward or beyond its present capacity or to cause activities which will result in such expansion of the Craney Island Disposal Area. In addition, no state funds shall be expended for any activities which will result in the expansion of Craney Island northward or westward or beyond its present capacity as a disposal area for material dredged from any site, including the Hampton Roads Harbor.

B. The Virginia Port Authority is hereby directed, in coordination with other state and federal agencies, including the United States Army Corps of Engineers, to locate, establish, and use ocean disposal areas for ocean-suitable dredge materials from Hampton Roads Harbor, or some other suitable site, and to use the existing Craney Island Disposal Area for dredge material suitable or unsuitable for alternate disposal, including ocean disposal, with priority given to materials dredged from the Southern Branch of the Elizabeth River.

C. Prior to the disposal of any dredged material either at an ocean area or on the Craney Island Disposal Area, after the Craney Island Disposal Area has attained its capacity limit, the appropriate state agencies shall investigate and consider the cost and availability of beneficial uses of the dredged material. The appropriate state agencies shall consult with state and federal agencies to ensure the environmental acceptability of any beneficial use. When such environmentally acceptable beneficial use is available and economically feasible, the appropriate state agencies shall pursue such use.

For purpose of this section, "Craney Island Disposal Area" means that parcel of land lying and being in the body of water known as Hampton Roads Harbor, within the City of Portsmouth and adjacent to the City of Suffolk.

APPENDIX 2

WATER RESOURCES DEVELOPMENT ACT OF 1986

§1115. PROJECT MODIFICATIONS FOR IMPROVEMENT OF ENVIRONMENT.

(a) The Secretary is authorized to review the operation of water resources projects constructed by the Secretary before the date of enactment of this Act to determine the need for modifications in the structures and operations of such projects for the purpose of improving the quality of the environment in the public interest.

(b) The Secretary is authorized to carry out a demonstration program in the two-year period beginning on the date of enactment of this Act for the purpose of making such modifications in the structures and operations of water resources projects constructed by the Secretary before the date of enactment of this Act which the Secretary determines (1) are feasible and consistent with the authorized project purposes, and (2) will improve the quality of the environment in the public interest. The non-Federal share of the cost of any modifications carried out under this section shall be 25 percent.

(c) The Secretary shall coordinate any actions taken pursuant to this section with appropriate Federal, State, and local agencies.

(d) Not later than two years after the date of enactment of this Act, the Secretary shall transmit to Congress a report on the results of the review conducted under subsection (a) and on the demonstration program conducted under subsection (b). Such report shall contain any recommendations of the Secretary concerning modification and extension of such program.

(e) There is authorized to be appropriated not to exceed $25,000,000 to carry out this section.

and

WATER RESOURCES DEVELOPMENT ACT OF 1990

Title III - Generally Applicable Provision

Section 304. The time period for the Section 1135 program for project modifications for the improvement of the environment is deleted, and $15 million is authorized to be appropriated annually to carry the program out.

APPENDIX 3

COOPERATIVE AGREEMENT

BETWEEN THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

AND

DEPARTMENT OF THE ARMY

FOR A PROGRAM TO RESTORE AND CREATE FISH HABITAT

Background: Within the National Oceanic and Atmospheric Administration (NOAA), the National Marine Fisheries Service (NMFS) is assigned the primary Federal responsibility for the conservation, management, and development of the Nation's living marine resources. The NMFS Habitat Conservation Policy recognizes that mankind will inevitably alter marine, estuarine, and anadromous fish and shellfish habitats which are essential to maintaining the Nation's fisheries. The ability of these habitats to support fish production is diminishing while pressures for conversion for other uses are continuing. In accordance with the Policy, NMFS is proceeding to: (1) promote, support, and originate habitat restoration and creation by Federal, state, and local resource, construction, and regulatory agencies and the private sector and (2) work directly with these agencies in developing policies, guidelines, and rule making to promote the conservation of coastal and anadromous fish habitats.

Within the Department of the Army, the U. S. Army Corps of Engineers (Corps) has general authority and broad experience, expertise, and capability to conduct water resources development activities. These include protection and restoration of fish and wildlife habitats. In addition, the Corps has conducted extensive basic and applied research in the beneficial uses of dredged materials. This research has shown that under the proper conditions, the restoration and creation of wetlands, seagrass beds, and other aquatic habitats necessary for fish production is both possible and feasible. It is Corps policy to restore and create fish habitat at existing projects when it can be accomplished in an acceptable manner without added cost. If added costs are involved, the Corps will consider those opportunities using funds and authorities which may be available to them and with appropriate cost sharing by non-federal interests.

This Agreement has resulted from a 1986-88 NMFS-Corps Pilot Study, which was conducted to:

> "... determine the practicability of establishing, within existing authorities, resources and funding, a NMFS-Corps nationwide habitat restoration and creation program. Such a program would contribute towards balancing fish habitat conservation with orderly development and management of the Nation's water resources."

11. Marine Research, Protection and Sanctuaries Act of 1972, as amended, Title II, 33 U.S.C. § 1441 et seq.

12. Federal Water Pollution Control Act, as amended, 33 U.S.C. § 1251 et seq.

13. River and Harbor and Flood Control Act of 1965, Section 219, 10 U.S.C. § 3036d.

14.Coastal Zone Management Act of 1972, as amended, 16 U.S.C. § 1451 et seq.

General Scope: This continuing Program will consist of: (1) systematically identifying fish habitat restoration and creation opportunities within the Civil Works Program; (2) formulating, coordinating, evaluating, and selecting habitat features[2]; (3) implementing selected features; and (4) carrying out required research/monitoring activities. It will involve field offices, laboratory, and headquarters offices of both agencies.

Because it is not intended that selected features be limited to wetland construction using dredged material, the broadest range of restoration needs and opportunities should be examined and included (e.g., restoration of salmon runs through removal of stream obstructions, increased shrimp production through water structure regulation to improve access, establishment of oysters through bed construction and seeding, and construction of artificial reefs).

The support and cooperation of other agencies, both Federal and state, is essential for Program success. Because individual sites will be found primarily in state waters, support of state agencies is critical. The U.S. Fish and Wildlife Service, the Environmental Protection Agency, and other resource agencies will also be invited to participate.

Under the Program, restoration and creation work will be carried out by the five NMFS regions and those participating Corps major subordinate commands (MSC) and district commands (DC), in cooperation with the above-cited other parties. The Program will be implemented primarily at the field level and will combine NMFS technical expertise with the Corps' broad water resources planning, engineering, design and construction expertise and capability.

Habitat features will be identified at projects of the overall Civil Works Program. Restoration an creation features may include marine, estuarine, and anadromous fish habitats. Features will be designed to result in a net increase of fish productivity when compared with current conditions. Thus, work under this Program should not be carried out with the purpose of mitigating anticipated damages from Corps projects.

Fish habitat restoration and creation features are highly individual in nature, requiring tailored and, sometimes, innovative design applications to fit unique site and resource conditions. Results are not always readily predictable and benefits are sometimes difficult to quantify. Because of these conditions, the Program may include two general types of habitat features: (1) readily implementable features, which will not involve long term monitoring requirements; and (2) experimental feature, which will require substantial monitoring and research activities. Readily implementable features will be constructed with the objective of increasing fish productivity, thus improving overall project efficiencies. Experimental features will have the primary objective of improving the technologies of fish habitat restoration and creation and/or environmental engineering, while expanding the understanding of the effectiveness and value of existing techniques.

Responsibilities: Within NMFS, Program implementation is delegated to its regional directors. Corps MSCs are authorized to pursue directly implementable features which do not involve added Corps project costs. Directly implementable and experimental features involving added project costs will require approval of the Assistant Secretary of the Army (Civil Works) (ASA(CW)) before implementation. Corps Headquarters, in coordination with ASA (CW), and NMFS headquarters will provide direction to their respective field offices on matters of national policy and program guidance. The Program should be designed and managed as an interagency team effort.

[2]. As used herein, the term "habitat feature" refers to the construction or other work required for habitat restoration and creation purposes within a Civil Works project (e.g., the artificial reef feature constructed under the NMFS-Corps Pilot Study at Mission Bay, CA).

Annually, each MSC will inform its respective NMFS region and other involved agencies of ongoing and future Civil Works projects. From the identified projects, NMFS regions and other involved agencies will identify potential areas and sites for habitat restoration and creation and assess potential fish benefits. Approved features will be planned, placed into the project schedule, and implemented cooperatively within the unique missions, authorities, capabilities, and expertise of the agencies.

Approved sites will be included in the Corps' O&M or project schedules. Each feature's planning, construction, and maintenance will be integrated routinely into scheduled project work.

The research offices of the Corps and NMFS may jointly oversee and monitor experimental features. Responsibilities for performing and funding these activities shall be addressed in the approval process for these features. Provisions will be made for publication and distribution of resulting scientific and technical information.

Funding: Each agency will be responsible for funding necessary for its participation both at the national and field levels.

Reports and Documentation: On an annual basis, participating NMFS regional directors and MSC commanders will submit joint progress reports to designated Washington headquarters offices. These reports will be evaluated and consolidated into a single annual progress report for Washington-level review. At the conclusion of two years, a joint NMFS-Corps assessment report will be submitted to the Under Secretary for Oceans and Atmosphere, U.S. Department of Commerce, and the Assistant Secretary of the Army (Civil Works). This report will include conclusions and recommendations with regard to continuation of the Program.

Effective Date and Duration: This Agreement will become effective upon signature by both parties and will remain in effect as long as both parties agree to participate. Differences should be resolved at the field level, if possible, and in headquarters, if not. Either party may terminate the agreement 30 days after written notice to the other party, with provision for an orderly closing out of ongoing operations.

U. S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	DEPARTMENT OF THE ARMY
Under Secretary for Oceans and Atmosphere	Acting Assistant Secretary of the Army (Civil Works)
Date	Date

Signed on 31 January 1991

APPENDIX 4

WATER RESOURCES DEVELOPMENT ACT OF 1992

TITLE II

§ 204. BENEFICIAL USES OF DREDGED MATERIAL

(a) IN GENERAL. The Secretary is authorized to carry out projects for the protection, restoration, and creation of aquatic and ecologically related habitats, including wetlands, in connection with dredging for construction, operation, or maintenance by the Secretary of an authorized navigation project.

(b) SECRETARIAL FINDINGS. Subject to subsection (c) of this section, projects for the protection, restoration, or creation of aquatic and ecologically related habitats may be undertaken in any case where the Secretary finds that—

(1) the environmental, economic, and social benefits of the project, both monetary and nonmonetary, justify the cost thereof; and

(2) the project would not result in environmental degradation.

(c) COOPERATIVE AGREEMENT. Any project undertaken pursuant to this section shall be initiated only after non-Federal interests have entered into a cooperative agreement in accordance with the requirements of section 221 of the Flood Control Act of 1970 in which the non-Federal interests agree to—

(1) provide 25 percent of the cost associated with construction of the project for the protection, restoration, and creation of aquatic and ecologically related habitats, including provision of all lands, easements, rights-of-way, and necessary relocations;

and

(2) pay 100 percent of the operation, maintenance, replacement, and rehabilitation costs associated with the project for the protection, restoration, and creation of aquatic and ecologically related habitats.

(d) DETERMINATION OF CONSTRUCTION COSTS. Costs associated with construction of a project for the protection, restoration, and creation of aquatic and ecologically related habitats shall be limited solely to construction costs which are in excess of those costs necessary to carry out the dredging for construction, operation, or maintenance of the authorized navigation project in the most cost effective way, consistent with economic, engineering, and environmental criteria.

(e) AUTHORIZATION OF APPROPRIATIONS. There is authorized to be appropriated not to exceed $15,000,000 annually to carry out this section. Such sums shall remain available until expended.