22

NORFOLK HARBOR, VIRGINIA

REPORT OF SURVEY INVESTIGATION

The Craney Island Disposal Area...

Replacement or Extension

Appendixes

U.S. ARMY CORPS OF ENGINEERS · NORFOLK DISTRICT ·

OCTOBER 1974

NORFOLK HARBOR , VIRGINIA
REPORT OF SURVEY INVESTIGATION
THE CRANEY ISLAND DISPOSAL AREA
Replacement or Extension

Technical Report

APPENDIX 1

PREPARED BY THE

NORFOLK DISTRICT, CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

SECTION A

THE STUDY AND REPORT

THE STUDY AND REPORT

TABLE OF CONTENTS

LIST OF TABLES

SECTION A.

THE STUDY AND REPORT

1. This section describes the study and its background, providing information helpful in understanding the organization and presentation of the report.

Purpose and Authority

2. Over 71 million tons (actually 71,490,389 tons) of waterborne commerce moved through the Port of Hampton Roads in 1970. This trade relies, in large part, on the man-made channels offering access to the various port facilities. Maintenance of authorized depths in the channels and anchorages requires the removal of over 3.8 million cubic yards of dredge material each year. Since 1957, most of this material has been deposited in the Craney Island Disposal Area. However, this practice cannot continue indefinitely. Craney Island Disposal Area will be filled to capacity in 1979, at the current rate of filling. This fact prompted local interests to request the survey study on which this report is made. The purposes of this study were to consider possible courses of action to provide for the future disposal of dredged material and to recommend the most beneficial overall solutions with the least social, environmental, and economic cost.

3. This study was undertaken in response to the following resolution adopted 3 October 1968 by the Committee on Public Works of the U. S. House of Representatives:

"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on Norfolk Harbor, submitted in House Document No. 563, 79th Congress, Second Session, and other pertinent reports with a view to determining whether further modification of the project for Norfolk Harbor, Virginia, is advisable at this time, with particular reference to providing a replacement for or extension to Craney Island Disposal Area for the accommodation of material dredged from Norfolk Harbor and adjacent waters."

Scope of the Study

4. In the Craney Island study a number of dredging and spoil disposal methods were examined. The choice of disposal sites was not limited to the immediate Hampton Roads area. During the formulation process, alternatives were explored and subsequently rejected only after they were found to be seriously deficient on economic, environmental, or social grounds.

Study Participants and Coordination

5. Principal responsibilty for conducting and coordinating the study belonged to the Corps of Engineers as did plan formulation, consolidating information from studies of other agencies, and preparing the report. Direct assistance with portions of this study was obtained from the following participants:

- Virginia Institute of Marine Science
- Virginia Division of State Planning and Community Affairs
- Waterways Experiment Station, U. S. Army Corps of Engineers, Vicksburg, Mississippi
- Virginia Port Authority
- Southeastern Regional Planning District Commission
- City of Portsmouth
- City of Suffolk
- City of Norfolk
- City of Chesapeake
- Mr. A. Lee Smith, Consultant, formerly of Norfolk Dredging Company
- Dr. Harold G. Marshall, Consultant, Department of Biology, Old Dominion University
- Old Dominion University Research Foundation
- U. S. Geological Survey

6. Views of the public were obtained at an initial public meeting on 10 September 1970, a formulation stage meeting on 1 June 1972, and a late-stage public meeting on 28 August 1974.

7. Coordination throughout the study was maintained with the Commonwealth of Virginia via correspondence and meetings. During this time, the Commonwealth acknowledged its responsibilities as a local sponsor for major navigation improvements in Hampton Roads. In January 1973, the Secretary of Commerce and Resources for Virginia designated the following state agencies to serve on a Craney Island Task Force:

- Commission of Game and Inland Fisheries
- Division of Industrial Development
- Division of State Planning and Community Affairs

- Governor's Council on the Environment
- Marine Resources Commission
- State Water Control Board
- Virginia Institute of Marine Science
- Virginia Port Authority
- The Attorney of Virginia (Acted as legal consultant)

Two main objectives of this Craney Island Task Force were to (1) review and evaluate each of the feasible alternatives identified by the Army Corps of Engineers and any other approaches that the Task Force considered to merit study, as they affect the environment, development within the area, and other pertinent criteria, and (2) recommend a site or a combination of sites for the future disposal area and identify the procedure that the state should follow in fulfilling its obligations to the Corps and the development of the site or sites. The report of the Craney Island Task Force was submitted to the Secretary of Commerce and Resources for the Commonwealth in September 1973 and was later submitted to the Governor and to the General Assembly. Appendix 3 contains a report of the Commonwealth's Craney Island Task Force.

8. In addition to local and state assistance, the study was coordinated with the following Federal agencies:

- U. S. Fish and Wildlife Service
- National Marine Fisheries Service
- Environmental Protection Agency

The Report

9. This report has been arranged into four documents, a main report, a technical appendix, a correspondence appendix, and an appendix which includes the pertinent reports of other agencies.

10. The main report presents a broad view of the overall study for the benefit of both lay and technical readers. Included in the main report are (a) description of the study area, (b) present status of the Craney Island Disposal Area, (c) need for a new disposal area and problems involved in fulfilling that need, (d) formulating a plan, (e) summary of the project economics, (f) division of project responsibility between Federal and non-Federal interests, and (g) recommendations to implement the selected plan.

11. The technical appendix contains greater detail. It follows the same general outline as the formulation and evaluation part of the main report. The formulation process is examined in the same order as in the main report. Correspondence and other agency reports, pertinent to the study, are presented in appendices 2 and 3, respectively.

Prior Studies and Reports

12. In 1944, Congress authorized a study to determine the advisability of providing a disposal area to accommodate dredged material from Norfolk Harbor and adjacent waters. A report on this study was submitted to Congress in 1945 with the result that a Federal project, the Craney Island Disposal Area, was authorized by the River and Harbor Act of 1946.

Table A-1. AUTHORIZATION OF PROJECTS WITHIN HAMPTON ROADS AREA

Acts	Work authorized	Documents and reports
	HAMPTON ROADS AND ELIZABETH RIVER	
Mar. 2, 1907	A channel 30 feet deep to navy yard	H. Doc. 381, 59th Cong., 1st sess.
June 25, 1910	Depth of 35 feet to navy yard	H. Doc. 551, 61st Cong., 2d sess.
Aug. 8, 1917	Depth of 40 feet and width of 750 feet to mouth of Southern Branch.	H. Doc. 140, 65th Cong., 1st sess.
Sep. 3, 1954	Widen 40-foot channel to 1,500 feet from 40-foot contour in Hampton Roads to a point just south of Norfolk International Terminal.	S. Doc. 122, 83d Cong., 2d sess.
Oct. 27, 1965	45 feet deep, Ft. Wool to Lambert Point, (800 feet wide, Norfolk International Terminal to Lambert Point).	H. Doc. 187, 89th Cong., 1st sess.
	SOUTHERN BRANCH	
June 25, 1910	For a channel with depth of 22 and 25 feet	H. Doc. 551, 61st Cong., 2d sess.
Aug. 8, 1917	Depth of 40 feet and width of 450 feet from mouth to Belt Line R. R. bridge.	H. Doc. 140, 65th Cong., 1st sess.
Mar. 3, 1925	Channel 30 feet deep and 375 feet wide to Virginia Ry. bridge thence 25 feet deep and generally 200 feet wide to Norfolk & Western Ry. bridge.	H. Doc. 226, 68th Cong., 1st sess.
Aug. 30, 1935	Depth of 25 feet and width of 200 feet from Norfolk & Western Ry. bridge to a point 2,500 feet above with a turning basin 500 feet square.	H. Doc. 182, 73d Cong., 2d sess.
June 30, 1948	Approach and turning area 40 feet deep and a maximum width of 830 feet opposite Norfolk Naval Shipyard thence a channel 35 feet deep and 375 and 250 feet wide to a point 1,900 feet above Norfolk & Western Ry. bridge and a turning basin 35 feet deep and 600 by 600 feet at upstream end.	H. Doc. 545, 80th Cong., 2d sess.
Oct. 27, 1965	40-foot deep channel, Belt Line bridge to Old Virginian bridge, 35-foot deep opposite St. Julians Creek.	H. Doc. 187, 89th Cong., 1st sess.

Table A-1. AUTHORIZATION OF PROJECTS WITHIN HAMPTON ROADS AREA (Cont'd)

Acts	Work authorized	Documents and reports
	EASTERN BRANCH	
July 5, 1884	Improvement of Eastern Branch	Annual Report 1885, p. 1015.
Mar. 2, 1907	Width of 500 feet and depths of 25 and 22 feet	H. Doc. 373, 59th Cong., 1st sess.
Mar. 2, 1907	Removal of shoals at mouth	Specified in act.
Mar. 3, 1925	Depth of 25 feet and width of 200 feet from Norfolk & Western Ry. bridge to Virginian Ry. bridge.	H. Doc. 226, 68th Cong., 1st sess.
July 3, 1930	30-foot channel to a point opposite terminal of Imperial Tobacco Co. in Berkley (inactive)	H. Doc. 37, 71st Cong., 1st sess.
Mar. 2, 1945	Depth of 25 feet and width of 300 feet from Norfolk & Western Ry. bridge to Campostella bridge.	H. Doc. 224, 76th Cong., 1st sess.
	WESTERN BRANCH	
Mar. 4, 1913	Channel 24 feet deep and 300 and 400 feet wide to West Norfolk highway bridge.	H. Doc. 566, 62d Cong., 2d sess.
July 3, 1930	For 18-foot channel to a point about 3,000 feet above West Norfolk highway bridge.	H. Doc. 265, 70th Cong., 1st sess.
	SCOTTS CREEK	
July 3, 1930	For existing project dimensions	H. Doc. 189, 70th Cong., 1st sess.
	ANCHORAGES	
June 25, 1910	A 30-foot anchorage at Lambert Point	H. Doc. 551, 61st Cong., 2d sess.
Aug. 8, 1917	A 12-foot anchorage at Pinner Point	H. Doc. 605, 63d Cong., 2d sess.
Sep. 3, 1954	An anchorage 38 feet deep and 1,500 feet square; anchorage 35 feet deep and 1,500 feet square; and anchorage 20 feet deep, 1,000 feet wide, and 3,000 feet long.	S. Doc. 122, 83d Cong., 2d sess.
Oct. 27, 1965	Two anchorages opposite Sewells Point, 45 feet deep with 1,200-foot swinging radius.	H. Docs. 187 & 143, 89th Cong., 1st sess.
	DISPOSAL AREA	
July 24, 1946	A trapezoidal-shaped area of about 2,500 acres of flats adjacent to and north of Craney Island, including levees, sluiceways, rehandling basins, and approach and exit areas.	H. Doc. 563, 79th Cong., 2d sess.

Appen

Table A-1. AUTHORIZATION OF PROJECTS WITHIN HAMPTON ROADS AREA (Cont'd)

Acts	Work authorized	Documents and reports
	CHANNEL FROM PHOEBUS, VIRGINIA TO DEEP WATER IN HAMPTON ROADS	
Aug. 30, 1935	Channel 12 feet deep and 150 feet wide from deep water in Hampton Roads in Phoebus waterfront	R. H. Comm. Doc. 33, 72d Cong., 1st sess.
	HAMPTON CREEK, VIRGINIA	
Sep. 19, 1890	Channel 9 feet deep, varying from 200 feet to 300 feet wide on bar at mouth; and same depth and 200 feet wide from mouth to Hampton Highway Bridge.	Annual Report, 1899, p. 974.
Aug. 30, 1935	A channel 12 feet deep and 200 feet to 300 feet wide on bar 12 feet deep and 150 feet wide in Hampton Creek.	Rivers and Harbors Committee Doc. 34, 72 Cong., 1st sess.
Mar. 2, 1945	A channel in Herberts Creek 100 and 80 feet wide and 12 feet deep from Hampton Creek to Kecoughton Road	H. Doc. 559, 76th Cong., 3d sess.
Oct. 27, 1965	Delete requirement for providing spoil-disposal area.	H. Doc. 201, 89th Cong., 1st sess.
	CHANNEL TO NEWPORT NEWS, VIRGINIA	
June 25, 1910	Channel 35 feet deep and 400 feet wide	H. Doc. 550, 61st Cong., 2d sess.
Aug. 8, 1917	Channel 35 feet deep and 600 feet wide	H. Doc. 605, 63d Cong., 2d sess.
Jan. 21, 1927	Channel 40 feet deep and 600 feet wide	H. Doc. 486, 67th Cong., 4th sess.
Oct. 27, 1965	Channel 45 feet deep, 800 feet wide from that depth in Norfolk Harbor Channel about 4.5 miles long.	H. Docs. 143 & 187, 89th Cong., 1st sess.
	ANCHORAGES	
Oct. 27, 1965	Two deep-draft anchorage berths opposite Newport News 45 feet deep over a 1,200-foot swinging radius.	H. Docs. 143 & 187, 89th Cong., 1st sess.
	NEWPORT NEWS CREEK, VIRGINIA	
July 24, 1946	Channel 12 feet deep and 200 feet to 60 feet wide.	H. Doc. 559, 79th Cong., 2d sess.

Table A-1. AUTHORIZATION OF PROJECTS WITHIN HAMPTON ROADS AREA (Cont'd)

Acts	Work authorized	Documents and reports
	DEEP CREEK, NEWPORT NEWS, VIRGINIA	
Aug. 26, 1937	Channel 6 feet deep from James River to Hicks Landing with widths to 80 feet and 50 feet; a turning basin 6 feet deep, 100 feet wide and 105 feet long; an anchorage basin 6 feet deep and 6.4 acres in area; and a timber jetty 800 feet long on the north wide of the anchorage.	H. Doc. 76, 74th Cong., 2d sess.
June 30, 1948	A channel 8 feet deep and 100 feet wide from that depth in James River to the mouth of Deep Creek, a distance of approximately 9,000 feet; thence 8 feet deep and 60 feet wide for a distance of 700 feet to the harbor; and a harbor 8 feet deep, 400 feet to 740 feet wide and 1,940 feet long to a point near Parkers Landing, totaling about 20 acres in area. Elimination of timber jetty.	H. Doc. 601, 80th Cong., 2d sess.
	NANSEMOND RIVER, VIRGINIA	
Aug. 11, 1888	Channel 12 feet deep, 400 to 200 feet wide, Town Point to mouth of Western Branch; thence, 12 feet deep, 100 feet wide to Suffolk; turning basin 200 feet square at Suffolk; and spur dikes and training walls at mouth of Western Branch.	Annual report for 1887, p. 1001
July 3, 1930	A channel 12 feet deep and 100 feet wide between the mouth and a point 0.45 mile above the highway bridge at Suffolk, a distance of approximately 18.7 miles. A turning basin 12 feet deep and 200 feet square at Suffolk; and a channel in the Western Branch 10 feet deep and 80 feet wide between its mouth and Reids Ferry.	H. Doc. 184, 70th Cong., 1st sess

SECTION B

RESOURCES AND ECONOMY OF STUDY AREA

RESOURCES AND ECONOMY OF STUDY AREA

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

SECTION B.

RESOURCES AND ECONOMY OF STUDY AREA

1. A general understanding of Hampton Roads resources and economy as related to port operation is a prerequisite to gaining an appreciation of the need for channel maintenance countered by the difficulty involved in choosing sites to dispose of dredged spoil.

Environmental Resources

ENVIRONMENTAL SETTING

2. Hampton Roads is located approximately midway of the Atlantic Seaboard, 180 miles southeast of Washington, D. C., at the southern end of Chesapeake Bay, as shown on plate B-1. Comprising a total land area of 1,350 square miles, the study area includes the cities of Norfolk, Portsmouth, Virginia Beach, Chesapeake, Suffolk, Newport News, Hampton, and the counties of York and Isle of Wight. The harbor in Hampton Roads is recognized as one of the largest and finest natural harbors in the world. The naval complex in the metropolitan area is the largest in the world, and the economic well-being of the area is highly dependent upon this military establishment. The most important of the area's basic industries is the Federal Government, made up primarily of the military and civilian activities under the jurisdiction of the Fifth Naval District, headquartered in Norfolk. Other primary industries in the area include manufacturing, shipbuilding, ship repair and other port-related activities, agriculture, and tourism.

CLIMATE

3. The climate of the study area is generally mild. Temperatures average 42 degrees in January and 78 degrees in July. Precipitation, primarily in the form of rain, averages about 43 inches annually. The saline, tidal waters of Hampton Roads are essentially ice-free. Occasionally, hurricanes or northeasters strike the area.

TERRAIN

4. The terrain of the study area is low-lying and generally flat. The maximum elevation is about 25 feet, except for isolated sand dunes along beach areas. Shallow water depths of less than 20 feet fringe the Chesapeake Bay and Atlantic Ocean shoreline. Other than the improved channels, water depths in the inland bays and connecting waters are generally less than 10 feet.

TIDES

5. Tidal heights experienced in Norfolk Harbor generally reflect the height of tides to be expected in other parts of Hampton Roads.

6. Water levels varying from approximately 1.0 foot below to 1.8 feet above mean sea level datum occur twice daily as a result of the normal astronomical tide. Water levels of 3 to 4 feet above mean sea level datum, associated with periods of moderately high sustained winds from the northeast, north, and northwest, may occur several times a year. During record hurricane and northeast storms, water levels in the area have been as low as 2 feet below, and as high as 8.0 feet above, mean sea level datum.

Natural Resources

7. Of the many natural resources in Hampton Roads, the most significant and noteworthy is the harbor. This naturally protected, 25-square mile area is formed by a confluence of three tidal rivers -- the James, the Nansemond, and the Elizabeth, as shown on plate B-1. Vessels from ports throughout the world enter the harbor and then travel to docks along two major channels -- one leading to Newport News, Hopewell, Petersburg, and Richmond, and the second leading to Norfolk, Portsmouth, and Chesapeake.

8. Other significant natural resources in Hampton Roads include beach areas along the Atlantic Ocean and Chesapeake Bay, the Dismal Swamp, and numerous estuarine areas. The Dismal Swamp and other forested areas serve as habitat for quail, duck, deer, bear, fox, squirrel, rabbit, muskrat, and other species. The estuarine and tidal waters contain numerous species of fish and shellfish, including the oyster, crab, clam, spot, croaker, flounder, bluefish, and others.

9. Mineral, forest, and water (ground and surface water) resources are abundant. Recent estimates indicated that in excess of 300,000 acres of commercial forest are located within the boundaries of the study area.

RECREATIONAL, HISTORICAL, AND CULTURAL RESOURCES

10. As would normally be expected, many of the recreational resources in the area stem from water-related activities. The beachfront areas along Chesapeake Bay and the Atlantic Ocean are a haven for thousands of natives and tourists during summer months. Inland, along many of the harbor's tributaries, recreational activities such as fishing, crabbing, swimming, and pleasure boating abound.

11. Hampton Roads and its immediate surroundings are endowed with many and varied points of historical and cultural significance. The more notable of these include Yorktown (scene of British surrender) of the Revolutionary War era, Jamestown Festival Park, Colonial Williamsburg, the College of William and Mary, site of the Civil War battle between the Merrimac and the Monitor, and Fort Monroe. Two long-range archeological investigations are active in Hampton Roads; one in Hampton and the other near Colonial Williamsburg. Both investigations are searching for historical items dating to Revolutionary War period of American history. In addition, the area contains 14 entries on the February 1974 "Federal Register -- National Register of Historic Places."

Human Resources

POPULATION CHARACTERISTICS

12. Hampton Roads is the second largest metropolitan area in Virginia. As indicated in the following table, the average annual rate of population growth in Hampton Roads was about 2.9 percent between the years 1950-1970.

Table B-1. POPULATION - HAMPTON ROADS STUDY AREA, 1950 - 1970

Locality	Land area, in sq. mi.	Population 1950	1960	1970
Norfolk	53	213,513	304,869	307,951
Portsmouth	29	80,039	114,773	110,963
Virginia Beach	259	42,227	85,218	172,106
Chesapeake	341	45,799	73,647	89,580
Nansemond (a)	408	25,238	31,366	35,166
Suffolk (a)	2	12,339	12,609	9,858
Newport News	69	82,233	113,662	138,177
Hampton	55	60,994	89,258	120,779
York County	129	11,750	21,583	33,203
Isle of Wight County	319	14,906	17,164	18,285
Total Hampton Roads Metropolitan Area		589,038	864,149	1,036,068
State of Virginia		3,318,680	3,966,949	4,648,494
OBE Economic Area 01022 (Norfolk Region)		838,391	1,056,352	1,198,403
Hampton Roads Area as a percent of OBE Area		70.3%	81.8%	86.5%

(a) Merged to become city of Suffolk, effective 1 January 1974.

Based on projections by the Office of Business Economics, U. S. Department of Commerce, the Hampton Roads Area population will increase from approximately 1,036,000 in 1970 to about 1.6 million by 2030.

13. Table B-1 indicates that in 1970, Hampton Roads accounted for nearly 87 percent of the population of the OBE Economic Area in which it is located. Based on trends exhibited historically and projections for both of these areas, Hampton Roads will most likely continue to hold a substantial share of the population and economic activity of the larger OBE area.

14. The following table summarizes projection estimates of population, employment, and income for OBE Area 22.

Table B-2. POPULATION, EMPLOYMENT, AND INCOME,
OBE ECONOMIC AREA 22
1970 - 2030

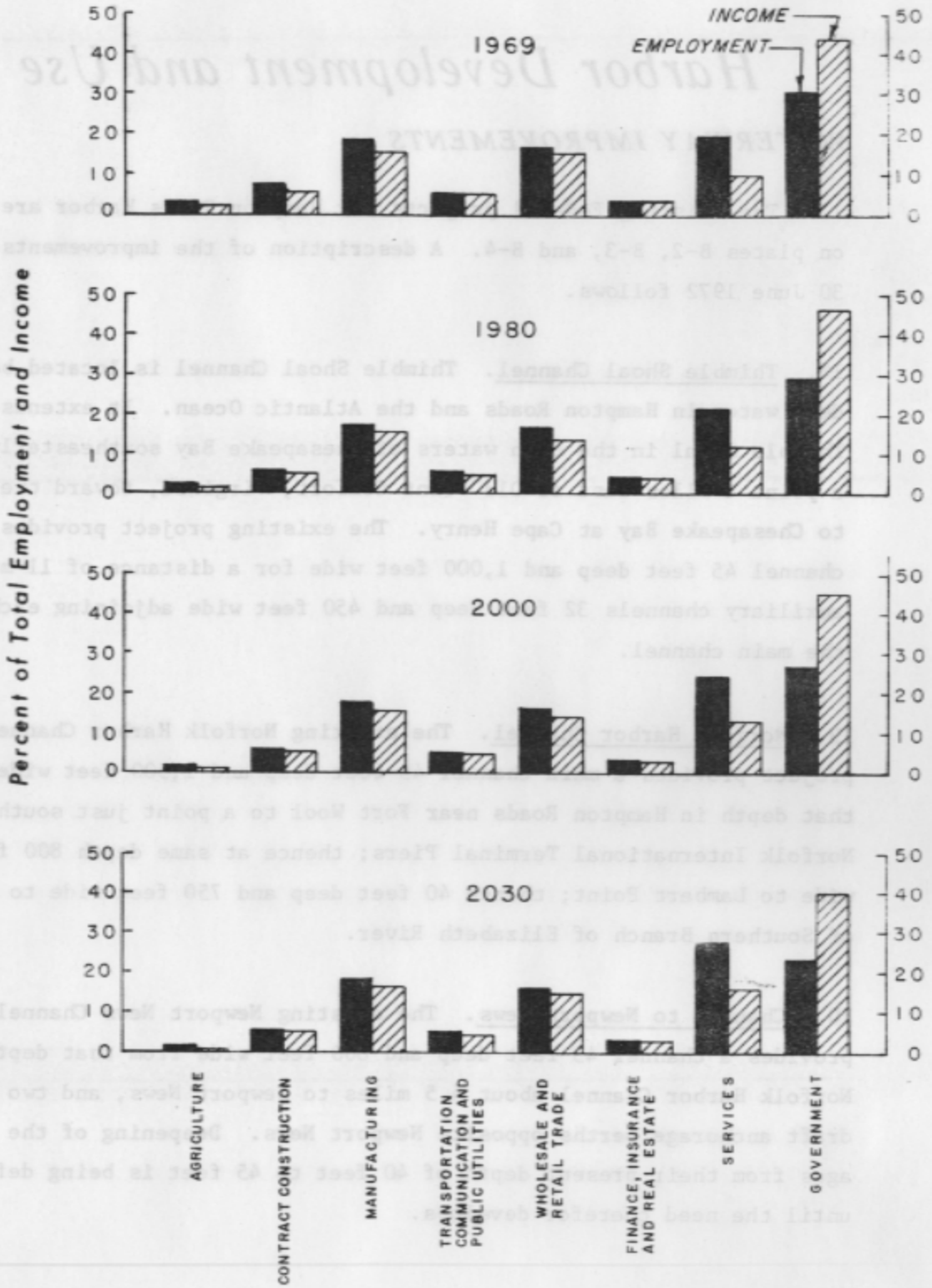
Item	Year						
	1970	1980	1990	2000	2010	2020	2030
Population (1,000's of persons) OBE Economic Area 22 (b) (c)	1,230 (a)	1,330	1,420	1,550	1,670	1,790	1,910
Employment (1,000's of persons) OBE Economic Area 22 (b) (c)	500 (a)	540	580	630	680	720	770
Total Personal Income (Millions of 1967 dollars) OBE Economic Area 22 (b) (c)	3,820	5,590	7,980	11,560	16,440	23,190	32,400
Per Capita Income (1967 dollars) OBE Economic Area 22 (b) (c)	3,100	4,210	5,610	7,460	9,830	12,990	17,200

(a) 1970 census.
(b) 1970 estimates from Office of Business Economics, U. S. Department of Commerce.
(c) 1980-2020 estimates based on OBERS projections, 1972 edition. 2030 estimates based on continuation of trend.

EMPLOYMENT AND SKILLS

15. Most important of the area's basic industries is the Federal Government, primarily made up of military and civilian activities under the jurisdiction of the Fifth Naval District with headquarters in Norfolk. Government activities accounted for about 30 percent of the area's total employment in 1960. This amount is expected to remain stable through 2030.

16. Although local industrial development organizations are attempting to attract industry to the area to provide for a more diversified economic base, projection estimates indicate that the government sector will continue to provide a substantial percentage of total employment and income. The industry showing the greatest increase is services. Total income from services is expected to increase from 9 percent in 1969 to 17 percent in 2030. Employment in services is estimated to grow from 17 percent in 1969 to 30 percent in 2030. Unemployment in the area has been very low in recent years. The unemployment rate in 1950 was less than 6 percent, decreasing to about 3.5 percent in 1960, and slightly more than 2 percent in 1969. Future unemployment rates ranging from 2.5 to 3.0 percent are expected. The following illustration summarizes the estimated percentages of income and employment by industry from 1960 to 2030, in OBE Economic Area 22.



Employment and Income by Industry for Norfolk Region

OBE Economic Area

Harbor Development and Use

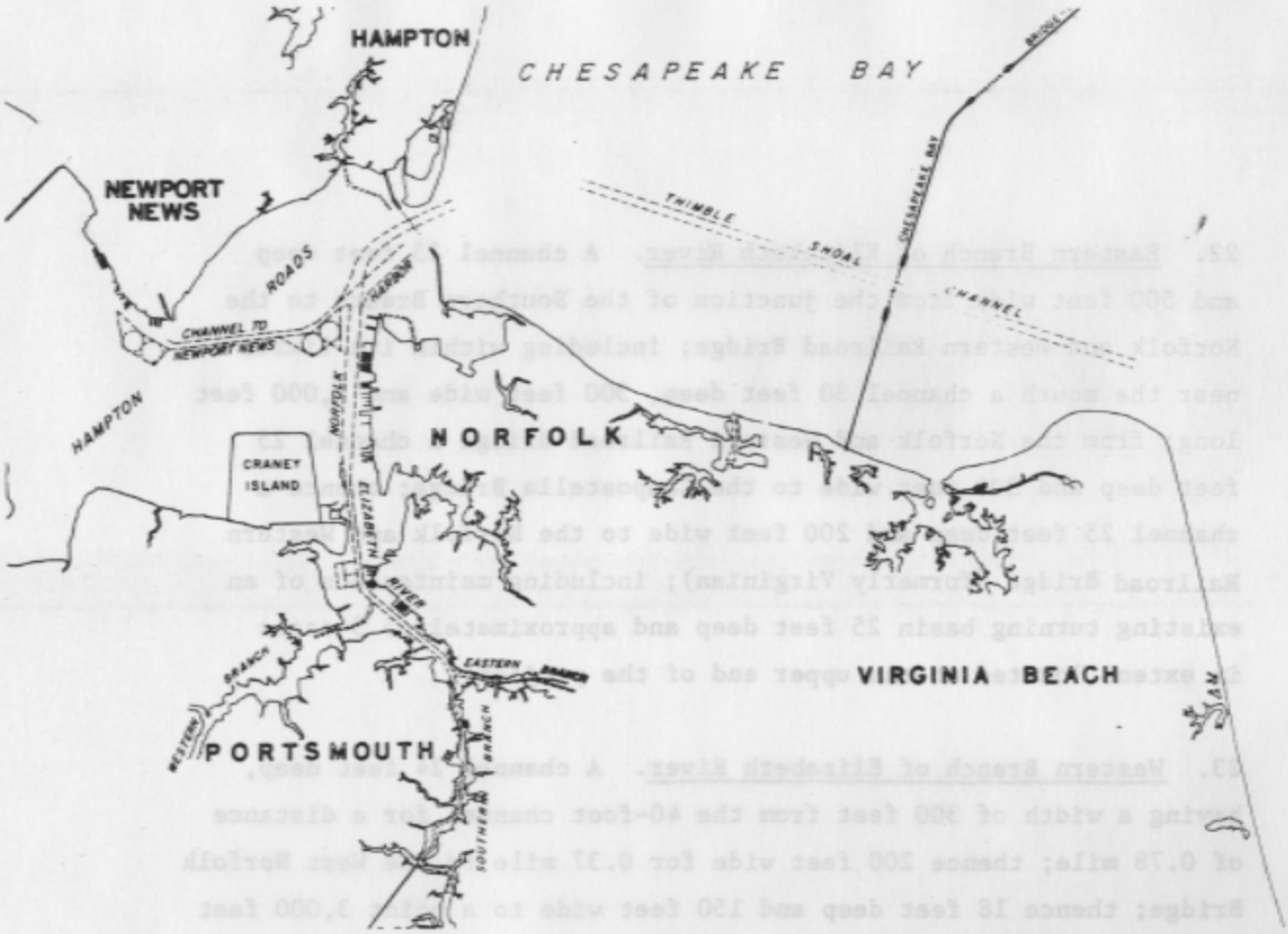
WATERWAY IMPROVEMENTS

17. The existing Federal projects for Hampton Roads Harbor are shown on plates B-2, B-3, and B-4. A description of the improvements as of 30 June 1972 follows.

18. Thimble Shoal Channel. Thimble Shoal Channel is located between deep water in Hampton Roads and the Atlantic Ocean. It extends through Thimble Shoal in the open waters of Chesapeake Bay southeasterly from a point 4 miles east of Old Point Comfort, Virginia, toward the entrance to Chesapeake Bay at Cape Henry. The existing project provides a main channel 45 feet deep and 1,000 feet wide for a distance of 11 miles with auxiliary channels 32 feet deep and 450 feet wide adjoining each side of the main channel.

19. Norfolk Harbor Channel. The existing Norfolk Harbor Channel project provides a main channel 45 feet deep and 1,500 feet wide from that depth in Hampton Roads near Fort Wool to a point just south of Norfolk International Terminal Piers; thence at same depth 800 feet wide to Lambert Point; thence 40 feet deep and 750 feet wide to mouth of Southern Branch of Elizabeth River.

20. Channel to Newport News. The existing Newport News Channel project provides a channel 45 feet deep and 800 feet wide from that depth in Norfolk Harbor Channel about 4.5 miles to Newport News, and two deep-draft anchorage berths opposite Newport News. Deepening of the anchorages from their present depth of 40 feet to 45 feet is being deferred until the need therefor develops.



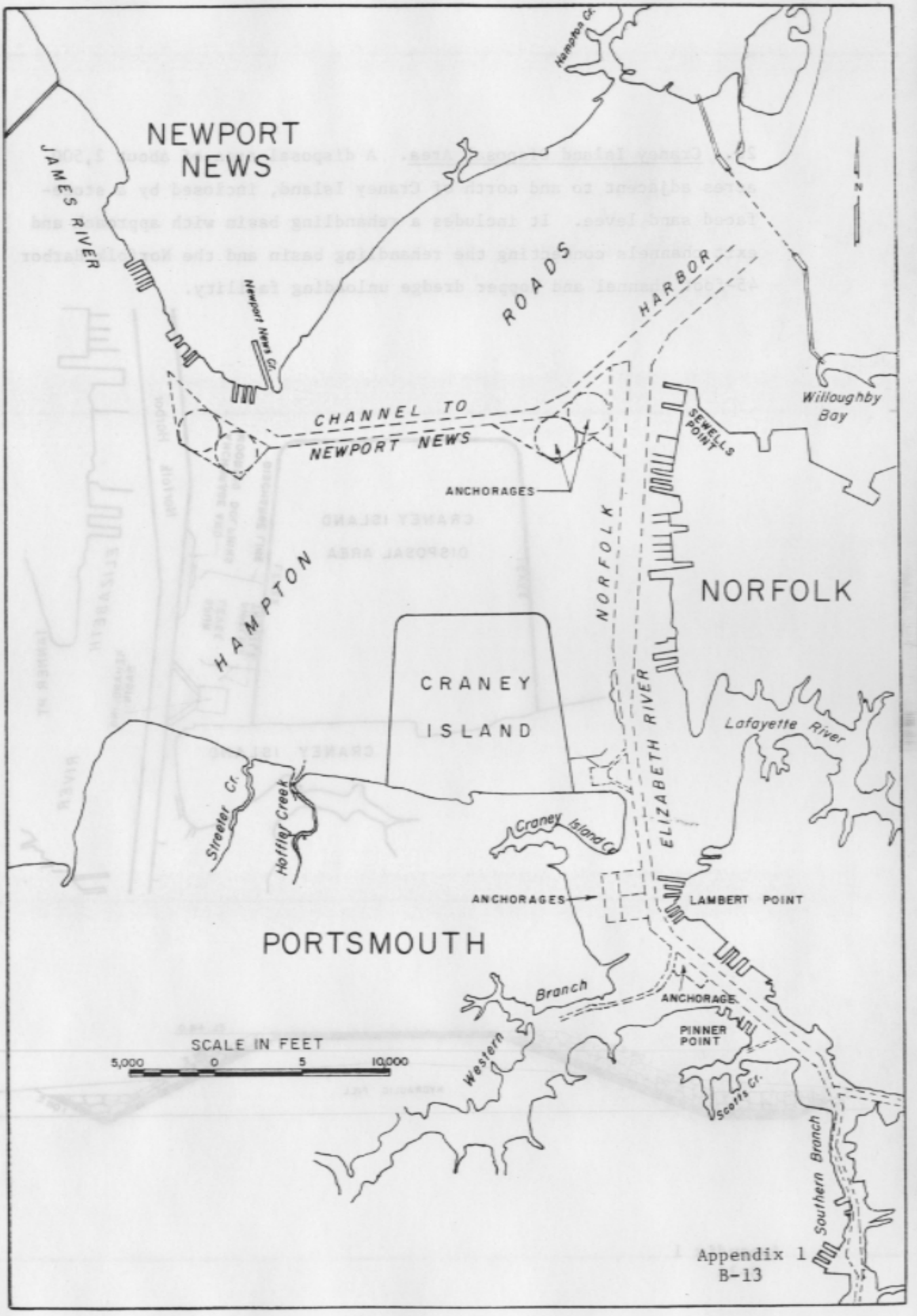
21. Southern Branch of Elizabeth River. A channel 40 feet deep and 450 feet wide from the junction with the Eastern Branch to the Norfolk and Portsmouth Belt Line Railroad Bridge; including an approach and turning area 40 feet deep and with a maximum width of 830 feet opposite Norfolk Naval Shipyard, extending 3,250 feet from Belt Line Railroad Bridge; thence 40 feet deep and 375 feet wide to the Norfolk and Western Railroad Bridge (formerly Virginian); thence 35 feet deep and 250 feet to 500 feet wide to a point 2,500 feet above the Norfolk and Western Railroad Bridge. Project includes an approach and turning area 40 feet deep opposite the Norfolk Naval Shipyard; a turning basin 35 feet deep, 400 feet to 600 feet long, and 800 feet wide at the mouth of St. Julians Creek; and a turning basin at the upstream end of the project 35 feet deep and 600 feet square.

22. Eastern Branch of Elizabeth River. A channel 25 feet deep and 500 feet wide from the junction of the Southern Branch to the Norfolk and Western Railroad Bridge; including within its limits near the mouth a channel 30 feet deep, 300 feet wide and 1,000 feet long; from the Norfolk and Western Railroad Bridge a channel 25 feet deep and 300 feet wide to the Campostella Bridge; thence a channel 25 feet deep and 200 feet wide to the Norfolk and Western Railroad Bridge (formerly Virginian); including maintenance of an existing turning basin 25 feet deep and approximately 5.5 acres in extent located at the upper end of the project.

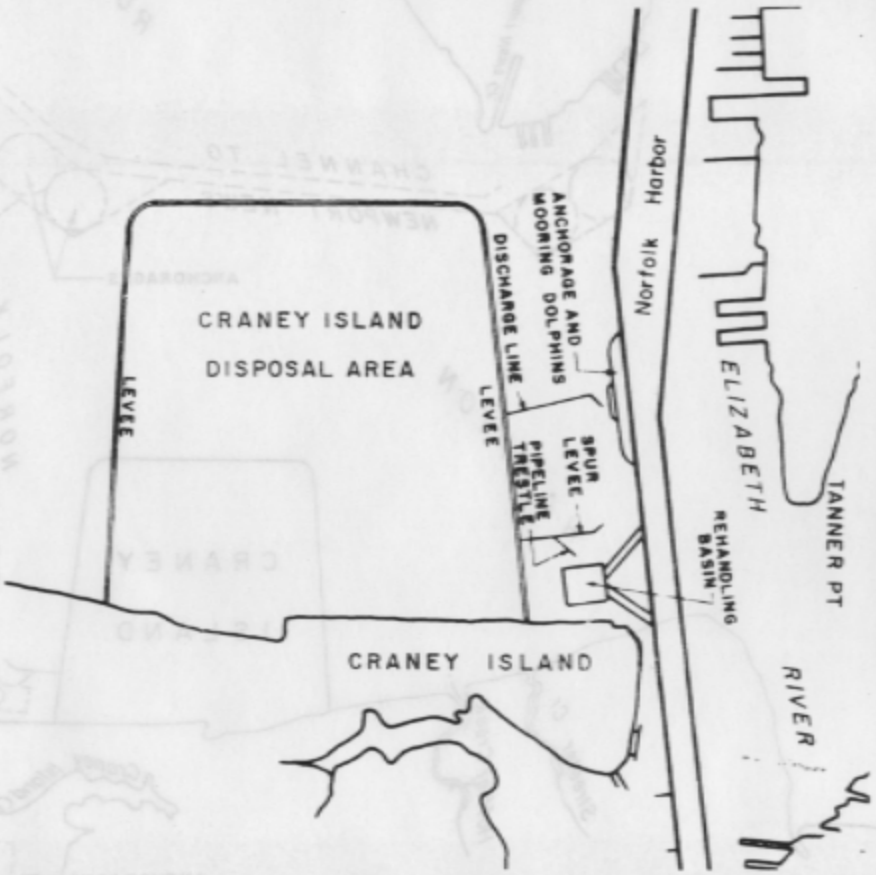
23. Western Branch of Elizabeth River. A channel 24 feet deep, having a width of 300 feet from the 40-foot channel for a distance of 0.78 mile; thence 200 feet wide for 0.37 mile to the West Norfolk Bridge; thence 18 feet deep and 150 feet wide to a point 3,000 feet above the bridge.

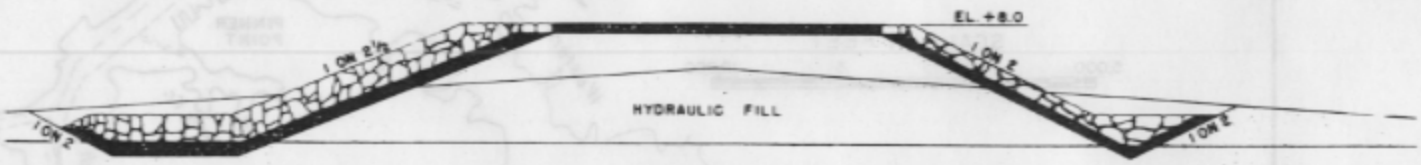
24. Scotts Creek. A channel 12 feet deep at mean low water and 100 feet wide from the 40-foot channel for a distance of 0.73 mile.

25. Anchorages. Two anchorages opposite Sewell Point authorized for a depth of 45 feet deep over a swinging radius of 1,200 feet (the deepening of one anchorage to 45 feet is completed, while deepening of the second anchorage from 40 to 45 feet is being deferred until greater need therefor develops); anchorage area on the west side of the 45-foot channel opposite Lambert Point aggregating 173 acres consisting of one space 1,500 feet square and 38 feet deep, one space 1,500 feet square and 35 feet deep, and one space 3,000 feet long by 1,000 feet wide and 20 feet deep; and a 45-acre anchorage, 12 feet deep, near Pinner Point.


NEWPORT NEWS
JAMES RIVER
Hampton Cr.
Newport News Cr.
ROADS
HARBOR
CHANNEL TO NEWPORT NEWS
ANCHORAGES
SEWELLS POINT
Willoughby Bay
HAMPTON
NORFOLK
NORFOLK
CRANEY ISLAND
ELIZABETH RIVER
Lafayette River
Craney Island Cr.
Craney Island
Sreeler Cr.
Hoffler Creek
ANCHORAGES
LAMBERT POINT
PORTSMOUTH
Western Branch
ANCHORAGE
PINNER POINT
Scotts Cr.
Southern Branch
SCALE IN FEET
5,000 0 5 10,000

26. Craney Island Disposal Area. A disposal area of about 2,500 acres adjacent to and north of Craney Island, inclosed by a stone-faced sand levee. It includes a rehandling basin with approach and exit channels connecting the rehandling basin and the Norfolk Harbor 45-foot channel and hopper dredge unloading facility.





27. Typical deepwater developments in Hampton Roads are pictorially illustrated. All pictures are referenced to mileage limits shown on plates B-3 and B-4.

Norfolk International Terminals (Mi. 5.8)

N. & W. Coal Piers, Lambert Point (Mi. 8.5)

Norfolk Naval Shipyard (Mi. 13. 5)

Industry Along 40 Ft. Channel (Mi. 14. 2)

DOCKS AND TERMINAL FACILITIES

28. The deepwater terminal and transfer facilities located along the existing project channels of the study area, as shown on plates B-3 and B-4, are summarized in the following table.

Table B-3. DEEPWATER TERMINALS IN HAMPTON ROADS (1970)(a)

Location	No. piers	No. berths	No. drydocks - shipways
Elizabeth River	22	66	2
Eastern Branch	13	23	4
Western Branch	-	-	-
Southern Branch	18	34	1
Newport News - Hampton	19	45	9
Nansemond River	-	-	-

(a) Excludes U. S. Navy terminal facilities.

Along 35 Ft. Channel Of Southern Branch (Mi. 17.6)

Newport News Shipbuilding and Dry Dock Company (Mi. 3.5)

Portsmouth Marine Terminal (Mi. 10.5)

TRANSPORTATION FACILITIES

29. The area is served by several major U. S. highways and many primary state highways. The interstate system, nearly completed, includes through Route I-64, and inner-city loops I-264, and I-464. The Hampton Roads Bridge-Tunnel and the Chesapeake Bay Bridge-Tunnel provide highway access across Hampton Roads and the Chesapeake Bay. Another bridge tunnel crossing between the Newport News-Hampton and Portsmouth-Suffolk areas is currently under study. In addition to the interstates, overnight motor freight access to Eastern Seaboard markets is available via U. S. Routes 460, 60, 58, 17, and 13. Second morning service is available from the Hampton Roads area to such distant markets as Boston, Atlanta, Pittsburgh, and Cleveland.

30. Hampton Roads is served by eight rail lines. Together, they provide accessibility to 27 states and two Canadian provinces. Rail service is provided to such northern points as Ontario, Canada, and upstate New York; southward to Miami, Florida and New Orleans, Louisiana; and westward to Omaha, Nebraska and Kansas City, Kansas. More than 65 percent of the total U. S. population lives within the area encompassed by this rail network. The eight railroad companies serving Hampton Roads are:

- Norfolk & Western Railway Company
- Chesapeake & Ohio Railway Company
- Seaboard Coast Line Railroad
- Southern Railway System
- Norfolk Southern Railway Company
- Norfolk, Franklin & Danville Railroad Company
- Penn-Central Transportation Company
- Norfolk & Portsmouth Belt Line Railroad

Areas Accessible by Rail From Hampton Roads

31. Because of the natural geographical division of this area, two major airports are required to accommodate this segment of the transportation industry. The Norfolk Regional Airport provides this service for the cities of Norfolk, Virginia Beach, Portsmouth, and Chesapeake and wide areas extending westerly and to the south. The Patrick Henry Airport on the north side of Hampton Roads provides this service for the cities of Newport News, Hampton, and Williamsburg and the Peninsula area. These two airports are served commercially by National, Alleghany, Piedmont, and United Air Lines. Other small airports in the area are attended during the day, offer charter services, and can accommodate light plane traffic.

32. At the Norfolk Airport, a multimillion dollar expansion program, completed in 1974, includes a new terminal with four times the capacity of the former facility, improved vehicular access, and extended runways. Patrick Henry Airport provides service for the cities of Newport News, Hampton, and Williamsburg and the surrounding Peninsula area. At Patrick Henry the instrument runway was recently lengthened and a terminal expansion program completed, which more than doubled its passenger and freight handling capacity.

WATERWAY COMMERCE

33. The following table shows a breakdown between total commerce in Hampton Roads (1970) and that of the individual segments; those being Elizabeth River, Eastern Branch, Southern Branch, and Channel to Newport News. While there have been fluctuations in the volume of waterborne commerce, reflecting changing economic conditions throughout the world, the overall trend in waterborne commerce for Hampton Roads has been upward. Table B-5 indicates the gradual increase in total commerce from nearly 21 million tons in 1945 to over 71 million tons in 1970. The influence of petroleum and coal exports (principally coal, which rose from nearly 19 million tons in 1945 to slightly over 62 million tons in 1970, has accounted for a substantial portion of the increase.

Norfolk Regional Airport

Table B-4. 1970 WATERBORNE COMMERCE IN HAMPTON ROADS

Item	Commerce (short tons) Elizabeth River (Main)	Southern Branch	Eastern Branch	Western Branch	Port of Newport News	Total
Foreign						
Inbound (Imports)	4,146,358	1,938,920	34,877	—	605,458	6,725,613
Outbound (Exports)	34,068,137	1,421,289	59,303	—	13,906,290	49,455,019
Coastwise						
Receipts	892,519	1,313,610	6,708	—	1,345	2,214,182
Shipments	692,268	35,306	54	—	17,360	744,988
Internal						
Receipts	511,011	1,380,637	1,859,419	—	164,121	3,915,188
Shipments	3,156,474	1,637,281	398,255	—	2,085,198	7,277,208
Local						
Receipts and shipments	324,867	26,581	3,000	—	803,743	1,158,191
TOTAL	43,791,634	7,753,624	2,361,616		17,583,515	71,490,389

SOURCE: Waterborne Commerce Statistics, Corps of Engineers.

Table B-5. COMMERCE BETWEEN 1945 & 1970 - HAMPTON ROADS
(Short Tons)

Class of commodity	1945	1950	1955	1960	1965	1970
Farm and food products	549,670	809,086	1,931,950	2,767,860	3,178,759	2,606,969
Forest, lumber and wood products	127,918	227,079	265,004	327,490	404,226	412,249
Petroleum and coal products	18,646,720	20,850,025	49,489,628	41,709,561	45,336,889	62,277,916
Nonmetallic minerals	6,046	67,691	958,174	965,160	3,039,215	3,820,005
Stone, clay, glass, and concrete products	448,685	1,363,411	1,403,619	1,303,317	213,050	262,552
Chemicals and allied products	390,200	721,206	680,044	539,079	648,664	840,160
Metallic ores and primary metal products	344,113	632,515	1,417,902	2,051,228	828,029	440,876
Manufactured goods and products	55,126	119,862	205,007	181,357	288,369	479,128
Miscellaneous	61,404	142,238	194,586	110,801	168,375	350,534
TOTAL	20,629,882	24,933,113	56,545,914	49,955,853	54,105,576	71,490,389

SOURCE: Waterborne Commerce Statistics, Corps of Engineers.

34. Principal commodities moving over the deepwater channels of Hampton Roads generally fall into the following groupings:

a. Farm and food products.
b. Forest, lumber, and wood products.
c. Petroleum and coal products.
d. Nonmetallic minerals.
e. Stone, clay, glass, and concrete products.
f. Chemicals and allied products.
g. Metallic and primary metal products.
h. Manufactured goods and products.
i. Miscellaneous items.

Commerce for 1970 divided into the above groups is shown in table B-6.

VESSEL TRAFFIC

35. Commercial vessels of the 100,000 deadweight tonnage class with partially loaded drafts approaching 45 feet operate from terminal facilities on the 45-foot projects of Hampton Roads. Other commercial vessels of 35,000 deadweight tons with loaded drafts of 35 feet operate on the existing 35- and 40-foot channels of the harbor. Also, large naval vessels move upstream along the 40-foot channel of the Southern Branch and berth at the Norfolk Naval Shipyard. Table B-7 shows trips and drafts of vessels using Hampton Roads harbors in 1970.

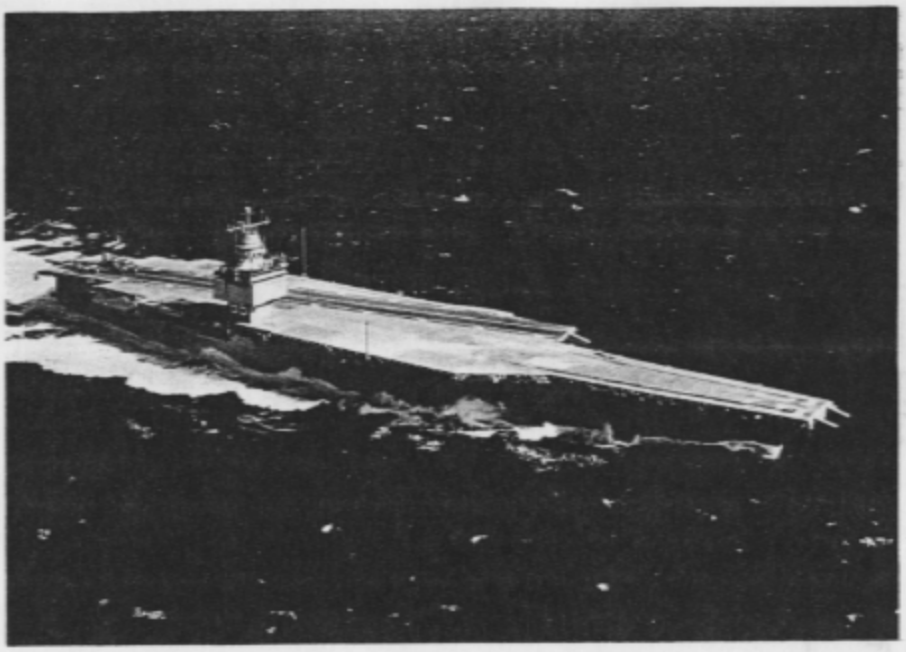
Table B-6. FOREIGN, COASTWISE, INTERNAL AND LOCAL COMMERCE FOR 1970
HAMPTON ROADS
(Short Tons)

Class of Commodity	Foreign		Coastwise		Internal		Local	Total
	Imports	Exports	Receipts	Shipments	Receipts	Shipments		
Farm and food products	236,393	2,009,360	2,739	35,644	272,266	50,015	552	2,606,969
Forest, lumber and wood products	215,487	185,248	2,556	2,564	--	--	6,394	412,249
Petroleum and coal products	4,959,024	46,249,128	1,751,511	694,698	589,320	6,946,291	1,087,944	62,277,016
Nonmetallic minerals	582,132	20,220	277,864	43	2,749,890	189,856	--	3,820,005
Stone, clay, glass, and concrete products	150,338	17,420	94,312	482	--	--	--	262,552
Chemicals and allied products	186,731	377,106	38,328	2,508	222,193	7,613	5,681	840,160
Metallic ores and primary metal products	171,773	220,772	172	160	46,249	1,750	--	440,876
Manufactured goods and products	213,105	188,263	31,044	5,828	2,556	38,172	160	479,128
Miscellaneous	10,630	187,502	15,656	3,061	32,714	43,511	57,460	350,534
TOTAL	6,725,613	49,455,019	2,214,182	744,988	3,915,188	7,277,208	1,158,191	71,490,389

Table B-11. TRIPS AND DRAFTS OF VESSELS IN 1970-
HAMPTON ROADS
(Short Tons)

Draft, in ft.	Inbound						Outbound					
	Self propelled vessels			Non-self propelled vessels			Self propelled vessels			Non-self propelled vessels		
	Passenger and dry cargo	Tanker	Towboat or tugboat	Dry cargo	Tanker	Total	Passenger and dry cargo	Tanker	Towboat or tugboat	Dry cargo	Tanker	Total
47							1					1
46							5	1				6
45							47					47
44							7	1				8
43							13					13
42	1	1				2	24	1				25
41	2	2				4	16					16
40	3	18				21	75	2				77
39	5	21				26	153	11				164
38	15	24				39	152	2				154
37	9	39				48	94	3				97
36	12	18				30	87	4				91
35	15	30				45	86	7				93
34	18	32				50	84	8				92
33	24	32				56	78	4				82
32	47	26				73	164	9				173
31	46	16				62	126	7				133
30	111	27				138	219	21		24		264
29	95	15				110	168	19		1		188
28	178	16				194	237	21				258
27	245	15				260	211	22				233
26	310	21		4		335	278	33				311
25	293	27	1			321	258	31		53		342
24	294	22		5		321	217	47	2	1		267
23	344	15	1	2		362	275	40				315
22	436	13		3		452	262	56		31	1	350
21	377	9			1	387	210	19	1	1		231
20	422	11	2		1	436	253	39	2			294
19	327	16			9	352	195	16	3	71	5	290
18 and less	14,549	1,951	13,084	7,553	4,306	41,443	14,198	1,999	13,035	7,345	4,312	40,889
TOTAL	18,178	2,417	13,088	7,567	4,317	45,567	18,193	2,423	13,043	7,527	4,318	45,504

SOURCE: Waterborne Commerce Statistics, Corps of Engineers



The World's First Nuclear - Powered Aircraft Carrier "Enterprise" Built at Newport News Shipbuilding and Dry Dock Company

36. In recent years there has been an upward trend in the number of large and deep-draft vessels calling in Hampton Roads, as shown in the following table.

Table B-8. TRIPS AND DRAFTS OF VESSELS (INBOUND AND OUTBOUND)- HAMPTON ROADS, 1950-1970 (a)

Draft, feet	Year				
	1950	1955	1960	1965	1970
41 - 45 (b)	-	-	-	11	116
36 - 40	-	-	1	179	583
31 - 35	205	332	701	633	573
26 - 30	945	2,385	1,454	1,066	1,254
20 - 25	1,728	1,972	2,518	2,384	1,799
TOTAL	2,878	4,689	4,674	4,273	4,325

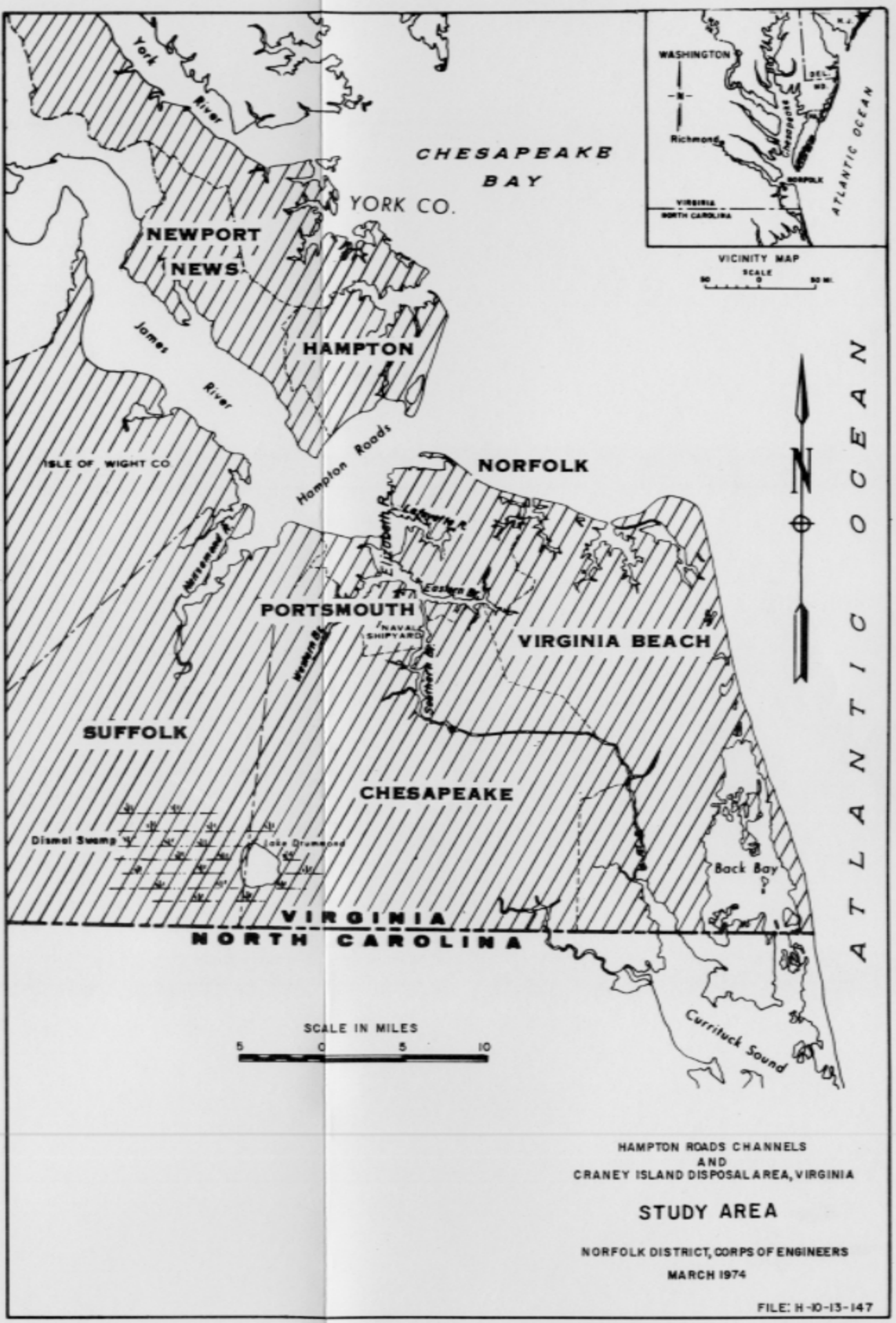
(a) Data exclusive of traffic generated by Federally-owned vessels.

(b) Includes partially loaded vessels whose fully-loaded draft would have been greater than 45 feet.

SOURCE: Waterborne Commerce Statistics, Corps of Engineers.

Maps and Other Descriptive Publications

37. Published maps of the study area include U. S. Coast and Geodetic Survey Charts No. 400 and 452 at a scale of 1:20,000 and Charts No. 529 and 562 at a scale of 1:40,000; U. S. Geological Survey quadrangles -- Norfolk South, Norfolk North, Deep Creek, Fentress, Newport News South, Newport News North, Benns Church, Chuckatuck, Bowers Hill, Suffolk, Kempsville, Little Creek, Poquoson West, and Poquoson East at a scale of 1:24,000; and maps from the various planning entities in the harbor. They show topographic and hydrographic features as well as the general development along deep-draft channels of the harbor. There are significant publications describing the economic potential of the area. Some of these publications were prepared by the Office of Business Economics, U. S. Department of Commerce; State of Virginia, Division of Planning; Southeastern Virginia Planning District Commission; Tidewater Virginia Development Corporation; and National Planning Associates. Many private consultant firms have made economic and development feasibility studies dealing with the general area of the Tidewater Virginia cities.



HAMPTON ROADS CHANNELS
AND
CRANEY ISLAND DISPOSAL AREA, VIRGINIA

STUDY AREA

NORFOLK DISTRICT, CORPS OF ENGINEERS

MARCH 1974

FILE: H-10-13-147

PLATE B-1

BACK RIVER

HAMPTON

INTERSTATE HWY 64

VA HWY 60

Old Pt Comfort

TUNNEL

Ft Wool

HAMPTON ROADS

US HWY 60

WILLOUGHBY BAY

VA HWY 170

VA HWY 337

VA HWY 165

VA HWY 168

VA HWY 169

ELIZABETH RIVER

LAFAYETTE RIVER

N O R F O L K

INTERSTATE HWY 64

LITTLE CR

US HWY 60

US HWY 13

V I R G I N I A

B E A C H

SCALE IN FEET

5,000 0 5 10 15,000

C H E S A P E A K E

THIMBLE SHOAL LT.

UPSTREAM LIMIT OF FEDERAL PROJECT

45 32

45 32

1,000' MAIN CHANNEL

450' AUXILIARY CHANNELS

7.1 MI (W)

5.2 MI (W)

1.8 MI (W)

TUNNEL

US HWY 13

B A Y

32

1,000' MAIN CHANNEL

4.6 MI (E)

45

45

32

LYNNHAVEN ROADS

LYNNHAVEN BAY

BROAD BAY

Cape Henry

US HWY 60

US HWY 13

Fisherman I.

TUNNEL

US HWY 13

A T L A N T I C O C E A N

NOTE: (E), (W) refer to distances East and West of O.

LEGEND:

New work remaining

Project Depths:
Main Channel 45'
Auxiliary Channels 32'

HAMPTON ROADS CHANNELS
AND
CRANEY ISLAND DISPOSAL AREA, VIRGINIA

THIMBLE SHOAL CHANNEL

NORFOLK DISTRICT, CORPS OF ENGINEERS
JUNE 1973

FILE: H-10-13-148

PLATE B-2

AKE

N O R F O L K

C H E S A P E A K E

PTON ROADS

U. S. NAVY

U.S.NAVAL BASE

ELIZABETH

PORTSMOUTH

U.S. HWY. 60

I-64

U.S. HWY 460

VA HWY 168

VA HWY 170

VA HWY 337

VA HWY 166

U.S HWY 58

U.S HWY 13

U.S HWY 17

N&W RY

N&S RY

N&P&L RR

S.C.L. RR

A&D RY

INTERSTATE HWY 264

Willoughby Bay

BROAD CR.

INDIAN RIVER

LAFAYETTE RIVER

PARADISE CR.

ST JULIAN CR

SCOTTS CR

DEEP CREEK

CANAL (ABANDONED)

TURNING BASIN

N&W RY BRIDGE

UPSTREAM LIMIT OF FEDERAL PROJECT 2.5 Mi

CAMPOSTELLA BRIDGE 1.6 Mi

JORDAN BRIDGE VA. HWY 337, 14.2 Mi

BRIDGE 0.4 Mi

N&P&L RR. BRIDGE 1.4 Mi

BERKLEY

SOUTHERN BRANCH

EASTERN BRANCH

WESTERN BRANCH

NORFOLK - CHESAPEAKE

NORFOLK NAVAL SHIPYARD

TUNNEL

FORT NORFOLK RESERVATION

TOLL FREE BRIDGE

UPSTREAM LIMIT OF FEDERAL PROJECT 0.73 Mi

BEGINNING OF ATLANTIC INTRACOASTAL WATERWAY

TANNER PT

SEWELL POINT

LAMBERT POINT

PINNER POINT

PINNER PT. ANCHORAGE

REHANDLING BASIN 7 Mi

CRANEY ISLAND

WEST NORFOLK

ANCHORAGES

ANCHORAGE AND MOORING DOLPHINS

SPUR LEVEE

PIPELINE TRESTLE

DISCHARGE LINE

LEVEE

DISPOSAL

45' ANCHORAGES 1,200' SWING RADII

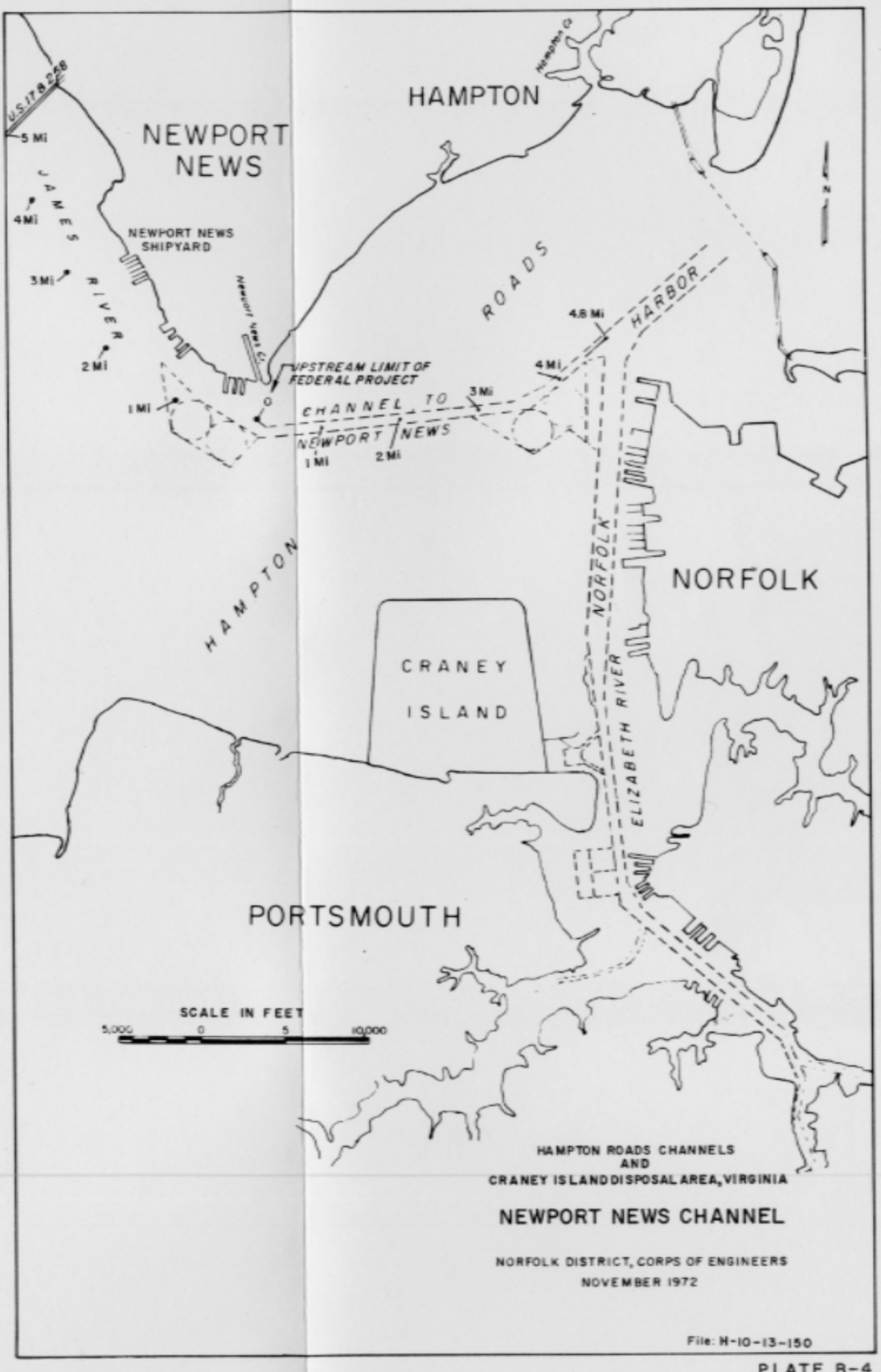
CHANNEL TO NEWPORT NEWS

MIDDLE GROUND LT

UPSTREAM LIMIT OF FEDERAL PROJECT 1.78 Mi

SCALE IN FEET

3,000 0 3 6 9,000



HAMPTON ROADS CHANNELS
AND
CRANEY ISLAND DISPOSAL AREA, VIRGINIA

NEWPORT NEWS CHANNEL

NORFOLK DISTRICT, CORPS OF ENGINEERS
NOVEMBER 1972

File: H-10-13-150

PLATE B-4

SECTION C

PROBLEMS AND NEEDS

PROBLEMS AND NEEDS

LIST OF TABLES

LIST OF PLATES

SECTION C.

PROBLEMS AND NEEDS

1. This section addresses the problems and needs associated with providing for disposal of material dredged from the channels and anchorages in Norfolk Harbor, as well as from surrounding waters. It presents a history of the area's dredging and disposal practices, reflects on experience with the Craney Island Disposal Area, estimates the "future" with respect to quantities of dredged spoil, and presents several problems associated with selecting a replacement for Craney Island.

Existing Conditions

2. Port activities, together with the movement of foreign trade through Hampton Roads, provide an extremely important economic stimulus to the Commonwealth of Virginia, and likely the entire nation. The following information was supplied by the Virginia Port Authority:

> "The Port of Hampton Roads has a substantial economic impact on the economy of the Commonwealth and the immediate port area. It has been calculated that a ton of bulk cargo contributes $5.50 to the economy of the state, while a ton of general cargo adds $25 to the economic base. Applying these factors to the volume of waterborne commerce handled in 1970 through the port, it can be said that a total economic impact of $361.8 million was generated by the Port of Hampton Roads in that year.

"Export coal is the largest commodity handled through the Port of Hampton Roads. In 1970, over 46.2 million tons of coal, valued in excess of $677 million, were exported through the coal loading facilities in the port. For the year 1970, a total of 70.9 million tons of coal was exported from this nation. Approximately 26 percent (18.3 million tons of the 1970 level) of all U. S. coal exports are transported into Canada by either rail or barge for Canadian consumption. Of all U. S. oceanborne coal exports, the channels within the Port of Hampton Roads handled 88 percent of the total."

Deep-draft channels and the natural benefits of size, location, and ocean accessibility have played a major role in developing Hampton Roads, said to be one of the most important harbor complexes in the world.

3. Existing navigation channels, anchorages, and pier facilities in Hampton Roads require periodic maintenance to accommodate the traffic of numerous and diverse merchant vessels. This is borne out in part by reference to table C-1. Between 1964 and 1971, there were 841 trips of commercial vessels in Hampton Roads which had loaded drafts 40 feet or greater. During this period, there has been an increase in the frequency of movement of larger vessels. For example, in 1967, 4 vessels operated in the port with a loaded draft of 45 feet or greater. In 1971, 71 vessels were so operating, 41 of these with a loaded draft of 46 feet. This is accomplished (that is moving a vessel which draws more depth than the authorized project dimension) by loading the vessel and awaiting the maximum high tide condition. Under the most favorable navigation conditions, the loaded vessels are able to move with an extremely small clearance under the keel. To this type operation, continued maintenance of the authorized channel dimensions is vital. The Navy too has a continuing need for maintenance of existing channel to facilitate operation of its aircraft carriers and other large vessels. Currently, the Navy is operating in the harbor with carriers and large petroleum, ammunition, and supply (AOE) ships which had fully loaded drafts of 38 and 41 feet, respectively.

Table C-1. TRIPS OF VESSELS WITH LOADED DRAFTS IN EXCESS OF 40 FEET (a)(b)(c)

Draft, ft	Year											
	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
48	-	-	-	-	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-	-	-
46	-	-	-	-	-	-	-	-	1	-	7	41
45	-	-	-	-	-	-	-	4	14	24	47	32
44	-	-	-	-	-	-	-	12	6	13	8	7
43	-	-	-	-	-	-	2	9	8	10	13	9
42	-	-	-	-	-	1	3	15	17	18	27	16
41	-	-	-	-	4	12	15	17	15	19	20	9
40	-	2	-	1	4	21	27	30	59	57	98	70
TOTAL	0	2	-	1	8	34	47	87	120	141	220	184

(a) Exclusive of Federally-owned vessels.
(b) Norfolk Harbor Channel; Channel to Newport News.
(c) Inbound and outbound.

SOURCE: Waterborne Commerce Statistics.

4. The necessity of continued maintenance dredging is of such magnitude that it is creating the real and pressing problem of diminishing disposal capacity at the Craney Island Disposal Area. The need is basic -- to provide a means for future disposal of dredged material.

The Need For Dredging

HISTORY

5. Prior to any improvement in Norfolk Harbor, there were shoals in Elizabeth River opposite Sewell Point over which the controlling depth was 21 feet. A bar existed at the mouth of the Eastern Branch over which was a depth of 15 feet. The Southern Branch had a narrow channel with controlling depths of 18 feet, 1-1/2 miles above the Norfolk and Portsmouth Belt Line Railroad Bridge, and of 12 feet for an additional 3 miles upstream to the Norfolk and Western Railway Bridge. The Western Branch had a controlling depth of 12 feet up to 1 mile above its mouth. The Channel to Newport News, in its unimproved state, had a controlling depth of 25 feet.

6. Like most coastal ports in the nation, increased vessel traffic generated by the growth of foreign and domestic commerce has created demands for improvement of the harbors' major navigable channels. The earliest navigation improvements in Hampton Roads consisted of approach and egress channels to waterfront facilities. The work was undertaken by private interests. The first Federal project for systematic improvement of Norfolk Harbor was adopted by Congress in 1876. That project provided for a channel 10 miles long, 500 feet wide, and 25 feet deep from that depth in Hampton Roads to the junction of the Eastern and Southern Branches; dredging through the bar at the mouth of the Eastern

Branch; deepening and widening of the channel at the mouth of the Southern Branch; and an additional anchorage in front of Berkley and Portsmouth. Between 1876 and 1907, this original project for Norfolk Harbor was modified eight times by River and Harbor Acts.

7. Since these early days of harbor improvement, local port interests (governmental and private), have frequently petitioned the Congress for assistance to keep improvement of the harbor abreast of economic development in the area. The Congress has favorably acted to provide for the progressive deepening and widening of navigation channels within Hampton Roads.

8. The existing project, authorized by the River and Harbor Act of 27 October 1965, provides for a main channel depth of 45 feet from that depth in Hampton Roads to the major port facilities and terminals of both Norfolk and Newport News.

9. The recent trend toward use of deeper draft coal-carrying vessels with greater cargo capacities has prompted local interests to once again seek Congressional assistance. As a result, the Chief of Engineers was directed by Congress to determine the need for modification of channel dimensions and anchorages. The study, under direction of the District Engineer at Norfolk, has been completed. The study considers deepening of the major channels from 45 to 55 feet and deepening of several anchorage areas.

TYPES OF DREDGING

10. All dredging considered in this report may be classified as either new work or maintenance work. "New work" is that dredging which will increase the official project depth of a navigation improvement.

"Maintenance dredging" pertains to the removal of sediment and other products of accretion from these navigation improvements so as to maintain the authorized project depth.

TYPES OF DREDGING PLANTS

11. Dredging in Hampton Roads is carried out by three basic types of dredging plants. These are (1) the hopper dredge, (2) the hydraulic pipeline dredge, and (3) the bucket dredge. Each dredging system has its distinctive operational characteristics. Which is selected depends on the type of material to be dredged, location of disposal areas, weather and sea conditions, and vessel traffic patterns within the harbor.

12. Over the years, most of the maintenance and new work dredging of the Channel to Newport News and the Norfolk Harbor Channel has been accomplished by Federally-owned hopper dredges. In the last 20 years, increasingly large quantities of material have been dredged by hydraulic pipeline dredges. Most of this work has taken place when hopper dredges would have been more costly to operate, such as while dredging anchorage areas or accomplishing new work in main channels having nearby disposal sites. Jobs involving small quantities of dredging or working in relatively constructed areas continue to be accomplished by bucket dredge.

The Need For Spoil Disposal

HISTORY OF DISPOSAL

13. In the 1870's the "Common Council" of Norfolk requested that material excavated from the harbor channels be used to fill up the low grounds within the city. Hampton Roads at that time was experiencing rapid postwar growth; few, if any, worried about possible environmental problems associated with spoil disposal. In actuality, the quantities of material dredged from Hampton Roads' ports and deposited on certain of Norfolk's downtown waterfront parcels were relatively small. Open-water disposal was commonly practiced during those years when sites such as Craney Island Flats and Tanner's Creek (now the Lafayette River) were considered suitable for that purpose.

14. By the turn of the century, the Federal Government was dredging millions of cubic yards in Hampton Roads instead of thousands, using the "Ripraps" dumping ground, so called because of its proximity to Fort Wool (or the Ripraps - see plate C-1). The dumping area extended between 1 and 3 miles east of Fort Wool, between the crest of Willoughby Shoal and the Willoughby shore. Although alternate value of the disposal area was regarded as practically useless, complaints regarding its use did arise. Some people alleged that the dumped material was being washed into and shoaling some of the dredged channels in the vicinity, that it was interfering with fishing, and that it was injuring Willoughby Beach as a recreation area. Nonetheless, use of the Ripraps area as a dumping ground continued until about 1913, when the capacity of the area was approached. Consideration was then given to a new area. The site was the island originally called Craney Island, which, although owned by the former War Department, was being used as a quarantine area by the cities of Norfolk and Portsmouth. The island was the point of disembarkation for immigrants arriving in Hampton Roads.

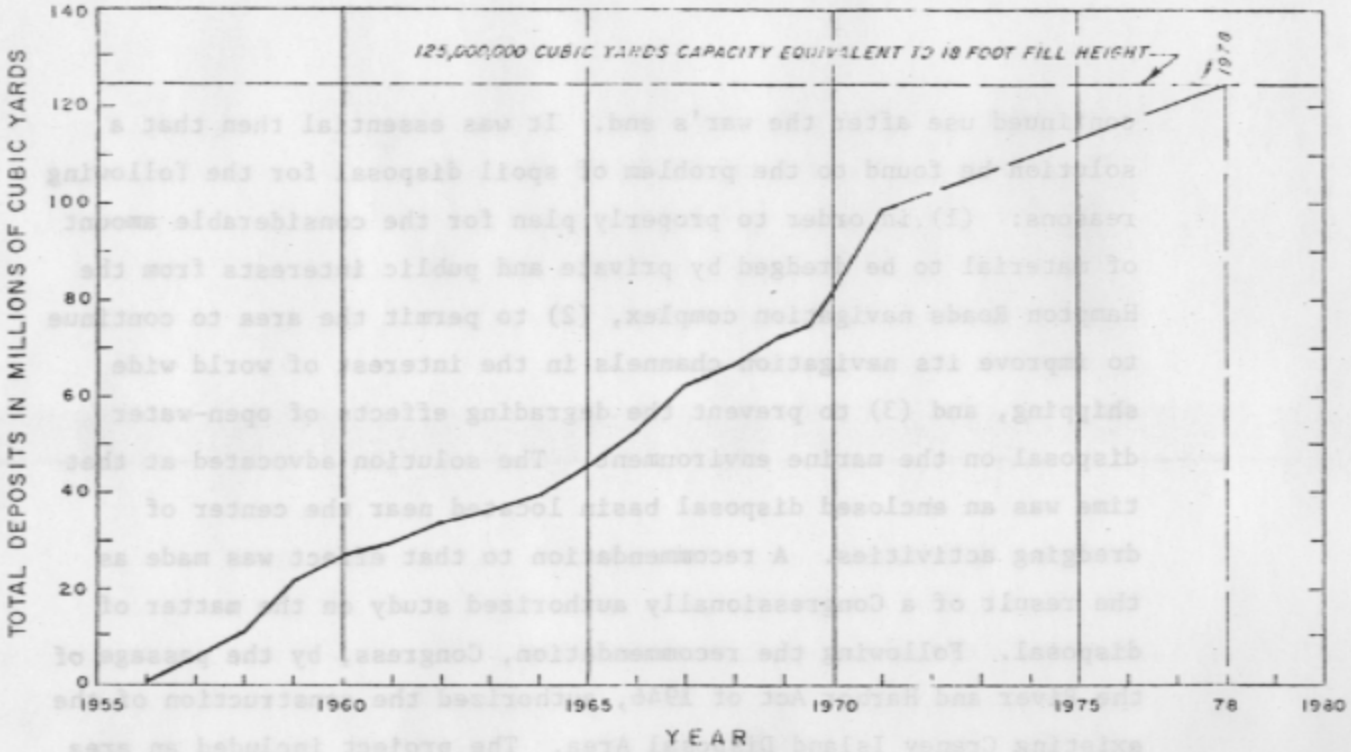
15. It was reasoned that by placing a bulkhead some distance from shore, but still not in water exceeding a depth of about 6 feet, a large repository for dredged material could be provided. Craney Island was in fact bulkheaded some years later by the Navy Department and over the years, until about 1939, large quantities of dredged material were placed on and immediately around the island by pipeline dredge. Today, Craney Island no longer exists as an actual island. It has been joined to the mainland by filling in the dividing waters. The site comprises a portion of the southern boundary for the current Craney Island Disposal Area.

16. The Lynnhaven Dumping Ground was established in 1918 for the use of hopper dredges and scows. This disposal area was used regularly until 1940 when amphibious training activities and emergency restrictions forced curtailment of disposal there. At the time its use was discontinued, the Lynnhaven dump had reached its capacity for hopper dredge dumping; then deposits were made for a time in deeper waters adjacent to the dumping ground as well as north and south of Thimble Shoal Channel.

17. During 1941-1942, a disposal area used briefly was established in the lower James River just above Newport News. However, depositing of material was discontinued because of adverse effects on adjacent navigable waters.

18. During World War II, when entrance to Hampton Roads was restricted by submarine nets, a wartime disposal area was established within the harbor 1.5 miles west of Fort Wool. This area of deep water had also been used prior to the establishment of the Lynnhaven dumping area. It was apparent in 1945, after a few years of dumping, that the capacity and retaining characteristics of the area would not permit

continued use after the war's end. It was essential then that a solution be found to the problem of spoil disposal for the following reasons: (1) in order to properly plan for the considerable amount of material to be dredged by private and public interests from the Hampton Roads navigation complex, (2) to permit the area to continue to improve its navigation channels in the interest of world wide shipping, and (3) to prevent the degrading effects of open-water disposal on the marine environment. The solution advocated at that time was an enclosed disposal basin located near the center of dredging activities. A recommendation to that effect was made as the result of a Congressionally authorized study on the matter of disposal. Following the recommendation, Congress, by the passage of the River and Harbor Act of 1946, authorized the construction of the existing Craney Island Disposal Area. The project included an area two miles long and two miles wide, adjacent to the waters of Hampton Roads, entirely enclosed by stone-faced levees. It contained about 2,500 acres and included the necessary appurtenant structures for the deposit of spoil material by all types of large and small dredges -- the hopper dredge, the hydraulic dredge, and the bucket dredge. The facility was completed in 1957, and has been in constant use since. By the time the Craney Island Disposal Area is completely filled, which by current projections will be about 1979, it will contain some 125 million cubic yards of spoil. The following curve illustrates how Craney Island has been cumulatively filled since the completion of construction.



CRANEY ISLAND DISPOSAL AREA

19. Thus, since 1957, Federal, state, and local interests have been unencumbered with the problem of disposal of dredged material in Hampton Roads. The methods of dredging within Hampton Roads depend to a great extent upon the favorable location of Craney Island Disposal Area. Although some dredged material has been disposed of by hydraulic placement either behind bulkheaded shoreland, or on adjacent lowlands, the vast majority of all such material has been placed in the Federal disposal area.

CRANEY ISLAND - IN RETROSPECT

20. The use of Craney Island Disposal Area has demonstrated that such a facility can be operated in the heart of a major port complex with

minimal disturbance to the surrounding community. For example, there are several communities of higher value residences in the immediate areas surrounding Craney Island. More homes are under construction or planned. To date, there have been no known complaints concerning vessel congestion brought about by disposal operations at the site. Its convenient location has facilitated a savings in transportation costs of dredged material over the alternative method of ocean disposal. When completed, Craney Island will have circumvented open-water dumping of 125 million cubic yards of polluted dredged material. On the other hand, there have been problems associated with the Craney Island facility. In itself, the facility is an environmental intrusion, but it has helped relieve potentially damaging environmental problems that have been associated with open-water disposal. Model tests at the Waterways Experiment Station have shown the facility to be hydrodynamically unsound in shape. However, when the disposal area was built the science of modeling was somewhat in its infancy. Today, the results of model tests can be used to determine a better shape for a large disposal area, one which will avoid the adverse effects of adjacent shoreline accretion, as has been a problem with the existing facility. About four square miles of open space in the harbor have been filled in with the corresponding loss of associated marine life, recreational potential of the area, and the natural vista. Conversely, the ultimate filling will create some 2,500 acres of vacant land that lies within the heart of a large and rapidly developing metropolitan area. Assuming that this "created" land is suitable for development, its location and potential for development are certainly factors to recognize as possible mitigating benefits for the aforementioned losses.

Future Dredging and Disposal Needs in Hampton Roads

21. The primary concern of this report deals with maintenance dredging -- the whys and hows relating to its continuance. Like the 1945 report which led to authorization of the present Craney Island Disposal Area, this study and report seeks a location for disposal which is safe, convenient, and economically acceptable. Unlike the earlier solution, alternatives for the future disposal area will be subjected to a detailed analysis of its environmental and social features, before a final selection is made.

22. As indicated in previous discussion, the channels and other navigation features in Hampton Roads must be maintained if the area's nationally vital commercial and defense functions are to continue. Such maintenance includes the dredging required by the Navy and private interests, as well as by the Corps of Engineers. The expected future dredging requirements for the area were sought in a review of dredging records in Hampton Roads. As a result, the following quantity estimates were developed:

a. Estimated future deposition into Craney Island Disposal Area as a result of channel and anchorage maintenance.

b. Estimated additional deposition that may result from further deepening of channels and anchorages in the harbors of Hampton Roads, and additional maintenance resulting therefrom.

c. Estimated deposition that may result from future permit dredging of slips and piers, dredging that may be accomplished by the Commonwealth of Virginia, and dredging accomplished by private interests.

23. In the following paragraphs the term "place measure" refers to the sum of the credited and excess yardages dredged. "Credited yardage" is the pay yardage and equals the inplace volume of material removed from within the project prism as determined from before and after dredging surveys. It includes the allowable overdepth dredging. Excess yardage is the nonpay yardage and equals the inplace volume of material removed from outside of the project prism as determined by before and after surveys.

24. The term "bin measure" is the volume in cubic yards that is excavated and hauled by a hopper dredge. It is determined from bin soundings and capacity tables established for each bin.

FUTURE DEPOSITION FROM NORFOLK HARBOR CHANNEL AND ANCHORAGES

25. A review of the historical maintenance requirements of Norfolk Harbor Channel was made to determine the expected future deposition into Craney Island or its alternative. Based on dredging history, the trend has been a steady increase in annual maintenance due primarily to the progressive deepening and widening of the channel.

26. In Fiscal Year 1924, the 40-foot deep, 750-foot wide project was completed. The annual maintenance requirements for the period 1925 through 1950 was 1,200,000 cubic yards annually based on bin measurement. This is approximately 1,000,000 cubic yards a year place measure. Average maintenance for the period 1951 through 1960 was 1,130,000 cubic yards, place measure. In Fiscal Year 1960, the 40-foot deep, 1,500-foot wide project was completed. This widening brought about a large increase in the annual maintenance requirements. A portion of the channel was

later deepened to 45 feet. The following table shows the annual maintenance of Norfolk Harbor Channel for the period 1961 through 1970. The average maintenance is about 1,840,000 cubic yards annually, place measure. This estimate reflects the required maintenance for the Norfolk Harbor Channel to its current depths of 45 and 40 feet.

27. Periodic dredging will be required to maintain project depths in the two anchorages (C and D) off Sewell Point. Since no maintenance history exists for these anchorages, the estimated maintenance was determined from bottom surveys and past experience with shoaling rates in the area. An estimated 173,000 cubic yards will be removed from Anchorages C and D to maintain their current dimensions of 45 and 40 feet. Anchorage "D," which is currently 40 feet, has been authorized for deepening to 45 feet.

Table C-2. MAINTENANCE DREDGING IN NORFOLK HARBOR CHANNEL

Fiscal year	Quantity, in cubic yards place measure
1961	665,431
1962	1,258,330
1963	2,047,380
1964	1,591,630
1965	2,618,550
1966	2,333,940
1967	1,197,650
1968	2,293,612
1969	2,202,920
1970	2,142,680
Total	18,352,323
Average (1961-1970)	1,835,230
Rounded	1,840,000 (a)

(a) This estimate includes maintenance of navy maneuvering area, which amounts to approximately 150,000 cubic yards per year.

FUTURE DEPOSITION FROM NEWPORT NEWS CHANNEL AND ANCHORAGES

28. The following table presents, by fiscal year, a summary of the maintenance history of the Channel to Newport News.

a. In Fiscal Year 1931, the 40-foot deep, 600-foot wide project was completed. Average annual maintenance for the fiscal period 1932 through 1945 was 34,000 cubic yards, bin measure.

b. In Fiscal Year 1969, the 45-foot deep, 800-foot wide project was completed. Average annual maintenance for the fiscal period 1946 through 1970 was 53,000 cubic yards, place measure.

Table C-3. MAINTENANCE DREDGING OF NEWPORT NEWS CHANNEL, 1932 THRU 1970

Fiscal year	Quantity, in cubic yards			
	Credited	Excess	Total Place measure	Bin
1970	114,350	74,260	180,610	-
			370,690	-
1963	527,663	239,220	766,893	-
1945	-	-	-	308,302
1943	-	-	-	163,572
1932	-	-	-	5,520

29. The Channel to Newport News will require additional maintenance dredging due to the increased project dimensions noted above. Based upon recent surveys in the area and the experience with recent maintenance in this channel, the 45-foot channel is expected to require 127,000 cubic yards of additional maintenance annually.

30. Periodic dredging will be required to maintain project depths in the two new anchorages (A and B) at Newport News. Since no maintenance history exists for these anchorages, the estimated maintenance was determined from bottom surveys in the area and past experience with shoaling rates. An estimated 25,000 cubic yards will be removed from Anchorages A and B to maintain their current dimensions of 40 feet. Both anchorages have been authorized for deepening to 45 feet.

31. Future annual maintenance in the Channel to Newport News and adjacent anchorages will require the removal and deposition of an estimated 205,000 cubic yards, place measure.

FUTURE DEPOSITION FROM NORFOLK NAVAL SHIPYARD

32. Dredgings from the Norfolk Naval Shipyard turning basin deposited into Craney Island Disposal Area, as extracted from records of the Corps of Engineers, has been as follows:

Table C-4. MAINTENANCE AT NORFOLK NAVAL SHIPYARD

Fiscal year	Quantity, in cubic yards, place measure
1970	71,200
1968	72,000
1965	107,900
Total	251,100
Average (1965-1970)	42,000

Future deposition from dredging at Norfolk Naval Shipyard is estimated to be 42,000 cubic yards annually.

FUTURE DEPOSITION FROM REHANDLING BASIN

33. Local interests and private sources will continue to request permission to deposit spoil into the rehandling basin from maintenance of their facilities. The program has proven to be well worthwhile. Deposition into Craney Island Disposal Area from the rehandling basin, as extracted from office records, follows:

Table C-5. MAINTENANCE OF REHANDLING BASIN

Fiscal year	Quantity, in cubic yards, place measure
1970	800,407
1967	532,198
1966	500,000
1965	1,207,756
1963	795,559
1962	-
1959	940,351
Total	4,776,271
Average (1957-1970)	341,000

It is estimated that deposition from the rehandling basin will average 341,000 cubic yards annually.

FUTURE DEPOSITION FROM PERMIT DREDGING

34. All permit dredging where disposal was accomplished by direct deposition into Craney Island, i.e., not rehandling, is included here. Dredging by permit has included the Naval Base piers, Norfolk and Western Railroad piers, Norfolk Port and Industrial Authority, and others. Permit dredging is summarized in the following table:

Table C-6. MAINTENANCE BY PERMIT

Fiscal year	Quantity, in cubic yards, place measure
1970	1,561,474
1969	1,106,027
1968	2,111,530
1967	1,425,660
1966	642,775
1965	1,167,819
1964	877,703
1963	615,843
1962	358,700
1961	2,330,468
Total	12,197,999
Average (1961-1970)	1,219,800

In the future, permit dredging is estimated to produce an estimated 1,220,000 cubic yards of material annually.

FUTURE DEPOSITION FROM THIMBLE SHOAL CHANNEL

35. The following summary is the maintenance dredging history of the Thimble Shoal Channel.

a. In Fiscal Year 1929, the 40-foot deep, 750-foot wide project was completed. Average annual maintenance for the fiscal period 1930 through 1956 was 410,000 cubic yards, bin measure. This includes the high maintenance of World War II years.

b. In Fiscal Year 1957, the 40-foot deep, 1,000-foot wide project was completed. Average annual maintenance for the fiscal period 1959 through 1965 was 302,000 cubic yards, place measure.

c. In Fiscal Year 1970, the 45-foot deep, 1,000-foot wide project was completed.

36. The Thimble Shoal Channel will require additional maintenance dredging resulting from the increased project depth noted above. An annual increase of 9,400 cubic yards, place measure, as estimated in Review Report on Channel to Newport News, Norfolk Harbor, and Thimble Shoal Channel, 1 March 1965, has been used. Thus, the future annual maintenance for Thimble Shoal is estimated to be 311,400 cubic yards, place measure.

37. The material in Thimble Shoal Channel is suitable for disposal at sea, when tested according to applicable criteria of the Environmental Protection Agency. It is assumed that all material to be removed from this channel will continue to be deposited at sea and not require confined disposal.

SUMMARY OF FUTURE DEPOSITION

38. The anticipated future deposition into Craney Island Disposal Area, and its replacement, based upon the information of the foregoing paragraphs, is shown in the following table. Note that the quantities indicated are those to be generated by normal maintenance dredging, such as is presently being accomplished. New deepening projects in the Port of Hampton Roads would cause an increase in this estimate. The estimate for future dredging, which takes into account estimated quantities based on maintenance of present and foreseeable channel dimensions is presented in later paragraphs.

Table C-7. FUTURE DEPOSITION FROM MAINTENANCE OF THE EXISTING PROJECT AND OTHER SOURCES

Item	Quantity, in cubic yards, place measure (1,000 c.y.)
Norfolk Harbor Channel	1,840.0 (a)
Norfolk Harbor Anchorages (C and D) (b)	173.0
Newport News Channel	180.0
Anchorages adjacent to Newport News (A and B) (c)	25.5
Naval Shipyard	42.0
Craney Island Rehandling Basin	341.0
Permit Activities	1,220.0
Total	3,821.5
Thimble Shoal Channel	311.4

(a) Maintenance of Norfolk Harbor Channel to current dimensions of 45 and 40 feet.
(b) Authorized for deepening from 40 to 45-foot depth by River and Harbor Act of 27 Oct 65. Deepening of Area "D" deferred.
(c) Authorized for deepening from 40 to 45-foot depth by River and Harbor Act of 27 Oct 65. Deepening thereof has been deferred.

FUTURE DEPOSITION FROM ADDITIONAL DEEPENING

39. The study for Norfolk Harbor and Channels considers the deepening of five channel segments in the Port of Hampton Roads. These are (1) Thimble Shoal Channel from 45 to 55 feet, (2) a new channel named the Atlantic Ocean Channel to 55 feet, (3) Norfolk Harbor Channel from 45 to 55 feet, (4) Channel to Newport News from 45 to 55 feet, and (5) the 35-foot

channel in the Southern Branch of Elizabeth River from 35 to 40 feet. The study also identifies the need for deepening six anchorage areas in the harbor. The quantities of "new work" dredging which would be generated by the deepening of these channels and anchorages is summarized in table C-8. Except for the material to be dredged from the Thimble Shoal and Atlantic Ocean Channels, all other would require confined disposal in a Craney Island-type facility.

40. Provision of the dimensions indicated for channels and anchorages would necessitate an increase in the amount of average annual maintenance. This increase is reflected in a comparison of table C-7 with table C-9 which follows.

Table C-8. FUTURE DEPOSITION FROM CONSIDERED NEW WORK

Item	Existing dimension	Considered dimension	Quantity of material, (1,000,000 c.y.)
Norfolk Harbor Channel	45' deep x 1500' wide (a)	55' deep x 1500' wide	30.6
Channel to Newport News	45' deep x 800' wide	55' deep x 800' wide	11.2
Anchorage A	40' deep x 1200' wide (b)	45' deep x 1200' wide (c)	1.7
Anchorage B	40' deep x 1200' wide	45' deep x 1200' wide (c)	1.7
Anchorage C	45' deep x 1200' wide	55' deep x 1400' wide	5.4
Anchorage D	40' deep x 1200' wide	50' deep x 1400' wide (d)	6.2
Anchorage E	-	45' deep x 1400' wide (d)	9.3
Anchorage F	-	35' deep x 1400' wide (d)	8.4
Anchorage G	-	35' deep x 1400' wide (d)	-
Anchorage H	-	35' deep x 1400' wide (d)	4.1
Southern Branch	35' deep x 250-500' wide	40' deep x 250-500' wide	2.6
Total			81.2
Thimble Shoal	45' deep x 1000' wide	55' deep x 1000' wide	35.6
Atlantic Ocean	-	55' deep x 1000' wide	8.2
Total			43.8 (f)

(a) Channel dimensions given: 1st item is channel depth, 2nd item is channel bottom width.
(b) Anchorage dimensions: 1st item is depth, 2nd item is swinging radius.
(c) Authorized by River and Harbor Act of 27 Oct 65. Deepening has been deferred.
(d) Proposed new anchorage areas.
(e) Area is naturally deep and would require no dredging to provide indicated depth.
(f) To be deposited at sea. Material in Atlantic Ocean Channel is similar in quality to that in Thimble Shoal Channel.

Table C-9. ANTICIPATED FUTURE ANNUAL DEPOSITION FROM MAINTENANCE OF PROPOSED PROJECT AND NORMAL SOURCES

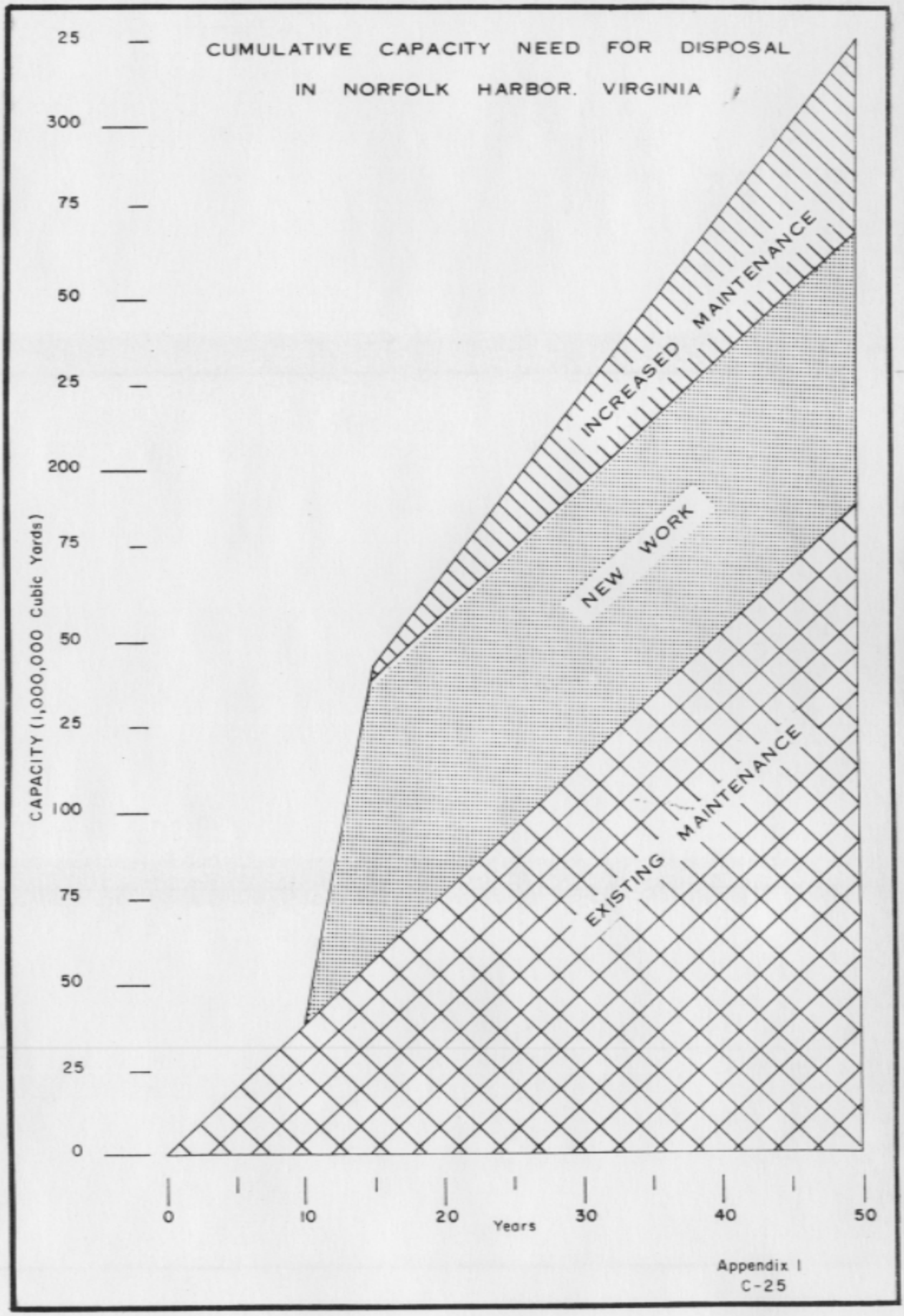
Item	Quantity, in cubic yards, place measure (1,000 c.y.)
Norfolk Harbor Channel	2,390
Newport News Channel	255
Anchorage A	66
Anchorage B	66
Anchorage C	250
Anchorage D	100
Anchorage E	110
Anchorage F	160
Anchorage G	-
Anchorage H	30
Upper Southern Branch	162 (a)
Permit Activities	1,220
Craney Island Rehandling Basin	341
Norfolk Naval Shipyard	42
Total	5,192
Thimble Shoal Channel	600
Atlantic Ocean Channel	130

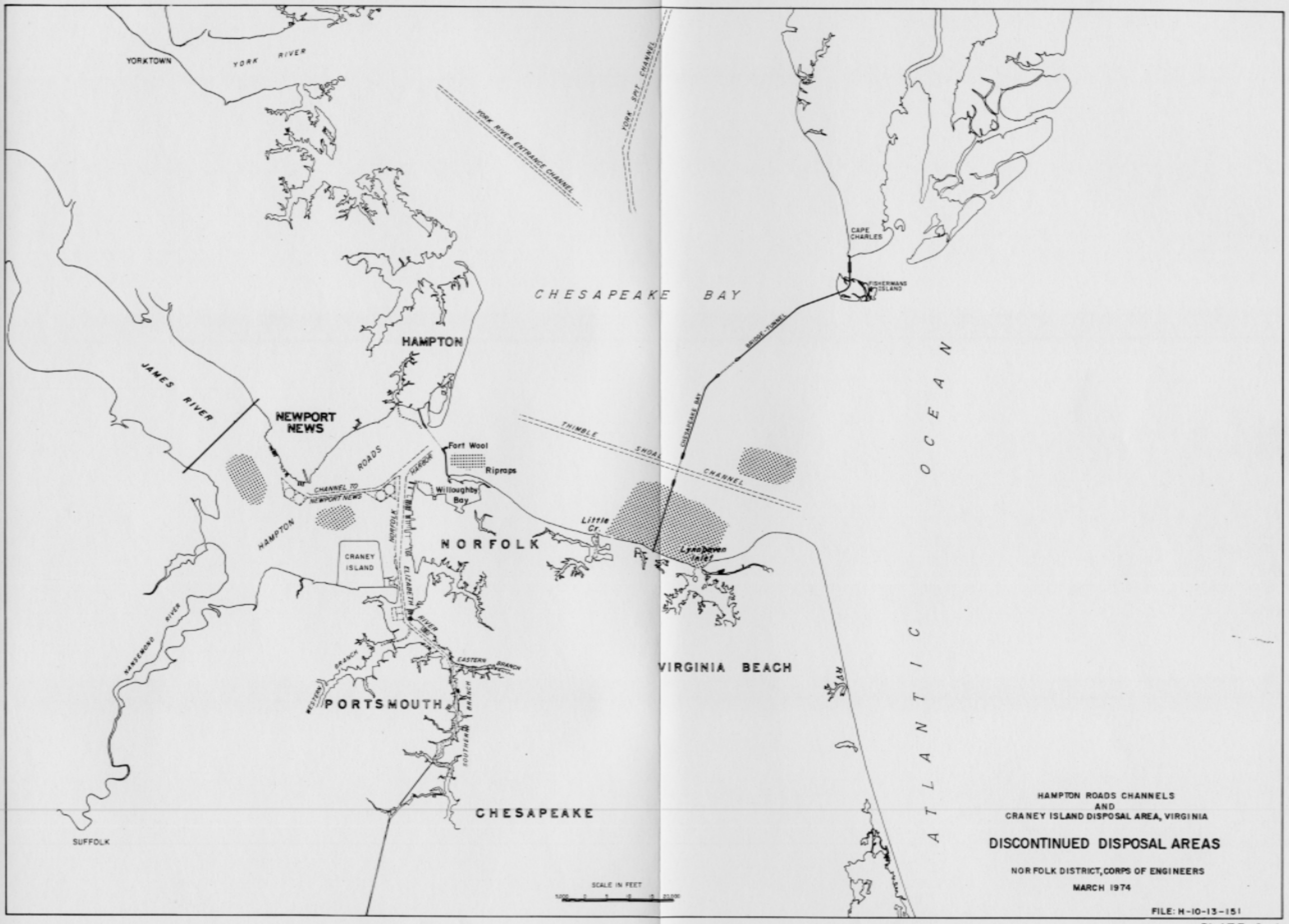
(a) Present maintenance of the Southern Branch Channel is disposed of in landside areas. It is assumed that future disposal for dredging here would be in the replacement to Craney Island.

41. In summary, normal maintenance and permit dredging activities in the Port of Hampton Roads are generating some 3.8 million cubic yards of dredge material. Since 1957, this material has been deposited in the Craney Island Disposal Area. At this rate of filling, the Craney

Island Area will be filled in 1979. Testing indicates that much of the current material is polluted according to standards of the an Environmental Protection Agency; thus, it is not fit for ocean disposal. According to local port interests, maintenance of authorized dimensions is critical to the economic well-being of the area. Such maintenance cannot be continued beyond 1979, however, unless an acceptable replacement for the current disposal area is found. Over a period of 50 years the total capacity of an area to accommodate 3.8 million cubic yards of annual maintenance dredging would be 190,000,000 cubic yards.

42. New work dredging which is foreseeable for the Port of Hampton Roads would generate the need for additional disposal capacity, over that previously mentioned. As indicated in table C-8, 81,200,000 cubic yards of material, most of which is polluted according to current regulations of the Environmental Protection Agency, would require confined disposal. Lastly, the deepened channels and anchorages would require maintenance and generate additional material over the current rate of removal. This increase would amount to approximately 1.4 million cubic yards annually. However, it is estimated that this increased need for maintenance would not be realized for at least 10 years. Thus, over a 40-year period, the increase in maintenance would generate some 56,000,000 cubic yards of material. The following illustration indicates the quantities of material to be disposed and the expected time frame over which the disposal would be accomplished. The chart illustrates that the total disposal capacity needed for a replacement of Craney Island is 38,000,000 cubic yards for the first 10 years, and 289,000,000 cubic yards for the remaining 40 years. A total capacity of 327,000,000 is needed to accommodate present and foreseeable quantities of dredged material removed from the harbor in Hampton Roads.


CUMULATIVE CAPACITY NEED FOR DISPOSAL
IN NORFOLK HARBOR, VIRGINIA
INCREASED MAINTENANCE
NEW WORK
EXISTING MAINTENANCE
CAPACITY (1,000,000 Cubic Yards)
25
300
75
50
25
200
75
50
25
100
75
50
25
0
0
10
20
30
40
50
Years



HAMPTON ROADS CHANNELS
AND
CRANEY ISLAND DISPOSAL AREA, VIRGINIA

DISCONTINUED DISPOSAL AREAS

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 1974

FILE: H-10-13-151

PLATE C-1

SECTION D

FORMULATING A PLAN

FORMULATING A PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

LIST OF TABLES

LIST OF TABLES (cont'd)

LIST OF PLATES

SECTION D.

FORMULATING A PLAN

1. The plan formulation phase of the study involved exploration of seventeen basic alternatives for future disposal of dredged material in Hampton Roads. The following paragraphs in this section present the broad planning objectives by which each of these alternatives were weighed, and the technical, economic, environmental, and social criteria used in the formulation process. Near the end of the section, discussion is presented which analyzes the reasons for selection of the recommended plan.

Planning Objectives

2. The following planning objectives were utilized throughout the formulation process. In the broadest sense, they are the basis for selection of the plan to be recommended.

- Provide a solution to the disposal of dredged material from operation and maintenance of channels and anchorages in the Hampton Roads area authorized and constructed by the Federal Government.

- Provide a solution to the disposal of dredged material from new channel and anchorage improvements currently under consideration by the Corps of Engineers as Federal projects.

- Provide a solution to the disposal of dredged material from dredging by other Federal agencies, and from non-Federal and private dredging.

- Provide a capacity for the three categories of dredging mentioned previously over a 50-year period commencing at the time of completion of the existing Craney Island Disposal Area.

- Minimize the destruction of bottomlands, wetlands, coastal zones, and marine wildlife resources in the Hampton Roads area.

Formulation and Evaluation Criteria

3. It was recognized early in the formulation process that the above broad objectives were not adequate measures or standards by which each alternative could be screened. Accordingly, a detailed set of formulation criteria, consistent with the needs of the study area and with current policy, was developed. This facilitated the screening of all alternatives according to technical, economic, environmental, and social considerations. More importantly, application of the criteria permitted the development and selection of a plan which best responds to stated problems and needs, and to the planning objectives.

4. The technical, economic, and environmental characterics of a theoretically ideal system for disposal of dredged material in Hampton Roads can be identified as follows:

- The system should be capable of handling all types of material normally dredged in Hampton Roads, e.g., silt, sand, shell, and mixtures of these.

- The system should accommodate large and small input loads without undue sacrifice of effectiveness. It should be capable of accommodating unanticipated new work without appreciable disruption. The system should be capable of handling the estimated 3.8 million

cubic yards of material to be dredged yearly through maintenance activities, and in addition, to accommodate a gradual increase or decrease in the maintenance dredging requirement.

- The system should function effectively regardless of weather conditions.

- The entire system should withstand disruption as a result of damage to part of the system. It should be a product of proven elements and practices, and be resilient under emergency or catastrophic conditions.

- The system should be capable of serving or utilizing all types of dredging equipment, including hopper dredges, hydraulic pipeline dredges, and mechanical (bucket) dredges. It should permit simultaneous operation of several types of dredges.

- If onshore or offshore levees are considered, they must be sized sufficient to withstand storm tides and wave action.

- The size and shape of any disposal area should optimize the relationships between capacity (useful life), economy, and future use of the area.

- The disposal plan should have an expected useful life of 50 years.

- The system should adapt to the needs of the users and general public as much as possible.

- The system should be publicly acceptable.

- The system should be open to and promote the stimulation of progress in terms of process or method evolution.

- The system should exhibit potential side benefits such as salvage or land reclamation.

- The system should have minimal adverse effects on existing marine and/or terrestrial life.

- The system should function effectively without polluting water, air, or land.

- The system should meet existing public health and environmental control standards.

- As nearly as possible, the system should be nuisance-free with respect to noise, dust, odor, and unsightliness.

- The system should be safe with respect to occupational hygiene and to operations, for both the people involved and the public served.

- The system should be aesthetically pleasing to the public which has to support and live with it.

- The system should not displace, devaluate, or destroy important historic and cultural landmarks or sites.

- The system should minimize the commitment of natural resources, whether they be marine bottomlands, wetlands, other coastal zones, inland environments, or wildlife in these areas.

- The useful life of the system should be maximized for a given commitment of natural resources.

- The selected plan should take into account the properties and capabilities of dredging methods as they relate to disposal of spoil and to construction of retaining levees.

- The plan or system should be consistent with present and future local, regional, state, and national needs for port and industrial growth.

- The system should be capable of being integrated into local or regional plans for solid waste management, water and air pollution abatement, transportation, recreation, and land use.

- The system should be economically competitive in respect to:

  . . . the total cost including investment, operations, maintenance, and replacement.

  . . . a rapid cutback in costs if the load is reduced, whether temporarily or permanently.

  . . . the overall economic impact on the surrounding area.

In addition to these, other criteria could certainly have been developed. However, the production of an exhaustive list in this regard, was not an intent of the initial formulation efforts.

5. The degree to which a plan for disposal of dredged material met the foregoing criteria was taken as a measure of its relative merit. Clearly, no system of disposal could have met all these criteria fully.

However, the evaluation, selection, and development of alternatives emphasized optimization in terms of the respective cost-performance and environmental parameters, and consideration of social impacts.

Possible Solutions

6. There are a number of solutions to the problem of spoil disposal. These include (1) reducing, by various means, the amount of material actually dredged, (2) dredging and disposing of the material by conventional methods such as open-water dumping or confinement within diked disposal areas similar to the existing Craney Island, (3) dredging and disposing of the materials by nonconventional methods such as recycling the spoil back to the land (where it came from originally), (4) using the material to fill and reclaim swampy, pitted, mined, or otherwise scarred and marginally useful land, and (5) using the material in commercial applications.

7. Under existing circumstances, it is not feasible to stop dredging in Hampton Roads. Even with development of an offshore terminal facility to serve Hampton Roads ports, the existing channels would be needed by vessels engaged in hauling general cargo or any commodity not efficiently handled by offshore facilities. The maintenance of present channel dimensions is also required for the continued operation of large naval vessels. As previously discussed, annual maintenance dredging requirements for the major channels of Hampton Roads and for other Federal, state, and private interests is estimated to be 3.8 million cubic yards.

8. It might be possible to reduce the required dredging by effecting some reduction in the rate at which these channels shoal. By preventing sediment from entering the estuary through upstream riverbank stabilization and erosion control measures, the sediment load of the estuaries joining in Hampton Roads might be reduced, thereby affecting the dredging requirement as well. Sediment causing shoals in Hampton Roads originates partially from upstream sources. Some observations indicate that sizeable portions of the sediment dredged from Norfolk Harbor Channel originate as urban runoff from the surrounding cities. However, there is little confirmed information concerning the source of the shoal material or the mechanism of its transport and deposit, and many unknowns regarding physical and economic features of this solution.

9. Regardless of implications in the above discussion, the authorized channel dimensions in Hampton Roads and the channels to private docks must be maintained to serve the continuing needs of commerce and defense in Hampton Roads; consequently, the current maintenance dredging program must be continued. The dredging itself, to be efficient, must not be of a type that will permit eventual return of the dredged material to the channel. Neither agitation dredging (where material is stirred up, resuspended, and hopefully carried away by stream or tidal currents) nor side-cast dredging (explained in section C) provides for positive and permanent removal of sediment. These two types of dredging are not considered to be effective methods of removal. In addition, they cause previously precipitated pollutants to be resuspended and reintroduced into the marine environment.

10. As explained in section C, conventional types of sediment removal considered appropriate for use in Hampton Roads, are hopper dredging, hydraulic pipeline dredging, and mechanical dredging. Open-water

disposal, in conjunction with these dredging methods, and in approved locations, has been practiced for many years, and is presently being carried out where there is no consequent environmental disparagement, or where beneficial results may be obtained. Such is the case with the disposal of material dredged from Thimble Shoal Channel. The disposal of this nonpolluted material is not known to have had significant adverse effects on the near-shore environment of the ocean. The two open-water disposal areas presently approved for disposal of this material are shown on plate D-1. One site is about 20 miles out to sea beyond Cape Henry. The other, Dam Neck, is closer to the channel. This area permits disposal at a reduced cost, and any of the sand deposited there, if carried shoreward, would likely nourish the beach.

11. The material dredged from Thimble Shoal Channel during maintenance work is taken to sea and deposited in the open-water areas discussed above. Therefore, it is not included in estimates of future yearly maintenance dredging quantities to be placed in Craney Island Disposal Area.

12. The brief history of disposal operations presented in section C of this report included all sites where open-water dumping has been practiced in the past by the Corps of Engineers. In general, all such areas were selected so as to be as close to the dredging sites as possible, and to have sufficient depth to preclude interference with or obstruction to navigation. In all open-water disposal, the use of areas which have proven to have poor retention characteristics has been discontinued.

13. Results of large-scale dumping of polluted dredged material are difficult to quantify. Nevertheless, this results in an important potential hazard. The environmental risk associated with such a disposal alternative must be reconciled.

14. With regard to pollution, a better solution to the spoil disposal problem is an enclosed disposal site such as the existing Craney Island Disposal Area.

15. Such a disposal area, with spillways or sluices to control effluent density, provides for a more positive retention of material. For convenience, enclosed disposal areas may be classified as harborside areas, inland areas, and offshore areas. A harborside area would include any shoreline site similar to the existing Craney Island Disposal Area, whether fast land, water, or both to begin with. A harbor location offers both protection from storms and high seas as well as economy in construction and operation.

16. Offshore areas are more vulnerable to storm and hurricane damage. They are very expensive to build because of the distance men and materials must be transported to the site, the adverse working conditions at the site, and the high cost of deepwater construction. Such areas can be built to have large capacities. In general, they do not have the adverse social and recreational effects which usually accompany harborside sites.

17. With present technology, it is both feasible and practical to move large quantities of dredged material great distances by pipeline. Such an operation, in effect, would allow removal of the main disposal area from a highly developed port area to a more remote inland area. To explore this method further, it would be possible to empty existing disposal areas by transferring the material elsewhere; thus recreating the disposal capacity of existing sites for future use. But, the problem remains one of locating a suitable depository for the transferred spoil.

18. There has always been a problem of what to do with dredged material. The general solution has been to consider it a form of waste, and to dispose of it by the most economical method. There have been many instances of creating or reclaiming island or shoreline land by using dredged material. In a few cases material from disposal areas has been used for construction fill. But for the most part, these occurrences have been the by-products instead of the planned results of disposal activity. Dredged material is referred to as "spoil" and thought of as a form of waste that must somehow be "disposed of." The "waste" approach represents a negative, or at best, a neutral attitude toward what is, by any terms, a resource. Dredged material could be viewed as a resource, not as a waste product. The benefits from the resource point of view might become more apparent if definitive, beneficial uses were well known and feasible both from an economic and environmental standpoint. Some examples of possible uses are given below. But, there are some serious drawbacks -- high salinity content of dredged material, the lack of uniform composition of material, the initial saturation by water, and the problem of handling and spreading the material. Perhaps the paramount consideration is the vast quantity of material to be disposed of annually -- 3.8 million cubic yards excluding any new work. The potentially beneficial uses of dredged material could be one or more of the following:

- Agricultural fill.
- Construction fill.
- Lowland reclamation.
- Topsoil fill.
- Creation of marshland.

- Rehabilitation of blighted areas, e.g.,
  strip mines,
  eroded areas,
  borrow pits,
  gravel pits.

- Creation of hills or islands for
  aesthetics,
  recreation,
  residential, industrial, or commercial development,
  offshore marine terminal development.

- Buttressing of existing sand dunes.

- Sanitary land fill cover.

- Ceramics (bricks).

Alternative Plans Considered

19. The following paragraphs describe the alternative plans considered for disposal of dredged material. None of the alternatives meets all stated selection criteria. No plan can reasonably be expected to do so.

EXISTING DISPOSAL AREA AT CRANEY ISLAND

20. The feasibility of alternatives described in succeeding paragraphs relies on the use that is made of the existing disposal facilities. In

order that these alternatives may be better understood and related to the present disposal method, a full description of the existing Craney Island Disposal Area is offered.

21. Construction of the Craney Island Fill Area began in August 1954. Prior efforts involved site analysis, engineering studies and specifications, contractual arrangements, and funding. It was found that the waters 4,000 feet west of the Norfolk Harbor Deepwater Channel, site of the planned fill area, varied in depth from the shoreline to a maximum of 12 feet. The harbor bottom was composed of sand from the shore to a point some 3,000 feet north of the existing Craney Island. At this location, the bottom composition changed to marine clay with depths up to 100 feet thick.

22. The soft marine clay required the utilization of special construction techniques in the early phases of construction. The base of the levee was built up with sand pumped from a hydraulic dredge. The hydraulic sand fill was constructed up to a height of 3.5 feet m.s.l. and had a slope of 1 on 15 down to 3.5 feet below m.s.l. Beyond this point the slope was reduced to 1 on 30 all the way to the natural bottom. The flat slope was needed to spread the weight of the levee over a wide area of the very unstable harbor bottom. To successfully achieve the desired results, the contractor had to develop a floating swing-discharge line in order to spread the dredged material evenly over the wide area required to obtain a 1 on 30 slope.

23. The procedure which was utilized called for the construction of the west levee first, followed by the construction of the north levee. With the west and north levees in place, a basin was created, protected from the James River currents, into which dredged material could be pumped while awaiting the completion of the main levees.

The east levee was the last completed, and only after much difficulty, with final closure due to the action of the tide. Closure took place on 8 January 1957.

24. Meanwhile the main levees were constructed by a crane with a clamshell rig which followed behind the advancing swing-discharge pipeline cutting a trench on either side of the fill, depositing the material in the middle of the levee. Thus, the levee was built to its design height of 6.5 feet above mean sea level. The two side trenches formed the toes for the protective stone riprap which was placed on the slopes. Stones used for the riprap ranged in size from 250 to 1,200 pounds. Finally, when the center section of the levee was stabilized, a bituminous, 22-foot wide roadway was placed around the entire fill area.

25. As indicated earlier, some material was being deposited before the enclosure was completed; however, it was not until mid-1957 that substantial amounts of spoil were being pumped behind the completed levees. The procedure for pumping dredged material called for operation to begin at the east and north sides and build to the west. Besides being convenient to those utilizing the fill area, it also ensured that any escaping silts would flow away from the deepwater channels. Three sluiceways were constructed in the west levee to allow the water within the diked area to flow out as fill was pumped directly into the disposal area; a rehandling basin was placed east of the east levee. Here, bucket-and-scow dredging operations deposited their material, which was then pumped behind the levees. This was first done by an old hopper dredge stripped of everything but its pumps and moored permanently in position to act as a depository for materials gathered by hopper dredges working in

the harbor. In 1963, this procedure ceased and hopper dredges, with new and larger pumps, pumped directly into the disposal area through a special mooring barge which provides the transition connections to a submerged pipeline.

26. Prior to construction, extensive tests were made of the harbor bottom. It was determined that there would be a consolidation of the marine clay bed under the weight of the levee and that settlement of up to 7.5 feet could be expected. To this date, the actual settlement which has taken place is not uniform. The most that has occurred in any one year and in any one place totalled 2.8 feet; at some specific places, total settlement did reach the projected 7.5 feet. Any changes which occurred in the design height of the main levee were corrected by project maintenance forces. Most of this consolidation took place during the first seven years of the life of the main levee. Since 1964, the amount of compaction has ceased and the levees have remained practically stable.

27. As material is continually pumped behind the levees, consolidation will be a factor in the inside portion of the fill area. At the time of original design, it was estimated that ultimate capacity would be in the vicinity of 100,000,000 cubic yards. Due to compaction of the underlying marine clay bed, this figure has been periodically upgraded. It is now believed that the fill area, when brought to design specifications, will hold approximately 125,000,000 cubic yards of material. As of March 1972, approximately 100,000,000 cubic yards had been deposited. Based on current projections, the area will be completely filled by 1979.

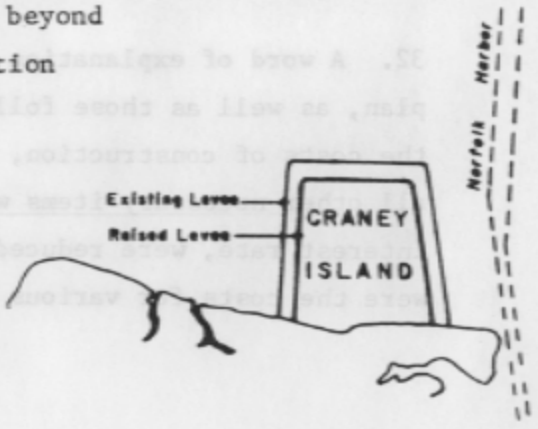
28. When completed and stabilized, Craney Island will have the following configuration:

Shape:	Trapezoidal - offshore dimension east-west. 9,000 feet, inshore dimension east-west. 11,000 feet, north-south projection 11,100 feet.
Area:	2,546 acres ±.
Elevation:	Main levee (+7 feet above m.s.l.) Step levee (+17 feet above m.s.l.) (Step levee approximately 100 feet inside main levee).
Material:	Marine clay. Shells. Silt. Sand.

Plate D-1 shows the location of the existing Craney Island Disposal Area.

PLAN A. RAISING EXISTING LEVEES

29. This plan would involve an increase in elevation of levees at the existing disposal area, thereby increasing the area's capacity and prolonging its useful life. The design height of the existing step levees at Craney Island Disposal Area is 17.0 feet m.s.l. By continuing fill operations beyond the present design height to an elevation of 29.0 feet m.s.l., that is, by raising the existing levees an additional 12 feet, the capacity would be increased by about 42 million cubic yards, and the useful life by about 11 years.



The earthen levees would be built up gradually, as needed, using select fill from the disposal area. The increase in capacity was determined under the assumption that three feet of settlement and compaction will take place during filling of the area. This plan would not require changes in present dredging or disposal methods. The existing rehandling facilities for hopper dredges and scows would be adequate. A slightly increased energy requirement for pumping into the area, resulting from the increased lift, would present no practical difficulty, since most of the material pumped is silty and of a very liquid nature.

30. There would be no initial outlay of construction funds required for this plan. Rather, the action of increasing the levee elevation would be a gradual one. It is reasonable to expect that gradual construction such as this be accomplished as a normal operation and maintenance chore. Based on experience at the existing facility, probable annual operation and maintenance costs are estimated to be $394,000. For sake of cooperative estimates, this figure has been rounded to $400,000.

31. The average annual maintenance dredging cost for Plan A is estimated to be $3,600,000. The total estimated annual charges for Plan A are $4,000,000 or about $1.05 per cubic yard.

32. A word of explanation concerning cost computations for this plan, as well as those following, may be helpful. For each plan, the costs of construction, operation, maintenance, replacement, and all other necessary items were estimated, and using the appropriate interest rate, were reduced to yearly (annual) costs. Added to these were the costs for various methods of dredging throughout the year.

These annual costs were then divided by the estimated annual maintenance dredging requirement, which adds up to about 3.8 million cubic yards, to obtain an overall average cost per cubic yard. For example, the yearly costs associated with the plan to raise the existing levees are estimated to be $4,000,000. Dividing this amount by the 3.8 million cubic yards yields a rounded figure of $1.05 per cubic yard.

33. The environmental impact upon the biological elements due to raising the elevation of the existing levees would be minimal. Life is sparse on these levees whose brief period of existence and the continual activity of levee construction have not been conducive to biotic development. The older levees have a vegetation predominated by grasses and shrubs often found in salt marshes exposed to prevailing winds. In areas protected by the height of the levee, well-developed vegetative beds are found. However, most of the vast expanse of more recently deposited spoils is barren, or has slight vegetative cover. Animal life is predominated by the gulls and other shore birds common to the Hampton Roads area. Evidence of the presence of a variety of small mammals, but in low concentrations, has been noted. These forms, such as the rodents, would gain access to Craney Island easily from the adjacent fields near the levee site. The gradual addition of more material with the subsequent burial and increased height of the present levees should have no major impact on the present environment. Animal populations would have time to relocate, and vegetation gradually covered would become reestablished. In addition, any related activity associated with the present dredging operations would also continue.

34. In summary, the advantages of this plan are (1) the existing rehandling facilities could be used, (2) no additional land would

be required, (3) present dredging methods could be continued, (4) the cost is relatively small, and (5) there would be minimal environmental and social impact in the raising of existing levees. The fact that no additional land would be required makes this plan particularly attractive from an environmental point of view. However, there would be some disadvantages associated with continuance of the disposal operation, viz., odor, aesthetics, and visual obstruction; nonetheless, these in fact represent the disadvantages of a continuity of the present system in lieu of change. Further, the adverse effects associated with the new disposal area construction are not applicable to this alternative. But, it may only be thought of as a short-term solution to the problem of polluted spoil disposal in the Hampton Roads area, considering disposal needs for continued maintenance and the possibility of new work dredging in the foreseeable future.

35. In addition to its short useful life, another disadvantage of this plan is that it delays the current potential development of the filled area by at least 11 years, based on maintenance deposition. In this connection, the Commonwealth of Virginia has presented preliminary findings pertaining to the ultimate use of the completed land fill. Priority was given to port facilities, industry, an airport, housing, and others. The Virginia Port Authority is also making a study to determine how this land could be used from an industrial standpoint adjacent to deepwater navigation channels. The Commonwealth realizes the potential problems which may be encountered when development on the disposal area is attempted. Still, there is a continuing interest in exploring the likelihood for development, regardless of the physical or economic implications involved. Regardless of its future use, Craney Island must be recognized as a potentially valuable piece of real estate.

36. Upon study, it was recognized that before recommending Plan A, it would be necessary to analyze the threat of massive slides which could occur if the landfill were overloaded. Results of foundation studies showed that the Craney Island Disposal Area could be raised to maximum elevation +29.0 feet m.s.l., providing the location and construction of additional levees were accomplished. The studies revealed that the +17.0 feet m.s.l. project limits should be relocated to a stable alignment. This new alignment would be located inland a distance not less than 250 feet from the centerline of the existing perimeter road. The relocation would apply to the north, east, and west levees. After relocation of the +17.0-foot interior, retaining levees would be constructed to elevation +29.0 feet and would encompass the entire perimeter area, including the southern end of the existing disposal area. The centerline of the proposed +29-foot levees would be located not less than 1,000 feet inland from the existing perimeter road paralleling the north, east, and west levees. The proposed +29-foot retaining levees would also parallel the southern limits of the existing disposal area, maintaining a line congruent with the existing property boundaries. The foundation studies were conducted to indicate the stability of an elevated disposal area at Craney Island. No specific studies were made with regard to the potential of the filled disposal area to accommodate future development. The studies did recognize the need for extensive further testing before development on the area was attempted.

PLAN B. WESTWARD EXTENSION

37. A westward extension of the existing Craney Island Area is a second possibility. The new site would be similar to the existing area, except that a channel would be provided between the present shoreline and levee to insure water access for the residents along the waterfront and to permit drainage from Streeter and Hoffler Creeks.

38. Various shapes for the addition are possible, but in general, it would extend westward, gradually tapering from the north, with the westernmost point near the mouth of the Nansemond River at Pig Point. The two most probable shapes are shown on the adjacent sketches, and are labelled Plan B1 and Plan B2. The configuration of Plan B1 was suggested by the Virginia Institute of Marine Science on the basis of hydrodynamic soundness. On the other hand, Plan B2 allows for much greater storage capacity with no increase in the length of levee required. Model tests of the two shapes made at the U. S. Army Corps of Engineers' Waterways Experiment Station in Vicksburg, Mississippi showed that the proposed westward extension of the present Craney Island area by construction of either Plan B1 or Plan B2 dike configuration would have no significant effects on current velocities, salinities, or tidal heights in the area.

39. In both plans, approximately 31,000 feet of levee would be required. The levee would inclose, in Plan B1, about 1,750 acres and in Plan B2, about 2,380 acres. The water depth in the area averages

9.5 feet, and a levee with an ultimate height of 17.0 feet would provide a storage capacity of 79,000,000 cubic yards in Plan B1 and 115,000,000 cubic yards in Plan B2. These capacities correspond to effective lives of 21 and 30 years, respectively. Neither plan would interfere with harbor traffic, since the area west of the existing disposal site is aside from harbor channels and small craft routes.

40. The area is conveniently located with respect to dredging and disposal activities. Its protected and centralized location would permit the continuance of the economical dredging and disposal methods now employed. By extending shore pipe to the new area, the existing rehandling facilities could be used.

41. Plan B would accomplish maintenance of the navigational features as follows: (1) initial removal of in situ (in-place) shoal material by current methods - hopper dredge, hydraulic pipeline, and bucket-scow; and (2) transfer of the material, using the existing rehandling facilities, to the diked area for final disposal. The existing rehandling facilities were described previously. Essentially, the rehandling operation would be the same as at present, with the qualification that approximately two miles of additional shore pipe would be used -- from the rehandling area to the new disposal area. In hydraulic pipeline dredging, the outfall end of the pipe would be inside the disposal area; i.e., the rehandling facilities would not be used.

42. Plan B2 will provide a storage capacity of 115,000,000 cubic yards or about 36,000,000 cubic yards more than Plan B1. Therefore, only the cost of Plan B2 is present in table D-1. The estimated cost of maintaining navigation by Plan B2 is $4,800,000 per year or $1.30 per cubic yard over the plan's 30-year life.

43. A major environmental impact of extending Craney Island westward would be the loss of between 1,750 and 2,380 acres of submerged bottomland. The availability of this area for boating and fishing would also be irrevocably lost. The benthic forms in this area would predominantly be smothered by the deposit of the spoils. Adjacent-dwelling animals would also be affected by the increased turbidity and siltation associated with this project. The overall result is a loss of bottom organisms and habitat and a possible modification of water quality. This last item would mainly be the result of an increase in the concentration of suspended solids and turbidity. Once the new levees were established, the new site would gradually be filled with vegetation similar to the existing Craney Island. Birds and small mammals would soon become established. There would be a gradual transition of the original acreage to dry land.

44. The benthic fauna affected by the westward extension would include nereid worms, bryozonas, mussels, oysters, and blue crabs. Commercial shellfish harvesting in the vicinity of Streeter and Hoffler Creeks is prohibited due to existing pollution levels attributed to population increase and human activity. There are a variety of fish, both resident to Hampton Roads and migratory, that frequent this area. These fish species include spot, croaker, summer flounder, bluefish, sea trout, and striped bass, among others.

45. Westward extension of Craney Island Disposal Area has been strongly opposed by the city of Portsmouth, as well as by individual residents of that city. The reasons given for opposing extension to the west are:

- The citizens of Portsmouth would be deprived of the beneficial use of a presently available natural harbor area.

- The existing environment of the area would be disturbed.

- Additional noxious odors would result.

- Residents along the waterfront would be adversely affected by odor, loss of access to the water, and possible future use of the completed area being incompatible with residential use.

- Drainage, now afforded by Streeter and Hoffler Creeks, would be impaired.

- Undeveloped land nearby would depreciate in value.

- The open-water area of Hampton Roads would be further diminished.

- The pleasant view from the present shoreline would be detrimentally altered.

The economic losses in this area of Portsmouth, resulting from the westward extension, has been estimated to be between $3.0 million and $5.6 million. This figure assumes that Plans B and C would be constructed.

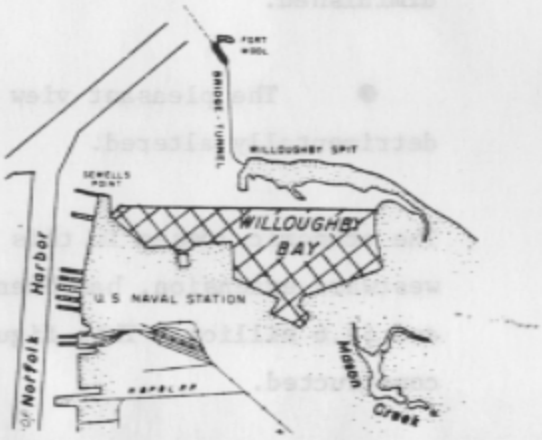
PLAN C. WESTWARD EXTENSION RAISED

46. This plan would involve an increase in elevation of the westward extension from +17 feet m.s.l. to +29 feet m.s.l. Like Plan A, this would increase the capacity of the area by 46,000,000 cubic yards and

extend its useful life by about 12 years. Levee realignment would be similar to Plan A. Other economic, social, and environmental factors of this plan would be the same as Plans A and B. They will not be repeated here.

PLAN D. WILLOUGHBY BAY

47. A fourth alternative is Willoughby Bay which is located at the northwest tip of the city of Norfolk, adjacent to the Norfolk Naval Base. The Bay is conveniently located with respect to dredging and disposal activities, by virtue of being adjacent to the entrance reach of the Norfolk Harbor Channel. The Navy has filled portions of the Bay, including the mouth of Mason Creek and the east end of the Bay. A disposal area at Willoughby would be arranged as shown on the adjacent sketch. A channel would be provided on the south side of Willoughby Spit to assure continued access to the water from the Willoughby Beach area. Otherwise, the Bay would be completely filled to an elevation of 17.0 feet m.s.l.



48. Drainage of the surrounding area, notably the aqueduct outfall from Mason Creek, would be affected with Plan D, although provision was made in the cost estimate for a suitable rearrangement of drainage facilities.

49. In Plan D, approximately 15,000 feet of levee would be required. The levee would inclose about 1,280 acres. With the water depth

averaging about 11.5 feet, a levee with an ultimate height of 17.0 feet m.s.l. would provide a storage capacity of about 60,000,000 cubic yards. This allows for 3 feet of settlement. The design capacity corresponds to an effective life of 16 years. This plan would not interfere with harbor traffic other than local recreational craft. The convenient location with respect to dredging and disposal activities would permit the continuance of the economical dredging and disposal methods now employed. The plan calls for the construction of a rehandling basin and hopper dredge pumpout facility similar to those at Craney Island Disposal Area. The rehandling facilities would be joined to the main disposal area by a 3,500-foot pipeline.

50. Plan D would accomplish maintenance of the navigational features as follows: (1) removal of shoal material by current methods; namely, hopper dredge, hydraulic pipeline, and bucket-scow dredging and (2) transfer of the material through rehandling facilities to the diked area for final disposal. The rehandling facilities would be similar to those at the Craney Island Disposal Area, consisting of a rehandling basin for dumping scows and a pipeline for hopper dredge unloading. This pipeline is planned as an alternative to a more costly approach channel, and would be approximately 3,500 feet long from hopper dredge to levee. Additional length would be added as needed.

51. The estimated cost of maintaining navigation features by Plan D is $5,500,000 per year, or $1.40 per cubic yard over its 16-year life. The estimated costs are shown in table D-1. These costs provide for initial construction of levees, spillways, access roads, rehandling facilities, drainage facilities, and navigation aids. The annual charges include interest, amortization, operation, maintenance, and dredging.

52. Opposition to the use of Willoughby Bay as a new disposal area logically stems from individuals living in that area. The objections are based on risk of air pollution, aesthetic and recreational losses, and lowered area property values imparted by the use of the Bay for disposal activities.

53. Implementation of Plan D would mean the permanent loss of approximately 1,280 acres of natural harbor area. The intangible effects include damage to marine life, loss of the Bay view, air pollution (odor), and the loss of water-oriented recreation within the project area. The Willoughby Bay area, once filled, could likely be developed and become a valuable asset to the community or the Navy, in keeping with developmental priorities at that time.

54. The Bay is approximately 1.5 by 1 nautical miles, the average depth being about 9 feet m.s.l. The entire southern shoreline of Willoughby Bay is on the Norfolk Naval Station property while the opposite shoreline is almost entirely residential property. Interstate 64, currently under construction, crosses about 4,000 feet of the northern edge of Willoughby Bay. Benthic flora associated with the Bay include several types of marine algae. The most conspicuous are those common to the shoreline, and include sea lettuce and other filamentous algae. A variety of marine coastal habitats are found within the Willoughby Bay. Sand flats, mudflats, small marshes, and rocky sections exist within the area.

55. Shellfish growing areas within the Bay have been condemned for commercial harvesting by the State Water Control Board. Heavy population density, heavy boat traffic, numerous marinas, and sewage treatment plant effluents are cited as reasons for the condemnation. Despite the condemnation, private catches continue in the Willoughby Bay area, especially of the blue crab. Elimination of recreational boating within

the protected waters of the Bay along with the aesthetic nuisances associated with a disposal area, such as sight and occasional odor, constitute additional environmental impacts of this alternative. According to local residents, properties fronting the Bay have already been adversely affected by the Interstate Highway crossing. Between 7th Street and the end of Willoughby Spit, 244 single family cottages, 28 duplexes, 80 large apartment buildings, and 5 motels or hotels would be in view of this disposal area.

56. Since the entire southern shore of Willoughby Bay is on the U. S. Naval Air Station and Naval Base, the Navy's views on the use of the Bay as a fill area were sought. The position of the Navy was first established to be one of no objection to the use of the Willoughby Bay site provided that (1) attention be directed toward a study of the environmental impact; (2) drainage facilities are suitably relocated; and (3) naval facilities, such as the aviation gas barge unloading facility located along the Bay, are suitably relocated. This position was amended by the Navy's presentation at the 1 June 1972 public meeting, which read in part as follows:

> "Although it was initially indicated that long-range benefits would accrue to the Navy from filling of Willoughby Bay would outweigh the potential disadvantages, there has been, in recent years, a degree of emphasis placed on preservation of the environment which causes a necessary reevaluation of our previous position. Inasmuch as Willoughby Bay is used extensively by Navy personnel and dependents, as well as the general public, we would not, at this time, want to be a party to the elimination of such an irreplaceable recreational facility."

A similar view was expressed by the city of Norfolk in its presentation at the 1 June 1972 meeting. Excerpts from the city's presentation read as follows:

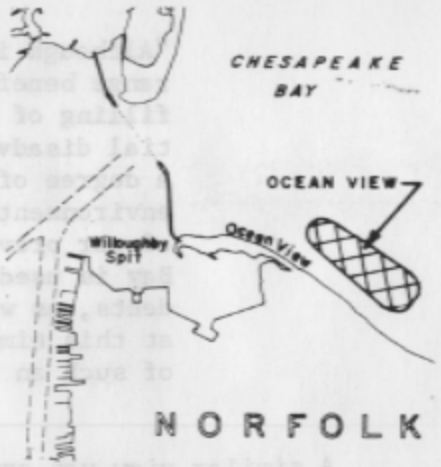
"The city considers the existing water and open space of Willoughby Bay to be substantially more important than any open-space land which might eventually be created after filling was completed. . .

"In summarizing, the city of Norfolk must oppose the filling of Willoughby Bay as a replacement for the Craney Island Disposal Area because of the lack of clear-cut advantages and a long list of disadvantages."

PLAN E. OCEAN VIEW AREA

57. An area north of Willoughby Spit and Ocean View in Chesapeake Bay was considered. The site location in open, deep water gives rise to comparatively high construction costs. The site is also inconvenient with respect to dredging activities, since it is some seven miles from the Norfolk Harbor Channel.

58. In Plan E, the disposal area would be arranged as shown on the adjacent sketch. The facility would be located offshore in order to prevent disruption of existing shoreline use. It would be filled to an elevation of 17.0 feet m.s.l. Approximately 60,000 feet of levee would be required. The levee would inclose about 4,500 acres. With the water depth averaging close to 25.5 feet, and allowing for 3 feet of settlement, a levee of an ultimate height of 17.0 feet m.s.l. would provide a storage capacity of about 300,000,000 cubic yards. This capacity corresponds to a useful life of 79 years.



59. Construction at this site would not interfere with navigation of large vessels, although it would inconvenience pleasure boaters and fishermen.

60. Plan E requires the construction of a rehandling basin and hopper dredge pumpout facility similar to those at Craney Island Disposal Area. The rehandling facilities would be joined to the main disposal area by a long pipeline in lieu of a more expensive approach channel.

61. Plan E would accomplish maintenance of the navigational features as follows: (1) initial removal of in situ shoal material by current methods; namely, hopper dredge, hydraulic pipeline, and bucket-scow dredging, and (2) transfer of the material through rehandling facilities to the diked area for final disposal. The rehandling facilities would be similar to those at the Craney Island Disposal Area and would consist of a rehandling basin for dumping scows and a pipeline for hopper dredge unloading. This pipeline was planned as an alternative to a more costly approach channel. The pipeline would be approximately 3,000 feet long from hopper dredge to levee. Additional length would be added as needed.

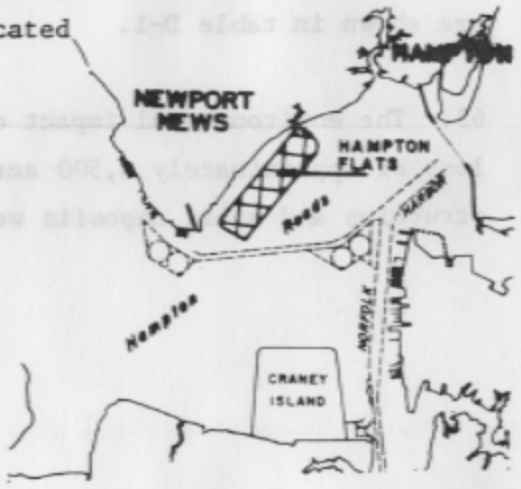
62. The estimated cost of maintaining navigational features by Plan E is $8,400,000 per year, or $2.20 per cubic yard over its 79-year life. The estimated costs, which include amounts for construction of levees, spillways, access roads, rehandling facilities, and navigation aids, are shown in table D-1.

63. The environmental impact of Plan E would include the permanent loss of approximately 4,500 acres of marine bottomland. Levee construction and spoil deposits would destroy sessile faunal species at

the immediate site with detrimental effects extending to adjacent areas. Species in the surrounding benthic regions, the more mobile species, and fish that enter this area may be detrimentally affected by the increase in suspended solids and the accompanying rise in turbidity. The total impact of the benthic organism loss to the food chains is unknown. The overall influence of this action to the higher trophic levels, or to the local shellfish beyond this site is unknown. There were no model studies made to note the influence of this facility to existing current patterns and the possible development of adverse water movements. Any modification to the present currents along the shore would affect floral and faunal constituents and the degree of beach erosion. It is feasible that these effects may make the area less desirable for various recreational water activities now found off Ocean View (swimming, boating, fishing). Further consideration of this site would necessitate a model study to more accurately predict current patterns and the impact of this facility to present and future activities along this beach section. If there are adverse effects to this highly commercialized shoreline, there would likely be strong opposition from the local land owners and the city of Norfolk. Additional factors, such as possible odors, an impaired view across the Bay, and possible influence of the increased turbidity to water quality were also considered in relation to this facility.

PLAN F. HAMPTON FLATS

64. Another possibility for a new disposal site is the area called Hampton Flats, located in Hampton Roads just southeast of the cities of Hampton and Newport News. This area is conveniently located with respect to dredging and disposal activities, in that



it is adjacent to the Channel to Newport News and the entrance reach of the Norfolk Harbor Channel. A disposal area at Hampton Flats would be arranged as shown on the sketch. Access to the present shoreline would be assured by building the levees away from the shore, as shown. Drainage from the nearby cities would not be affected.

65. Approximately 43,000 feet of levee would be required in Plan F. The levee would inclose about 1,800 acres. With the water depth averaging about 12.5 feet, a levee with an ultimate height of 17.0 feet would provide a storage capacity of about 90,000,000 cubic yards. This also allows for 3 feet of settlement. The capacity corresponds to an effective life of 24 years. Plan F would not interfere with harbor traffic other than recreational craft. Current dredging methods could be continued with this convenient and protected area as a disposal site. The plan calls for construction of a rehandling basin and hopper dredge pumpout facility similar to those at Craney Island Disposal Area. The rehandling facilities would be located near the southwest extremity of the area.

66. Plan F would accomplish maintenance of the navigational features as follows: (1) removal of shoal material by current methods -- namely, hopper dredge, hydraulic pipeline, and bucket-scow dredging; and (2) transfer of the material through rehandling facilities to the diked area for final disposal.

67. The estimated cost of maintaining navigational features by Plan F is $7,200,000 per year, or $1.90 per cubic yard over its 19-year life. Estimated costs of the plan are shown in table D-1.

68. Approximately 1,800 acres of marine bottomland would be lost in its conversion to a disposal site. All benthic organisms unable to

move out of the area would also be destroyed. The total biomass would be rather extensive and include a variety of polychaete worms, bryozoans, mussels, and oysters. The area is worked by oystermen, crabbers, and fishermen. Recreational usage is also high, with much boating, sailing, and sport fishing in the area. Previously mentioned fish for Hampton Roads are among those in this locale.

69. The direct environmental impact on Hampton Flats would be the loss of this bottomland and its trapped biota. The total productive contribution of this area to the local food chains is unknown. In addition, the adjacent areas may be influenced by an increase in the total suspended solids and the subsequent effect to water quality. The essential influence of this facility to the nearby shorelines and the major currents in Hampton Roads has been studied in preliminary model tests at the U. S. Army Corps of Engineers Waterways Experiment Station in Vicksburg. These studies indicate adverse circulation currents may accompany the implementation of this facility. A major product of this action would be material transport to Hampton Creek and adjacent areas by these new currents. More study would be required to determine these disadvantages due to the effect of current patterns on the existing shorelines, associated biotic communities and navigation channels.

70. The Hampton Flats area, once filled, would be an extremely valuable asset to the surrounding community, but because of the adverse environmental effects associated with the site it was not considered to be among the more workable alternatives.

PLAN G. RAGGED ISLAND

71. Ragged Island is a wetland marsh that projects into the James River near the south end of the James River Bridge. It is located about 9 miles from the center of the dredging activity and is shown on the adjacent sketch.

72. In this plan, approximately 64,000 feet of levee would be required which would inclose about 2,320 acres. Elevation of the area averages +3 feet m.s.l. A levee with an ultimate height of 17.0 feet would provide a storage capacity of about 64,000,000 cubic yards. This again allows for 3 feet of settlement. The capacity corresponds to an effective life of 17 years.

73. Plan G would not interfere with harbor traffic other than recreational craft, and only slightly with these. Current dredging methods could be continued. The plan requires construction of a rehandling basin and hopper dredge pumpout facility similar to those at Craney Island Disposal Area. The rehandling facilities would be joined to the main disposal area by a 13,500-foot pipeline.

74. Plan G would accomplish maintenance of the navigational features as follows: (1) removal of shoal material by current methods -- namely, hopper dredge, hydraulic pipeline, and bucket-scow dredging and (2) transfer of the material through rehandling facilities to the diked area for final disposal. The rehandling facilities would be similar to those at the Craney Island Disposal Area and would consist of a rehandling basin for dumping scows and a pipeline for hopper dredge unloading. The pipeline was planned as an alternative to a more costly

approach channel, and would be approximately 13,500 feet long from hopper dredge to levee. Additional length would be added as needed. Although not reflected in the cost estimate, booster pumps would likely be required since most hoppers do not have the capability for pumping such a distance.

75. The estimated cost of maintaining navigational features by Plan G is $7,000,000 per year, or $1.80 per cubic yard over its 17-year life. The estimated costs are shown in table D-1.

76. The use of Ragged Island as a deposit site would result in the loss of 2,320 acres of wetland salt marsh. It is a well-known fact that the wetlands marsh typically represents a productive and vital link to a variety of ecological relationships present in the estuary. The Virginia Wetlands Act of 1972 recognizes this significance and stipulates wetlands destruction should be avoided if at all possible. Ragged Island contains the major vegetation and fauna characteristic to the salt marsh community, and its use as a disposal site would irrevocably destroy this habitat.

PLAN H. HORSESHOE AREA OFF BUCKROE BEACH

77. A disposal area could be built off the Buckroe Beach area, in what is known as The Horseshoe. The area is somewhat removed from harbor facilities where the majority of dredging is required. A disposal area at Buckroe would be arranged as shown on the adjacent sketch. Rehandling areas would be located on the south side of the area, as shown, where they would be protected from northern

exposure. The entire facility, located offshore, would avoid conflict with existing development and costly disruption of present use, and would permit continued access to the present shoreline. Drainage of the adjacent land areas would not be affected.

78. In Plan H, approximately 63,000 feet of levee would be required. The levee would inclose about 6,100 acres. With the water depth averaging 15.5 feet, a levee with an ultimate height of 17.0 feet would provide a storage capacity of about 340,000,000 cubic yards over an effective life of 89 years. This allows for three feet of settlement during filling. Current dredging methods could be continued. The plan calls for the construction of a rehandling area for scows and hopper dredge pumpout facilities similar to those at Craney Island Disposal Area. The description and related costs which follow were estimated for a land-tied area of slightly different shape, but in the same location. The difference in total cost, for a facility with storage as given above, and located offshore, is not believed great enough to alter the average annual cost over an 89-year life.

79. Plan H would accomplish maintenance of the navigational features as follows: (1) removal of shoal material by current methods -- namely, hopper dredge, hydraulic pipeline, and bucket-scow dredging and (2) transfer of the material through rehandling facilities to the diked area for final disposal.

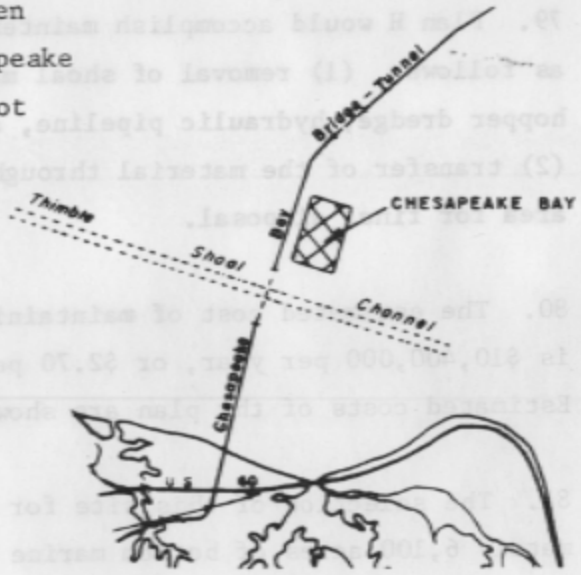
80. The estimated cost of maintaining navigational features by Plan H is $10,400,000 per year, or $2.70 per cubic yard over its 89-year life. Estimated costs of the plan are shown in table D-1.

81. The selection of this site for levee construction removes approximately 6,100 acres of bottom marine land from this area. This location

contains a variety of benthic marine organisms that would be destroyed by the spoils deposit. The mechanical process of levee construction and spoils transfer to this site may also lead to detrimental environmental effects to adjacent areas due to siltation and the influence of suspended particles on the water quality. The contribution of this bottom area to the food and habitat needs of motile species is unknown. There may also be modifications to the current patterns off Buckroe Beach due to the presence of this project. What influence this structure and such new water movement would have on nearby shorelines and their natural communities is unknown. Further model studies would be required to more accurately predict the influence of this project on the local coastal region. Unfortunately, the planned testing model of the Chesapeake Bay will not be completed for several years.

PLAN I. CHESAPEAKE BAY

82. A Chesapeake Bay alternative was considered for the east side of the Chesapeake Bay Bridge-Tunnel complex as shown on the adjacent sketch. As considered, the facility would be located between Thimble Shoal Channel and Chesapeake Channel. This location would not interfere with harbor traffic. It is, however, far removed from the center of dredging activity, with the result that use of present dredging methods would become comparatively expensive.



83. In Plan I, approximately 48,000 feet of levee would be required. The levee would inclose about 2,980 acres. The water depth averages 29.5 feet in this area; therefore, a levee of 17.0 feet ultimate height would provide a storage capacity of about 216,000,000 cubic yards, allowing 3 feet for settlement during filling. This capacity corresponds to an effective life of 57 years. Present dredging methods could be continued, but at a greatly increased cost. The plan calls for construction of a rehandling basin and hopper dredge pumpout facility similar to those at Craney Island Disposal Area. The rehandling facilities would be located on the south side of the facility. This arrangement is advantageous for two reasons: (1) the location is closer to dredging areas and (2) the rehandling facilities would be protected from adverse weather factors of a northern exposure.

84. Plan I would accomplish maintenance of the navigational features as follows: (1) removal of shoal material by current methods -- namely, hopper dredge, hydraulic pipeline, and bucket-scow dredging; and (2) transfer of the material through rehandling facilities to the diked area for final disposal. This plan does not preclude, obviate, or anticipate various dredging methods; however, the costs were estimated by assuming that present dredging methods would be continued.

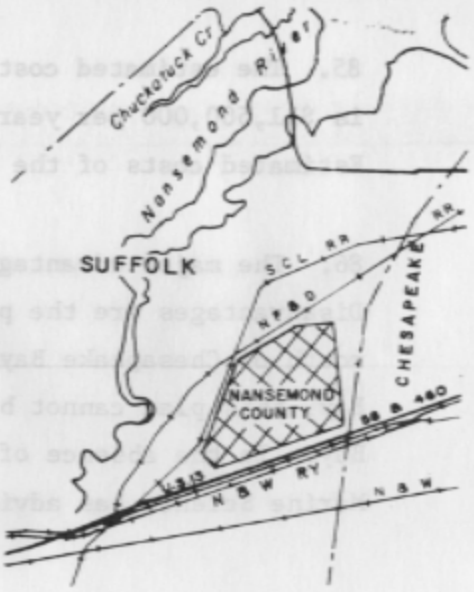
85. The estimated cost of maintaining navigational features by Plan I is $11,500,000 per year, or $3.00 per cubic yard over its 57-year life. Estimated costs of the plan are shown in table D-1.

86. The major advantage of Plan I lies mainly in its large capacity. Disadvantages are the plan's high cost and its restriction of the mouth of Chesapeake Bay. In the absence of a model of the Chesapeake Bay, this plan cannot be model tested to determine its effect on the Bay. In the absence of such knowledge, the Virginia Institute of Marine Science has advised against this alternative.

87. The environmental impact of Plan I includes the loss of approximately 2,980 acres of marine bottomland. There would be the additional destruction in this area of benthic organisms that would be unable to avoid damage from deposit of the spoils. This general area also represents a very popular site used by local sports fishermen. No doubt the construction activity would affect the fishing and pleasure boat traffic by removing this area from recreational use. The contribution that these bottom areas at the mouth of the Chesapeake Bay make to the habitat needs and food requirements of local and migrant fish and other species is unknown. It is also not known to what extent this project effects the local currents and subsequent transport of materials to adjacent sections. Model testing studies would be necessary to more accurately predict such changes to the present current patterns.

PLAN J. NANSEMOND COUNTY

88. It is technologically feasible to transport dredged material by pipeline over long distances. Such a transport capability allows the consideration of alternative disposal areas considerably removed from the harbor itself. The nearest onshore area feasible is approximately 5,000 acres located in the eastern sector of the city of Suffolk (originally Nansemond County) as shown on the adjacent sketch. The area is bounded by U. S. Route 460 on the southeast, a pipeline on the southwest; the Atlantic Coastline and Norfolk, Franklin, and Danville Railroads on the west and north; and by the Nansemond County-Chesapeake City boundary line on the east. The area is not accessible by navigable water routes; however, it is feasible



to connect Craney Island to the Nansemond area by pipeline. The considered pipeline would be 16 inches in diameter and approximately 55,000 feet in length. It would utilize five successive booster stations. As envisioned, the line would run from a rehandling basin formed from part of the west side of Craney Island, alongside the existing rail line, to the northern tip of the Nansemond County Disposal Area. Drainage would be southeastward through the disposal area to the Nansemond River, or be returned to Craney Island via the existing pipeline, as described in a later paragraph.

89. In this plan, approximately 58,000 feet of levee would be required. The levee would be a simple non-riprapped earth-raised type. It would inclose about 5,000 acres. The area elevation averages +20 feet, m.s.l., which, with a levee of ultimate height +47 feet m.s.l., would provide a storage capacity of about 240,000,000 cubic yards. This allows for 3 feet of settlement. The capacity corresponds to an effective life of 63 years.

90. Plan J would permit continuance of the economical dredging and disposal methods now employed. The existing rehandling facilities would be used for hopper dredge pumpout and scow unloading. The dredged material would be pumped through pipelines across the filled portion of Craney Island Disposal Area to the confined rehandling basin on the west side of the disposal area. The material would be injected into a long pipeline by a rehandling unit and pumped to the Nansemond area by successive booster stations. Several pipeline rights-of-way would be reserved in this plan; other than these and the rehandling area, the filled Craney Island Disposal Area would be available for development. Also, it is possible that the useful life of this disposal area could be significantly prolonged by removing native material from the site and using it for construction fill or topsoil.

91. Plan J would accomplish maintenance of the navigational features as follows: (1) initial dredging, which consists of removing the shoal material by hopper dredge, pipeline dredge, and bucket dredge; (2) rehandling through pipeline from hopper dredge pumpout facilities and scow dumping basin (hydraulic pipeline dredges discharge directly into the diked rehandling basin); (3) temporary storage in the diked harborside rehandling basin; and (4) removal from the rehandling basin by pipeline for final disposal in the diked remote land disposal area in Nansemond County. Rehandling and final disposal of the dredged material would be accomplished by a rehandling unit and pipeline.

92. The estimated cost of maintaining navigational features by Plan J is $8,300,000 per year, or $2.20 per cubic yard over its 63-year life. Estimated costs of the plan are shown in table D-1.

93. The Nansemond County Disposal Area alternative encompasses approximately 5,000 acres of land just north of U. S. Route 460 between the Chesapeake city limits and Suffolk. The heavily timbered land is relatively flat with highest elevations ranging about 25 feet m.s.l. Numerous drainage canals have been cut through the area, primarily to regulate water levels and to afford fire prevention measures. The surface soils are primarily peat and are usually less than 5 feet thick. Subsurface mineral deposits of economic value, with the exception of a thin veneer of sand, are not known to exist.

94. Present commercial land use consists of timber and related industry. Three hunt clubs currently use the area during winter months, the largest of which has about 60 members who take about 60 deer per year from the forest.

95. A large variety of timber trees occur in this area; among them loblolly and pond pine, black and tupela gum, cypress, southern white cedar (juniper), red maple and several species of oak; together with numerous shrub species, such as greenbay, redbay, and wax myrtle. Most of these species are very sensitive to the amount of moisture contained in the soil and their areal distribution is controlled by the prevailing water level. Of particular commercial value is the southern white cedar, a species endemic to the Dismal Swamp and adjacent forest.

96. Animal forms found in Nansemond County are those which are adapted to both dense woods and standing water. Principal mammals found here include the white-tailed deer, black bear, marsh rabbit, and grey fox. This site and adjacent land appear to support a larger concentration of black bear than is found in the Dismal Swamp south of U. S. Highway 460. This is due to its isolation from the rest of the Dismal Swamp and the fact that bear are not hunted as much as in the Swamp.

97. There are perhaps 80 species of breeding birds in the Dismal Swamp proper and presumably the majority of these would also be found north of U. S. Highway 460. This number includes both transient and resident species. There are no known endangered species in the Dismal Swamp.

98. Reptiles and amphibians also abound in the Dismal Swamp area. There are about 14 species of reptiles present, which include three poisonous species -- the water mocassin, the copperhead, and the cane break rattler. Approximately 15 to 20 species of amphibians occur in the Swamp region.

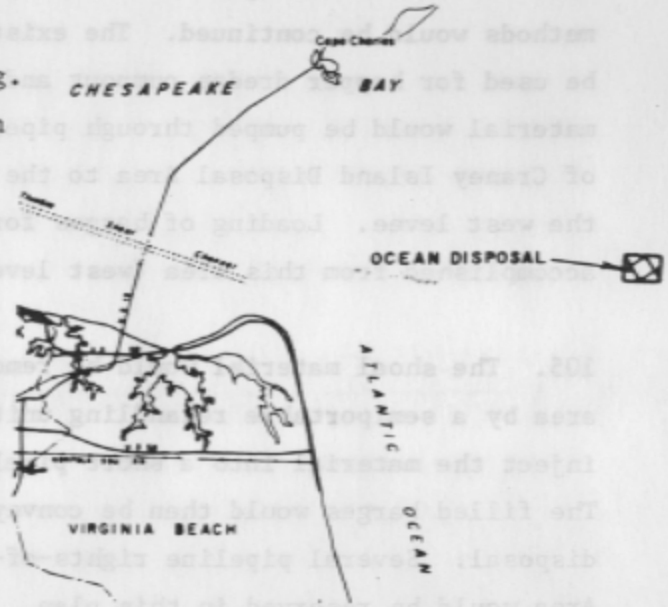
99. A major environmental impact to the Nansemond County site would result in the use of this plan. Approximately 5,000 acres of timber-producing swampland would be lost. The levee construction and subsequent spoil deposit would eventually cover this portion of land. Fill operations would proceed in a checkerboard fashion so the time of complete land coverage would be extended several years. All timber and present vegetation would be destroyed by this action. Wildlife would be forced into adjacent wooded areas or eventually be destroyed. The game animals would be significantly affected and would remove from this property a popular recreational activity. However, this disposal area may be gradually reclaimed for a variety of uses. These future plans may involve development as a recreational site.

100. Two major environmental considerations of the Nansemond site deal with the effects saltwater drainage and seepage could have on the surrounding area. The problem of what to do with drainage runoff from spoil is of paramount importance. Two preliminary plans have been considered: (1) to collect and drain the water by culverts into the Nansemond River and (2) to return the runoff to Craney Island by the same pipeline mechanism used to transport to the Nansemond site. Substantive knowledge of the quality of this saltwater and its influence after deposition, particularly on the salinity and water quality of the river, is a "must" in order to more accurately predict an overall environmental impact. Also, the potential for serious damage to native ground water supplies by saltwater seepage has been recognized. Knowledge of location, extent, and direction of these supplies, and possible means for preventing damage from seepage is likewise of paramount importance. An extensive network of research (test) wells in the Nansemond site would likely be required before this question could be resolved.

PLAN K. DISPOSAL AT SEA BY TUG AND SCOW

101. Several methods of disposal at sea were considered. With present technology, a long pipeline could be built which, with successive booster stations, would carry the dredged material from Craney Island Disposal Area out to sea. The material could also be carried to sea in barges filled from Craney Island, or utilized with a specially designed dredge, or by hopper dredge. The costs of the various plans considered were estimated to range from $1.70 per cubic yard to $3.20 per cubic yard. All plans for disposal at sea have a common disadvantage, namely, the potentially adverse environmental effects of ocean dumping.

102. Maintenance of the navigational features by this plan would be accomplished by hopper dredge and bucket dredge with the material disposed at sea. In the case of the hopper dredge, the ship would be filled to overflow, whereupon dredging would cease and the load would be carried to sea for dumping. The open sea disposal area is shown on the adjacent sketch. All work, where possible, would be done by hopper dredge. The dredging around piers and slips and other confined places would be done by bucket dredge discharging into attendant barges. The barges, when loaded, would be towed to sea, two at a time, and the material dumped.



103. The estimated cost of maintaining navigational features by Plan K is $11,100,000 per year, or $2.90 per cubic yard. The life of this plan is not limited by storage space, since obviously the

disposal area is not confined. The entire cost as presented above is for dredging and transportation of the shoal material. The estimated costs are shown in table D-1.

PLAN L. BARGING TO SEA FROM CRANEY ISLAND

104. Maintenance dredging would be accomplished in three steps in this plan: (1) initial dredging, which consists of removing the shoal material by current methods -- namely, hopper dredge, hydraulic pipeline dredge, and bucket-scow dredge; (2) temporary storage in a diked harborside rehandling area (a portion of Craney Island Disposal Area); and (3) rehandling, which consists of removing the material from the rehandling area, with transport by tug and barge, to sea for final disposal. The initial dredging could be carried out by government or contract dredges. For this plan it was assumed that current methods would be continued. The existing rehandling facilities would be used for hopper dredge pumpout and scow unloading. The dredged material would be pumped through pipelines across the filled portion of Craney Island Disposal Area to the confined rehandling basin along the west levee. Loading of barges for transport to sea would be accomplished from this area (west levee).

105. The shoal material would be removed from the rehandling basin area by a semiportable rehandling unit. The rehandling unit would inject the material into a short pipeline emptying into barges. The filled barges would then be conveyed by tug to sea for final disposal. Several pipeline rights-of-way at Craney Island Disposal Area would be reserved in this plan. Other than these and the rehandling area, the filled disposal area would be available for development.

106. The special rehandling equipment would be operated 16 hours per day, for the equivalent of 260 days per year, and would require work crews consisting of a foreman, operator, two repairmen, and four dumpmen. The towing phase could be accomplished by contract or by government owned and operated barges and tugs.

107. The estimated cost of maintaining navigational features by Plan K is $11,500,000 per year or $3.00 per cubic yard over the 50-year period of analysis. A total of ten barges, two tenders, and four tugs would be required for the operation of this plan.

PLAN M. DISPOSAL AT SEA BY PIPELINE

108. Maintenance dredging in this plan would be accomplished in three steps: (1) initial dredging, which consists of removing the shoal material by current methods -- namely, hopper dredge, hydraulic pipeline dredge, and bucket-scow dredging; (2) temporary storage in a diked harborside rehandling basin (a portion of Craney Island Disposal Area); and (3) rehandling, which consists of removing the material from the temporary disposal area with transport to sea by pipeline for final disposal. The rehandling phase would be accomplished by a government owned and operated rehandling unit which would inject the material into a long pipeline to be pumped to sea by successive booster stations. The rehandling equipment would be operated 16 hours per day for the equivalent of 228 days per year, and would require work crews consisting of a foreman, operator, two repairmen, and two dumpmen for each shift. The booster stations would be unmanned and remotely operated and controlled from the rehandling unit.

109. A portion of Craney Island Disposal Area was considered for temporary disposal because of its proximity to dredging areas, its

protected location, and, in general, the lower cost from both an environmental and economic point of view. Various state, local, and private interests have proposed development of Craney Island Disposal Area, when completely filled, for recreation, industrial, commercial, and/or residential use. Use of a portion of the area as a temporary disposal area may conflict with some proposed plans for Craney Island's development, but any such conflict is surmountable through coordinated land use planning.

110. The rehandling unit would consist of a modified barge, endless chain bucket pickup, hopper and first booster unit. The endless chain bucket was selected because of its advantages of delivering the material at close to in situ density and being relatively small in size and power equipment. Also, such a system delivers a constant supply of material to the pump, preventing fluctuations of the hydrodynamic forces throughout the pipeline which would cause variations in the slurry velocity and density. A segregating device, such as a rotating screen above the hopper, is envisioned as a means of preventing clogging of the long pipeline by oystershells or foreign objects.

111. The horsepower requirements and pipe friction, consequently pipe wear, will increase as a function of the discharge velocity. Therefore, the optimum velocity is considered to be the lowest velocity which will reliably transport the solid matter. Studies made by the Philadelphia District concluded the optimum discharge to be 12 feet per second and recommended using 850 horsepower motors for each pump at each booster station. These figures were considered applicable to the Norfolk Harbor shoal material as the in situ density and percent passing a 200 mesh screen are close to that determined for

Delaware River silts. Additional studies were made by the Philadelphia District to determine the wear properties of various types of pipes. Results of these tests showed that all lined sections failed and that steel pipe conforming to AlS1-C-1036 had the least wear. Of the steel pipes studied, no pipe composition or treatment was found to be clearly superior, although the different types behaved differently.

112. The booster station proposed by the Philadelphia District was adopted for this study. Operation of the booster stations would be remotely controlled from the rehandling unit. Electric power would be used to operate the booster stations and would be obtained from a commercial source. The booster stations would be spaced 12,500 feet apart to permit any one of a group of four units to be out of service without disrupting operations.

113. It was assumed that the pipeline system would operate 16 hours per day for 228 days per year; costs were based on this assumption. In practice, however, it would be possible to operate 24 hours per day on a 7-day per week schedule, or on whatever schedule is deemed best suited to the requirements at the time. The remainder of the year would account for downtime or bad weather.

114. The estimated cost of maintaining navigational features by this plan is $10 million per year, or $2.60 per cubic yard over the 50-year period of analysis. The estimated first cost and annual charges are shown in table D-1. The chief disadvantages of this plan are its inflexibility, a large initial investment, and a long period for amortization required.

PLAN N. DISPOSAL AT SEA BY SPECIAL DREDGE AND BY TUG AND SCOW

115. Maintenance of the navigational features in this plan would be accomplished by a specially designed dredge and by bucket dredge, with the dredged material being conveyed to sea by barge for disposal.

116. The special dredge, as designed by personnel of the Philadelphia District, Corps of Engineers, is essentially a hopper dredge without hoppers. In that sense, this plan is similar to Plan K, with the difference being that in Plan M the special dredge replaces the hopper dredge. The special dredge is pictured on the following page. It was conceived by the Philadelphia District as part of its Long-Range Spoil Disposal Study, and is described as follows:

> "This dredge would be of a catamaran design with a propulsion system similar to that installed in modern ferries or four vertical shaft Voith-Schneider propellers or four outboard motor type (in wells) propellers. Two dragarms would be installed at the centerline of the dredge, one pointing fore, the other aft. The trailing dragarm would be in the raised position. This arrangement avoids turning at the end of each cut. Each dragarm is to be rigid throughout its length with the dredge pump adjacent to the draghead with the driving motor at the upper end of the ladder. Both dredge pumps would discharge into a common short piece of vertical pipe and branch from there to the distribution pipe on each side of the barge. It is envisioned that the system will work without valves, by installing a control flap in the "y" connection into the vertical pipe. The flow into the barges would be controlled by raising or lowering the distribution pipes. That is, if flow into one barge is desired, the distribution pipe on the other side will be raised until its outflow ceases." a/

---

a/ Long-Range Spoil Disposal Study, Part IV, Substudy 3, Development of New Dredging Equipment and Technique, dated June 1969, U. S. Army Engineer District, Philadelphia, Corps of Engineers, North Atlantic Division.

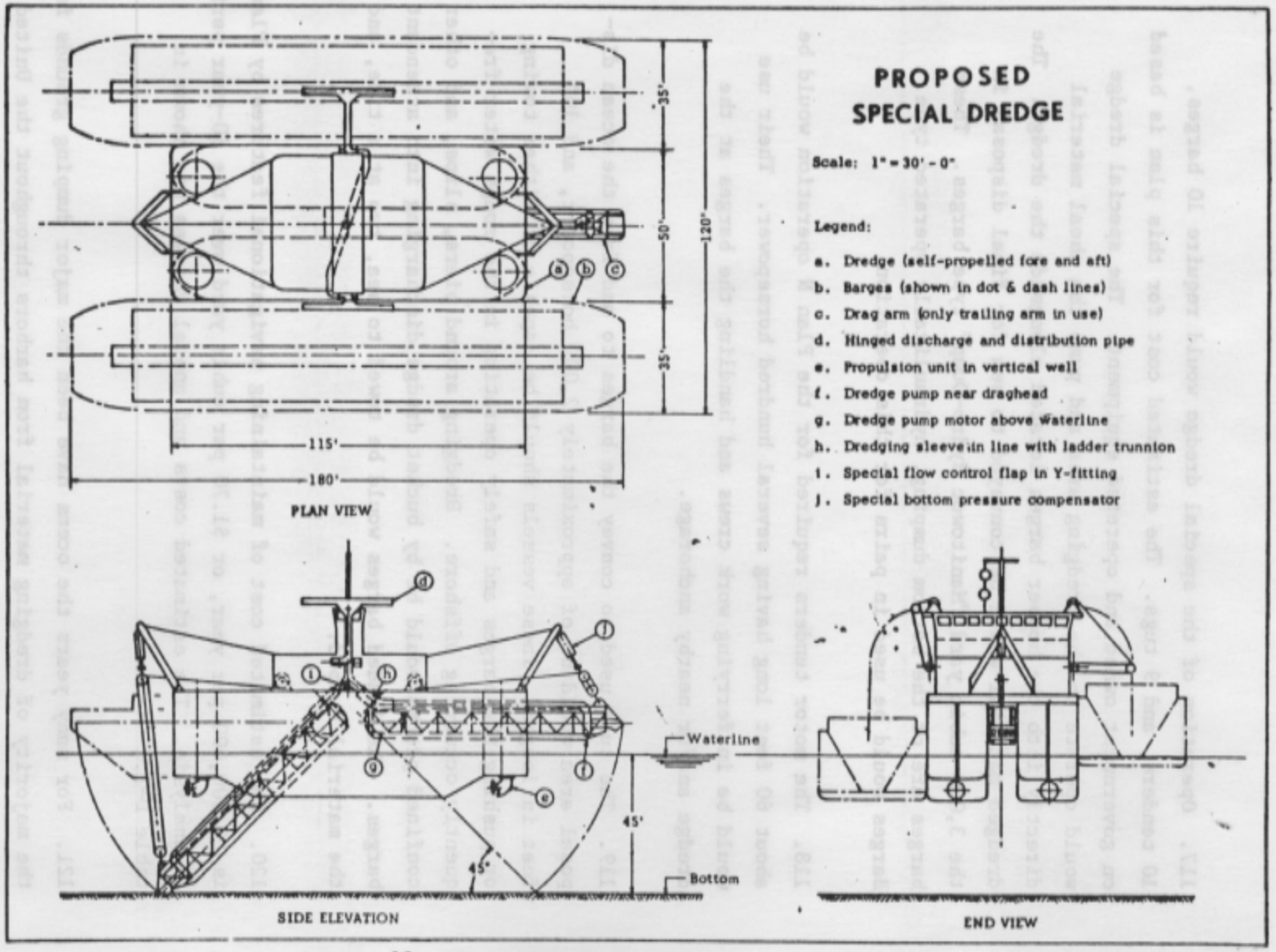


Figure 11 PROPOSED SPECIAL DREDGE

117. Operation of the special dredge would require 10 barges, 10 tenders, and 9 tugs. The estimated cost for this plan is based on government owned and operated equipment. The special dredge would operate in the dredging area and pump the shoal material directly into the hopper barges located alongside the dredge. The dredged material would be conveyed to sea for final disposal in the 3,000 cubic yard "Manitowoc Hydro-Dump" type barges. These barges are of the bottom dumping, hydraulically operated type. Barges would be used in pairs for this operation.

118. The motor tenders required for the Plan N operation would be about 60 feet long having several hundred horsepower. Their use would be in ferrying work crews and handling the barges at the dredge and/or nearby anchorage.

119. The tugs used to convey the barges to and from the ocean disposal area would be of approximately 2,000 horsepower, and 100 feet in length. These vessels should be capable of either towing or pushing the barges and safely operating in the rough water frequently occurring offshore. Dredging around piers, slips, and other confined places would be by bucket dredge discharging into attendant barges. The loaded barges would be towed to sea, two at a time, and the material dumped.

120. The estimated cost of maintaining navigational features by Plan N is $6,500,000 per year, or $1.70 per cubic yard over the 50-year period of analysis. The estimated costs and annual charges are shown in table D-1.

121. For many years the ocens have been the major dumping grounds for the majority of dredging material from harbors throughout the United

States. The environmental impact from such action was not considered. It is common knowledge that the chemical composition of the sea has been changing in time through a process of accepting products from the natural drainage systems entering the oceans, and, more recently, from man's activities. The dredged spoils commonly contain heavy metals that may enter food chains and eventually become more concentrated in the higher trophic levels to eventually become toxic. The results may destroy specific biotic constituents, upsetting food chains and the natural balance. The presence of additional suspended matter and biodegradable materials in offshore areas may have a pronounced effect on water quality. Such activities may drastically reduce the dissolved oxygen concentrations present. Dependent on the areal extent of such oxygen reduction and the time of the year, there would be a considerable influence on the marine animals within this area. The complete extent of such action over an extended time period is unknown, but it certainly would be expected to have a pronounced impact on the life forms that would depend directly or indirectly on this locale or its inhabitants. Current action may also distribute these water masses or the waste materials over the continental shelf to seriously affect coastal habitats and their populations.

PLAN O. DISPOSAL BY TRUCK HAUL TO ABANDONED BORROW PITS

122. This plan involved consideration of reclaiming abandoned borrow pits by using them for disposal areas. Detailed planning, including the preparation of a unit cost estimate, depended upon several basic assumptions. These included (a) that the dredged material would be hauled by trucks, (b) that the material would be loaded on trucks from the existing Craney Island, and (c) that borrow pits would be available within a reasonable (0-25 mile radius)

driving distance from the point of loading to provide capacity for a 50-year project life.

123. By this plan, maintenance of the navigational features would be accomplished as follows: (1) initial removal by current methods -- namely, hopper dredge, hydraulic pipeline dredge, and bucket-scow dredge; (2) temporary storage in a diked harborside rehandling area (a portion of Craney Island Disposal Area); and (3) rehandling which consists of removal from the temporary disposal area to inland disposal areas by truck. The estimated rehandling cost was based on the work being done by contract.

124. It is estimated that maintaining navigational features by this plan would cost $12,300,000 per year or $3.20 per cubic yard over the 50-year period of analysis. The estimated costs and annual charges for Plan 0 are shown in table D-1.

125. This plan is unusually attractive for two reasons. First, it involves the use of existing development, even the reclamation of an otherwise low-value resource, rather than the commitment of additional natural resources. Second, very little, if any, diking or other construction would be required to make the sites operational as disposal areas.

126. The plan has several difficulties of an environmental and operational nature that weigh heavily upon its overall feasibility. First, the possibility of saltwater damage to ground water supplies is much the same as with the Nansemond site. Second, a survey of the area revealed that the capacity of available borrow pits is significantly less (between 5 and 10 years) than the assumed 50-year life. Third, the plan would present serious difficulties from an operational point

of view because of the large number of trucks that would be required. An estimated 1,000 (12 cubic yards) truck loads based on operating on a 16-hour, 6-day week schedule would be utilized to move the annual input of 3.8 million cubic yards. Impacts of this substantial volume of traffic on the condition of existing highway systems, and safety of everyday highway users must be considered detrimental.

PLAN P. INLAND DISPOSAL BY RAIL

127. One method of dredged spoil disposal is by rail haul to a suitable fill site. The idea of solid waste disposal by rail haul has captured the attention of many in recent years. Some promising results from studies have been reported, although the studies have dealt with solid waste in general, which has characteristics substantially different from dredged material. Single point pickup, large quantities, and the fact that no processing is required, all suggest potential economy in an operation of spoil disposal by rail. However, the fluid nature of the material when dredged requires a settling and drying basin. Also to be confronted are (1) location of disposal area, (2) loading, (3) unloading, and (4) the environmental impacts.

128. *LOCATION OF DISPOSAL AREA.* Primary areas being considered for spoil disposal utilizing rail haul are the open pit and strip mining areas of western Virginia and West Virginia. Although there are other type mining operations in the area, the open pit, the area strip, and the contour strip mining areas appear to be the most conducive to disposal of dredged spoil. The extent of area available and the exact locations have not been determined, but for the purpose of this study it is assumed that the area is available in sufficient "fillable" capacity. The open pit type areas appear to offer

the greatest potential for disposal. This type of operation is exemplified by quarries producing limestone, sandstone, marble, and granite. The resulting pits are usually very deep, confined, and free from ground water infiltration.

129. Area strip mining as a specific operation is usually practiced on relatively flat terrain. A trench or "box cut" is made through the overburden to expose the deposit to be removed. As each succeeding parallel cut is made, the overburden is deposited in the cut previously made. The final cut leaves a trench as deep as the overburden, plus the thickness of the ore or mineral removed. Thus, area stripping, unless graded or levelled, usually resembles the corrugations of a gigantic washboard.

130. Contour strip mining is most commonly practiced where deposits occur in rolling or mountainous terrain, as is the case in Appalachia. Basically, this method consists of removing the overburden above the bed by starting at the outcrop and proceeding along the hillside. This type of mining creates a shelf or "bench" on the side of the mountain. On the inside, it is bordered by the high wall which may range from a few feet to perhaps more than 100 feet in height, and on the opposite, or outer side, by a rim below which there is frequently a precipitous downslope that has been covered by spoil material cast down the hillside.

131. *LOADING.* Due to the fluid nature of the spoil material, loading presents a major problem. Rail cars can be obtained to move the material in a fluid nature, but the efficiency of the operation is greatly reduced if the material is not allowed to settle and drain so that it is in at least a semi-dry state. The drying process would

possibly be carried out at the present Craney Island site, but would require most of the 2,500 acres. After discussion with officials of the Norfolk and Western Railway Company, the most feasible means of loading appears to be by a conveyor system. Trains entering Craney Island would be loaded directly, versus double handling. The conveyor system would have to be constructed so as to be readily relocated after the material in a dry area was removed.

132. *TRANSPORTATION.* There are at least four basic alternatives for a rail haul spoil disposal system. They are (1) regular freight train service, (2) dedicated freight train service, (3) rent-a-train, and (4) return haul by unit train. The last appears to be the most suitable to solve the problem at hand. However, utilization of trains returning to West Virginia and western Virginia requires washing of cars after unloading to avoid possible contamination of products, largely coal, being transported to the Hampton Roads Area. This washing, with attendant disposal of residue, may result in an economic situation which would demonstrate that dedicated freight train service would be more feasible. Officials of Norfolk and Western have suggested, for estimating purpose, that a 70-ton car be used, with a maximum of 55 cars per train. Since one cubic yard of material weighs approximately one ton, one unit train will transport about 3,850 cubic yards of spoil. To move the estimated 3.8 million cubic yards annually, about 150 rail cars would have to be loaded and unloaded daily with at least 3 trains per day leaving the loading area.

133. *UNLOADING.* The major elements of the unloading process can be grouped as follows:

- Unloading of rail cars.
- Conveyance to pit and/or strip mine areas.
- Final deposition of spoil.

Implementation of the unloading process depends, of course, upon the state in which the spoil arrives. Operation for a relatively dry material will differ greatly from that in a slurry form. In order to facilitate the unloading process, it is assumed that a railroad trestle will be constructed at the unloading point. Utilization of the trestle will permit bottom dumping of the rail cars either manually or automatically, depending upon which method proves to be the most economical. After unloading, the material will then be transported to the designated mining area. This operation could be carried out by using existing mine trucks if the mine is in operation, or by using a special fleet of trucks if an abandoned mining area is used. The final step of the unloading operation would be the deposition of the spoil material at the site.

134. The open pit type mine would be more suited for disposal than strip mine areas. However, open pit mines are few in number, especially in the Appalachian Mountains, and as such are not given detailed consideration. The area strip mine sites offer a greater potential for disposal than the contour strip mine areas. The last trench left in an area strip mine site would be the primary disposal point with additional area available between the spoil banks. The latter between-banks area lends itself directly to the reclamation operation and would help owners defray their reclamation costs. In a completely different approach, it also might be possible to work abandoned strip mines backwards in order to use the total area to better advantage.

135. *COSTS*. The cost of this method of disposal is dependent upon:

- Method of loading.
- Amount of material to be removed.

- Location of disposal area.
- Type of mining area used.
- Method of unloading.
- Distance between unloading site and final disposal area.

136. A brief discussion of the cost components is presented in the following paragraphs.

137. It is assumed that the existing 2,500-acre Craney Island would be used as a rehandling and drying area for the spoil material. The area could, for example, be divided into four equal parts, thereby leaving three areas for drying while one is in operation. Assuming an excavation depth of five feet, each area will allow for the removal of about 5 million cubic yards which is equivalent to about 1.5 years of maintenance and new work. The conveyor system as contemplated would be constructed so that it could be moved from one drying area to another. It is estimated that the cost of loading at Craney Island would be $0.50 per cubic yard. This cost is quite approximate. The design and construction of the conveyor system may result in a unit loading cost considerably higher.

138. The exact location of the disposal area will have a significant effect on the transportation cost. The cost of rail haul disposal can be finalized only when the exact location of the disposal area and a plan of operation are determined. Officials with Norfolk and Western Railway Company estimate that the cost would be between $2.00 and $2.50 per cubic yard. Assuming that the disposal area will be somewhere in western Virginia, a figure of $2.25 per cubic yard appears to be appropriate.

139. The method of unloading, the distance to the unloading point, and the type area used for disposal can all have a significant effect on the total unit cost. It is assumed that the unloading can be carried out by personnel at the mining area, the haul distance is relatively short, existing mine trucks are available for use, and sufficient disposal capacity is available in area strip mines. Using the above assumptions, it is estimated that unloading and ultimate disposal of the spoil material will cost in the order of $0.40 per cubic yard.

140. The total unit cost for rail haul is estimated as follows:

Item	Cubic Yards ($)
a. Dredging spoil from channel and depositing in Craney Island	1.00
b. Loading spoil material onto railroad cars	0.40
c. Freight rate to western Virginia	2.30
d. Unloading material into mines	0.40
Total	$4.10

Thus, the annual cost of maintenance dredging only would be ($3,800,000 c.y. x $4.10/c.y.) $16,000,000 compared to the least costly alternative plans presented in table D-1 as having total costs of $1.20 per cubic yard. The estimated cost and annual charges of this plan are also shown in table D-1.

141. *ENVIRONMENTAL FACTORS.* Regardless of the location of the fill site, there are several environmental factors associated with rail

haul disposal which must be reconciled prior to its implementation. Some of the more pertinent environmental factors are discussed in the following paragraphs.

142. The placement of dried dredge spoils in mined areas would involve the loss of some scrub vegetation and the fauna that have entered these areas from adjacent regions. The loss of these resources is slight when compared with the impact on the prevailing life forms which resulted in the original strip mining operations. Filling the excavation would provide the first step in returning the devastated areas to their original state.

143. Ground water resources and the local watershed at the spoil fill site can easily be jeopardized by the percolation of dissolved salts from the spoil material into the underlying strata. In addition to dissolved salts, other pollutants such as heavy metals may also become part of the leachate which in turn could contribute to the contamination of local water resources. The rate and direction which the leachate will flow through the underlying strata are questions which must be answered before the total environmental impact of such an operation can be determined. Similarly, the quality of the spoil materials must be carefully analyzed prior to determining their impact on the environment at the fill site.

144. An additional consideration associated with the placement of dredge spoil in a surface-mined area is the freshwater runoff and its impact on the surrounding surface water resources. Sediment-laden runoff will invariably increase the sediment load in nearby rivers, ultimately affecting the biological productivity and carrying capacity of these rivers. Turbidity increases will also indirectly cost the taxpayers more to arrest erosion and to remove sediments from the rivers for both flood protection and navigation purposes.

145. A final consideration, should this alternative be adopted, is the requirement for a settling and drying basin at Craney Island so that the spoil materials could partially consolidate and dry prior to their being loaded onto train cars. This intermediate step, while continuing the aesthetic nuisance, would also preclude the commercial and/or industrial development of the present Craney Island site.

146. In summary, there appear to be several environmental factors associated with rail haul disposal which make its selection as an alternative method of disposal questionable not only from an environmental standpoint but from an economic standpoint as well. Regardless of the final outcome, the selection of a replacement facility should be made only after studies have been completed which will determine the impact of the disposal site on the surrounding environment.

NO IMPROVEMENT ALTERNATIVE

147. Over the years, the Port of Hampton Roads has provided a warm-water port which has been vital to the successful operation of maritime trade in Virginia. The port has developed into the second largest port on the East Coast since the first Federal project for systematic improvement was adopted by Congress in 1876. Port facilities have developed to an extent that there are now 126 piers and 227 berths available for use in the Hampton Roads area.

148. About 90 percent of the oceangoing coal exports move through Hampton Roads, the largest coal-handling complex in the world. The quantity of coal exported from Hampton Roads in 1971 was in excess of 33 million tons with a market value of over $600 million. Other commodities exported were in excess of 3 million tons with a market

value of nearly $1.3 billion. The imports moving through Hampton Roads in 1971 were 9.8 million tons with a market value of $838 million. This movement of commodities, both imports and exports, not only provides an economic livelihood for persons in Virginia, West Virginia, and Kentucky but is also an important entity in the balance of trade for the United States.

149. In addition to the tremendous movement of commerce in Hampton Roads, it also contains the world's largest naval complex. The economic well-being of the area, indeed the nation's security, is highly dependent upon this military complex.

150. The existing project depth for the major channels in Hampton Roads is 45 feet. The present trend is the utilization of larger vessels to more economically carry larger cargoes. This trend has been realized in Hampton Roads by vessels taking advantage of the entire 45-foot depth and in some instances the increase in depth due to the rise in tidal elevations. Therefore, any decrease in project depths in the area would curtail the present transportation patterns. The average shoaling rate in major channels serving Hampton Roads is estimated at 0.8 feet per year. Should this shoaling continue without maintenance, only a matter of several years would pass before a majority of the vessels leaving the harbor would be severely hampered by diminished channel depths. In the eyes of shippers, manufacturers, and all who are concerned with maintaining a healthy economic climate in Hampton Roads, such an occurrence would only be viewed as catastrophic. Undoubtedly, the vital exports of coal would soon be curtailed -- later eliminated. Not only coal but other commodities would be likewise affected.

SUMMARY OF ALTERNATIVE PLANS CONSIDERED

151. The ability of 17 spoil disposal plans to favorably respond to problems and needs outlined in section C has been discussed in the preceding paragraphs. A brief description of each plan has indicated a wide variance in terms of estimated total cost, length of useful life, and environmental impact. The following tables compare the various plans and present a summary of the major features of each plan.

Table D-1. SUMMARY OF PROJECT AND COST DATA OF VARIOUS ALTERNATIVE AREAS FOR FUTURE DISPOSAL

Item	A Raise existing levee	B Westward extension	C Westward extension raised	D Willoughby Bay	E Ocean View area	F Hampton Flats	G Ragged Island	H Buckroe Beach	I Chesapeake Bay
PROJECT DATA									
Elevation, ft., m.s.l.									
Initial	+17	- 8	+17	-10	-24	-11	+ 3	-14	-28
Ultimate	+29	+17	+26	+17	+17	+17	+17	+17	+17
Area, acres	2,500	2,380	2,380	1,280	4,500	1,800	2,320	6,100	2,980
Capacity, million cubic yards	42	115	46	60	301	90	64	340	216
Levee length, ft.	36,000	31,000	36,000	15,000	60,000	43,000	64,000	63,000	48,000
Useful life, yrs @ 3.8 million cubic yards per year	11	30	12	16	79	24	17	89	57
PROJECT COST ($1,000)									
Initial investment	-	12,500	-	12,600	60,800	27,300	13,600	59,300	83,100
Annual charges	400	1,200	400	1,400	4,200	2,500	1,600	4,100	5,500
Annual dredging cost	3,600	3,600	3,600	4,100	4,200	4,700	5,400	6,300	6,000
Total annual charges	4,000	4,800	4,000	5,500	8,400	7,200	7,000	10,400	11,500
Cost per cubic yard	$1.05	$1.30	$1.05	$1.40	$2.20	$1.90	$1.80	$2.70	$3.00

Table D-1. SUMMARY OF PROJECT AND COST DATA OF VARIOUS ALTERNATIVE AREAS FOR FUTURE DISPOSAL (Cont'd)

Item	J Nansemond County	K Sea, by hopper dredge, tug, and scow	L Sea, barging from Craney Island	M Pipeline to sea	N Sea, by special dredge, tug and scow	O Truck haul to abandoned borrow pits	P Inland disposal by rail haul
PROJECT DATA							
Elevation, ft., m.s.l.							
Initial	+20	-	-	-	-	-	-
Ultimate	+27	-	-	-	-	-	-
Area, acres	5,000	-	-	-	-	-	-
Capacity, million cubic yards	240	240	240	240	240	240	240
Levee length, ft.	58,000	-	-	-	-	-	-
Useful life, yrs @ 3.8 million cubic yards per year	63	50	50	50	50	50	50
PROJECT COST ($1,000)							
Initial investment	26,300	(a)	(b)	52,500	20,400	(d)	(e)
Annual charges	4,700	7,500	9,900	6,400	1,500	8,700	15,100
Annual dredging cost	3,600	3,600	4,600	3,600	5,000	3,600	4,600
Total annual charges	8,300	11,100	11,500	10,000	6,500	12,300	19,700
Cost per cubic yard	$2.20	$2.90	$3.00	$2.60	$1.70	$3.20	$4.10

(a) Cost based on existing unit price (Cost/c.y.) of Corps' hopper dredge and contractor's unit price for tug and scow.
(b) Cost based on existing price to Craney Island plus contractor's unit price for barging.
(c) Includes interest and amortization on required initial investment plus annual charges on replacements.
(d) Cost based on existing price to Craney Island plus contractor's unit price for truck haul.
(e) Cost based on existing price to Craney Island plus expected contractor's price for loading, transportation and final disposition.

Table D-2. ALTERNATIVE PLANS CONSIDERED

Plan	Advantages	Disadvantages	Action
Raising levees	Cost, environmental features, accessibility.	Short useful life.	Further consideration and study.
Westward extension	Cost, environmental features, accessibility.	Loss of open water space, aesthetics, decrease in surrounding property values.	Further consideration and study.
Westward extension raised	Cost, environmental advantages, accessibility.	Short useful life, aesthetics.	Further consideration and study.
Willoughby Bay	Cost, accessibility.	Short useful life, preclude extensive recreational use, destroy small boat harbor, aesthetics.	No further consideration.
Ocean View area	Accessibility, useful life.	Cost, aesthetics, construction difficulties.	No further consideration.
Hampton Flats	Accessibility.	Cost, destroy fishery resources, possible adverse effects on natural current patterns to cause shore erosion.	No further consideration.
Ragged Island	Cost.	Short useful life, destruction of natural wetlands area.	No further consideration.

Table D-2. ALTERNATIVE PLANS CONSIDERED (Cont'd)

Plan	Advantages	Disadvantages	Action
Horseshoe area off Buckroe Beach	Use life.	Destroy native fishery resources, partial redistribution of Chesapeake Bay current patterns.	Further consideration and study.
Chesapeake Bay	Useful life, accessibility	Excessive cost, possible damage or destruction to marine environment.	Further consideration (a)
Nansemond County	Cost, useful life.	Environmental features, possible damage to ground water aquifer.	Further consideration and study.
Disposal at sea, Plans J, K, L, M	Cost, useful life.	Accessibility, possible damage to ocean environment.	Further consideration and study.
Truck haul - abandoned borrow pits	Reclamation of natural resource.	Cost, short useful life, possible ground water damage by salt water seepage, traffic congestion.	No further consideration.
Inland disposal - rail haul	Reclamation of natural resource.	Excessive cost, possible ground water damage by salt water seepage.	No further consideration.
Do nothing	Cost, no commitment of resources.	Stifle harbor development, adverse economic effect on region, state, and nation.	No further consideration.

(a) The Chesapeake Bay site was originally rejected because of cost considerations. Like the Buckroe site, Chesapeake Bay site would need model testing. At the request of the Commonwealth of Virginia, this area was retained for detailed study.

152. On the basis of previous discussions and the comparison of major features, it is concluded that 10 of the 17 alternatives have sufficient potential to receive additional study. These plans are as follows:

- Raising levees at existing disposal area.
- Westward extension of existing disposal area.
- Westward extension raised.
- Horseshoe area off Buckroe Beach.
- Chesapeake Bay.
- Nansemond County.
- Disposal at sea (4 variations).

The remaining eight plans were not selected for further study because of excessive cost or potentially severe and irreparable environmental impact. These plans are as follows:

- Willoughby Bay.
- Ocean View area.
- Hampton Flats.
- Ragged Island.
- Truck haul to abandoned borrow pits.

- Inland disposal by rail haul.
- Do nothing.

The further study of alternatives has been narrowed in scope and is thus concerned with the 10 plans mentioned previously. Of these, the plans for a westward extension and later raising the elevation of a westward extension are combined.

Factors Associated With Plan Selection

RATE OF FILLING

153. Section C, Problems and Needs, presented information relative to the projected rate of annual maintenance in Hampton Roads. It concluded that, on an average 3.8 million cubic yards of spoil will be removed from the channels in Hampton Roads annually, and require confined deposition. Additional information was presented which indicated that implementation of a 55-foot channel project in Hampton Roads would generate some 81 million cubic yards of "new work" spoil. Because of these increased channel dimensions, an increase in the level of required maintenance could be expected. This would amount to an estimated 1.4 million cubic yards per year for 40 years, or a total of 56 million cubic yards. These three quantities were the basis for sizing the "life" of alternatives considered in detail. The certainty of required disposal for some 3.8 million cubic yards of maintenance material is a real one. At a minimum, the selected plan of disposal should definitely anticipate this amount of material.

The remaining quantities of estimated "new work" and "new work maintenance" are certainly valid considerations for long-range planning, and should be included in any long-range disposal plan for Hampton Roads.

USEFUL LIFE

154. Review of the nine (ten reduced to nine) alternatives selected for further study indicated a wide disparity in useful project lives. Based on annual deposition of 3.8 million cubic yards, these ranged from (a) raising levees, 11 years; (b) westward extension raised, 42 years; (c) Chesapeake Bay, 57 years; (d) Nansemond County, 63 years; (e) Horseshoe area off Buckroe Beach, 89 years; (f) ocean disposal, unrestricted (4 variations).

155. Without doubt, the question of how long the plan will last is of the utmost importance. Normally, navigation projects have a planning horizon (useful life) of 50 years. This fact would logically indicate that a plan for disposal be likewise structured. For this reason, however, an equivalent comparison between the various disposal plans mentioned cannot be accomplished since one project with a 20-year life is simply not equal to another with a life of 30 years. Thus, the logic used to select one plan over another cannot be grounded in the question of useful life, unless these lives are equivalent. The implementation of a 50-year project life in the further study of alternatives would necessitate that (a) all plans with lives of less than 50 years be eliminated, or (b) combinations of the various plans be evaluated, with each combination possessing a useful life of at least 50 years. Further discussions will identify several combinations which are possible. However, it should be reiterated that the pressing need for

disposal capacity will be realized in 1979, when the current Craney Island project is filled. At that time, continued maintenance dredging at an annual rate of 3.8 million cubic yards will be contingent entirely upon the selection of a replacement for the current plan. Granted, additional deepening of channels and anchorages, and the generation of additional material to be disposed is also a valid consideration. Realistically, the full impact of additional deepening would not likely be felt in a disposal area until the mid to late 1980's or later. Therefore, the selection of a recommended plan will be guided by the more critical needs of continued maintenance in the harbor, while the various plans selected for more study will be sensitized to an input by "new work," contingent entirely upon the selection of a replacement for the current plan.

156. The following table indicates the impact which the lump sum placement of all "new work" and "new work maintenance" would have on the eight plans. The total new work quantities involved amount to 137 million cubic yards (81 new work + 56 increased maintenance).

Table D-3. IMPACT OF NEW WORK ON ALTERNATIVES

Plan	Capacity (million cubic yards)	Useful life @ 3.8 million per year	Useful life @ 3.8 million per year plus 137 million, lump sum
Raise levees	42	11	(a)
Westward extension raised	161	42	6
Buckroe Beach	340	89	53
Chesapeake Bay	216	57	21
Nansemond County	240	63	27
Sea (all)	unrestricted	unrestricted	unrestricted

(a) This plan would not have sufficient capacity to accommodate total input of "new work."

ECONOMICS

157. In this study, economic considerations as a tool for comparing alternatives consist of two elements. These are (a) initial construction cost and (b) unit operating cost. Initial construction costs include the costs of rights-of-way and site acquisition, levee or other containment construction, and appurtenant equipment at the disposal site. Unit operating costs include the costs of dredging, transportation, pumpout, and maintenance converted to a "per cubic yard" basis. Project first costs are amortized for the expected useful life of the project, thence converted to a per unit basis. Thus, the two unit costs can be combined to arrive at an equitable, economic basis to compare plans.

ENVIRONMENTAL IMPACT

158. In its simplest character, this project is an environmental project. It involves the artificial removal of a resource (bottom sediments), artificial transport of this resource, and the placement of the resource in an area whose composition will most likely be unlike that from which the sediment was removed. The cycle is one of man-imposed environmental changes. It is certain that environmental impacts are associated with the action of dredging. In this study, however, the method of dredging (and associated environmental impact) would not noticeably vary with the selected plan of disposal. Consequently, such impacts were not used to compare alternatives and select a plan.

159. The environmental variables which are pertinent elements of plan comparison are those relating to the area to receive the material, and the impact that deposition thereon would have. If a diversion of environmental values and potential impacts were sought, there would likely

be two considerations. These are (a) environmental resources which would be immediately destroyed or damaged by actual construction, and (b) environmental resources which would be damaged, destroyed, or replaced as a result of gradual spoil deposition.

PUBLIC SENTIMENT AND SOCIAL IMPACTS

160. In the search for a necessary means of disposing of material dredged from the channels in Hampton Roads, the pertinent questions are not "if," but "how" and "where." Compounding the usual problems in a study of this type is the prevailing, yet understandable public sentiment which opposes, for one reason or another, the selection of any specific location or plan. At the same time, this sentiment is demanding that an acceptable plan of disposal be located -- to maintain project channel depths, to continue the area's vital defense and commerce activities, and to stimulate a healthy economy. Maintaining the search until a plan acceptable to all interests is located would be futile. Since every alternative involves impacts on the social environment, objections from the parties affected are a real certainty. This is not to say that public sentiment is of little or no value. Quite the contrary.

161. As stated, the objectives of this study has been to locate a plan which maximizes benefits to be received by the general public, yet minimizes the necessary commitment of economic and environmental resources, and considers the social impacts of each alternative. Public sentiment has been a valuable tool in assessing the location, extent, and value of economic and environmental resources. Probably its greatest value, however, has been gauging social impacts.

Table D-4. COMPARISON OF COMBINATIONS (a)

Combination Plan	Total Capacity (cubic yards)	Useful life (years)
Raise Craney Island, westward extension raised, Buckroe Beach	543	107
Raise Craney Island, westward extension raised, Nansemond site	443	81
Raise Craney Island, Buckroe Beach	382	64
Raise Craney Island, Chesapeake Bay	258	32
Nansemond, Chesapeake Bay	456	84
Raise Craney Island, westward extension raised, Chesapeake	419	74
Raise Craney Island, Nansemond site	282	38
Westward extension raised, Nansemond site	401	69
Westward extension raised, Buckroe Beach	501	96

(a) The list is not exhaustive, but developed for comparative purposes only.

Selecting a Plan

162. The selection of a long-range plan to meet dredge disposal needs in Hampton Roads must consider the impact of continuing annual maintenance, together with the input from prospective new work. This implies an area in the capacity range of 325 million cubic yards over a 50-year life. Of the nine plans remaining at this point, only five of these have such capacity. Four of the five involve disposal at sea, which is not currently allowed according to Environmental Protection Agency guidelines. Disposal at sea should not be eliminated from consideration, since the EPA guidelines are subject to reevaluation and change. Such change in the favor of more ocean disposal could easily redirect the complexion of all future disposal activities in Hampton Roads. The fifth plan, Buckroe, has not been model tested, and will not be so tested until the Chesapeake Bay model is completed in 1977 or later.

163. By using combinations of the nine plans, it is possible to develop "systems" which provide the necessary capacity and useful life to be truly labeled a "long-range plan." In certain cases, a long-range plan may be somewhat less than the 50-year objectives stated. Table D-4 indicates the capacity and useful lives of several long-range combinations. Combinations involving sea disposal were not listed, since sea disposal would always provide an unrestricted life, and negate the effective capacity of limited capacity plans. Also, combinations involving the westward extension without raising, are omitted. The table reflects the possibilities from the standpoint of capacity and useful life, of a limited number of combinations.

164. Unanswered questions still remain with several of the basic alternatives, and in turn, with any combinations of these. Additional

investigation and evaluation of these questions will be required to facilitate selection of a long-range plan, which would achieve the survey objectives, and favorably respond to a majority of the formulation criteria. Table D-5 lists each of the basic alternatives and the major areas of additional study needed.

Table D-5. ALTERNATIVES -- ADDITIONAL STUDY NEEDED

Alternative	Studies recommended	Estimated cost
Westward extension raised	Social impact analysis, economic impact of plan on adjacent area (city of Portsmouth), foundation investigations, detailed environmental investigations, public involvement.	$ 620,000
Buckroe Beach	Model testing, social impact analysis, economic impact on adjacent area (city of Hampton), foundation investigations, detailed environmental investigations, public involvement.	650,000
Nansemond site	Advanced hydro-geologic study, social impact analysis, economic impact studies, biological impact analysis, public involvement.	330,000
Chesapeake Bay	Model testing, social impact analysis, foundation investigations, detailed environmental investigations, detailed environmental investigations, public involvement.	630,000
Ocean disposal	Economic impacts, detailed environmental testing and analysis of several disposal sites, design of new equipment, public involvement, federal/state/local agency coordination.	1,770,000
TOTAL		$4,000,000

SUMMARY

165. Each of the nine plans has been evaluated for responsiveness to stated objectives and formulation criteria. Eight of these plans have need of several additional studies prior to possible

selection as a long-range replacement for the Craney Island Disposal Area. Combinations of these plans may be possible. However, the same needs for further study would exist if a combination plan were selected. An eighth plan, raise the elevation of levees at the existing Craney Island, has need of only one additional study, i.e., a social impact analysis. However, the social impacts of raising levees would be relatively minor in relation to the expected impacts of the other plans to be studied. This plan has been recognized as possessing the least environmental impact of the eight considered in detail. It is the most favorable plan of the eight from an economic efficiency point of view. However, the plan is not sensitive to the long-range disposal needs in Hampton Roads. It would last for 11 years, based on the existing rate of annual maintenance. Accomplishing the necessary additional studies on the remaining eight would facilitate the selection of a plan which is sensitive to these needs.

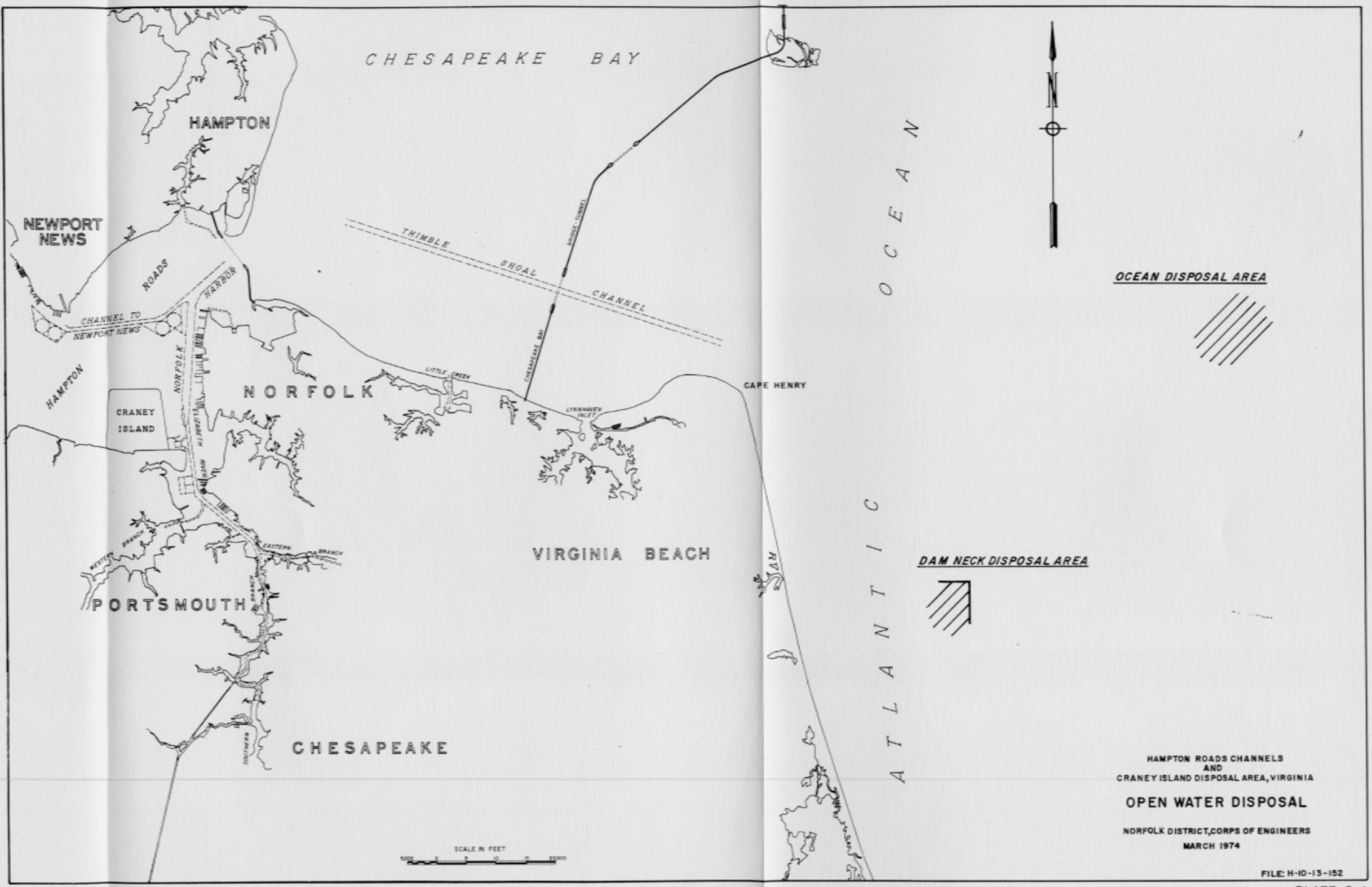
166. It is concluded that the selected plan for replacement of Craney Island Disposal Area should be the following:

- Part 1 -- Gradually raising the elevation of containment levees at the existing Craney Island from elevation +17 feet m.s.l. to +29 feet m.s.l.

- Part 2 -- Accomplishing additional studies on eight alternatives for dredge material disposal. These studies would be conducted during Phase 1 of the recommended action plan (item above) and permit development of a long-range plan of disposal.

167. The recommendation for gradually raising levees at the existing site would provide some 11 years of disposal capacity for the maintenance efforts in Hampton Roads. The useful life of Craney Island

Disposal Area would be extended from 1979 to around 1990-91. The recommendation for additional studies during Phase 1 investigations would lead to a plan to provide a further replacement when the elevated site is filled. This later disposal plan would be sensitive to dredge disposal needs of maintenance and foreseeable new work well into the twentieth century.



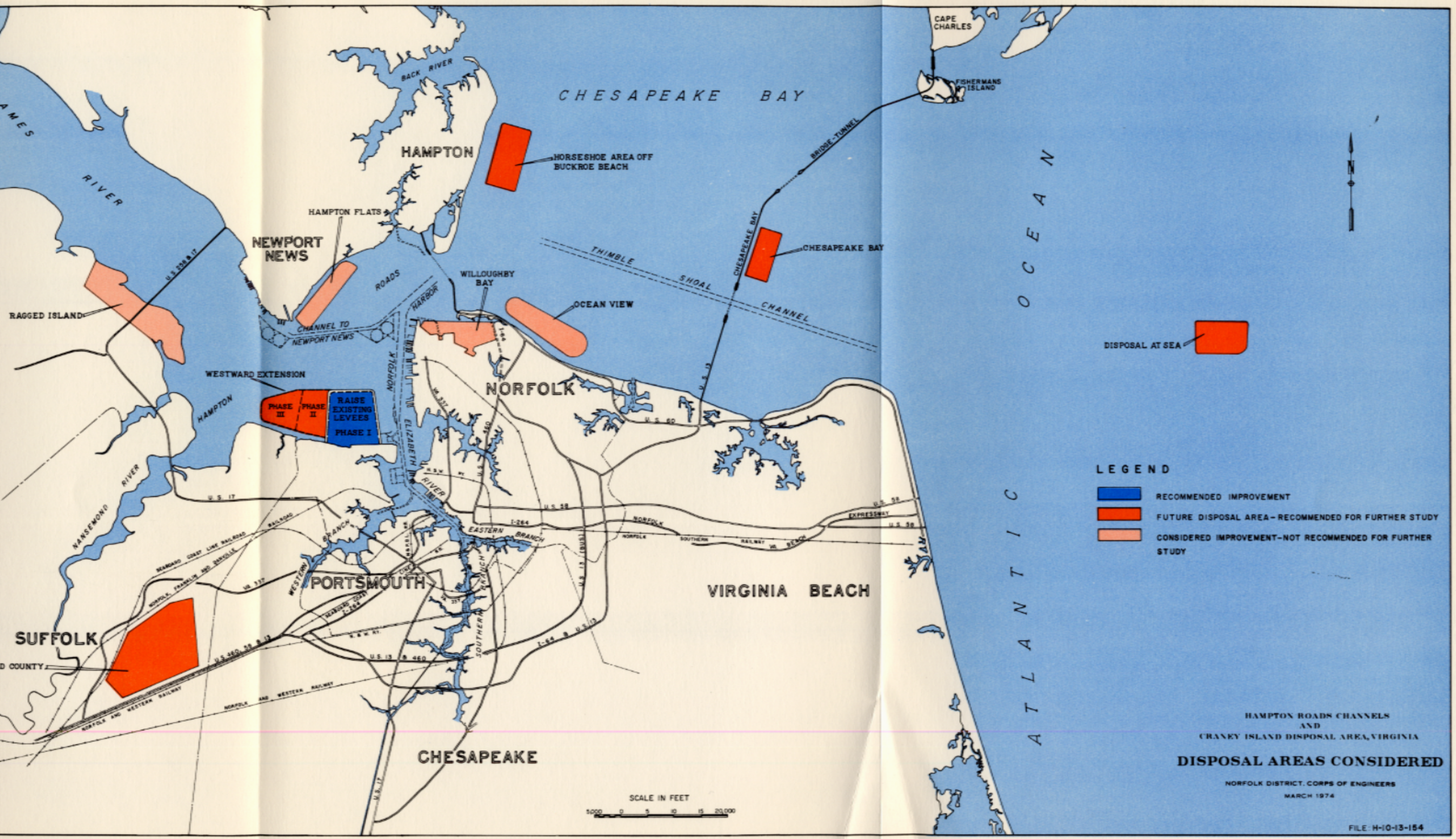
HAMPTON ROADS CHANNELS
AND
CRANEY ISLAND DISPOSAL AREA, VIRGINIA

OPEN WATER DISPOSAL

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 1974

FILE: H-10-13-152

PLATE D-1



HAMPTON ROADS CHANNELS
AND
CRANEY ISLAND DISPOSAL AREA, VIRGINIA

DISPOSAL AREAS CONSIDERED

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 1974

FILE: H-10-13-154

PLATE D-2

SECTION E

THE SELECTED PLAN

THE SELECTED PLAN

TABLE OF CONTENTS

LIST OF PLATES

SECTION E.

THE SELECTED PLAN

1. This section of Appendix 1 describes the plan of improvement selected in the previous section on formulation. The description goes beyond a routine discussion of plan elements and structures; it strives to present all the meaningful effects of the selected plan, both favorable and unfavorable. It also presents significant information on design, construction, operation, and maintenance as required for a reasonable understanding of the technical aspects of the plan. Economic information is presented in a subsequent section.

Plan Description

2. Among all alternatives considered, part 1 of the selected plan was determined to be the most responsive to the immediate need for future disposal from an economic, social, and environmental standpoint. The plan provides for the continued use of the Craney Island Disposal Area by raising the existing levees. Such action would provide eleven additional years of capacity. Thus, the useful life of Craney Island may be extended to 1990, based on the current rate of dredged material deposition into the area.

3. Craney Island Disposal Area would be filled to its current design elevation of approximately 17 feet above mean sea level which, at the present rate of dredged material deposition will be accomplished in 1979. When this stage of the Craney Island project is reached, a portion of the disposal area would be further filled by initially

shifting the location of the confining levees inland a distance of 1,000 feet. From this point, these levees would be gradually raised to an elevation of 29 feet above mean sea level, and would provide an area with an ultimate disposal capacity of about 42 million cubic yards. This estimate of capacity includes an allowance of 3 feet for settlement.

4. Along the east and north levees, the 1,000-foot strip of property to be left at elevation +17 feet m.s.l. would be available for other concurrent uses. Several easements across and around this area would be required to facilitate pumpout from the rehandling basin, and construction of the interior levees. Land along the west levee would not be available, as possible construction of the westward extension alternative would forego use of this area.

5. An additional feature of the selected plan (Part 2) is the further analysis and study of eight alternatives considered in the formulation process. These plans are:

- Westward extension of the Craney Island Disposal Area.
- An inland site in the city of Suffolk (formerly Nansemond County site).
- The lower Chesapeake Bay site known as Horseshoe Area off Buckroe Beach.
- A lower Chesapeake Bay site located east of the Chesapeake Bay Bridge Tunnel.
- Disposal at sea (4 variations).

6. Pending completion of the further studies of these plans, one site could be selected. This site will be a long-range plan, capable of accommodating the current quantity of dredge material generated by maintenance dredging for a period of at least 40 years. This plan will also have sufficient capacity to accommodate all material generated by foreseeable new work dredging of channels and anchorages in the harbor. Also, the need for additional capacity generated by maintenance of the deepened channels and anchorages will be accommodated by the plan to be selected.

7. Further study of the eight alternatives mentioned is needed primarily for the following reasons.

- The two sites in lower Chesapeake Bay should be model tested. The Chesapeake Bay Model would permit this testing. However, this model will not be completed until at least 1977.

- Detailed socioeconomic impact studies are needed for each of the eight plans. To date, such studies have been of a preliminary assessment nature, and have not been explored in the detail needed for sound plan formulation.

8. Other areas of concern during the additional studies recommended will include:

- The problem of ground water contamination by saltwater intrusion at the Nansemond site.

- The location and extent of pollutants in the channel and anchorages to be dredged.

- Additional testing and analysis into the alternatives of disposal at sea.

8a. Additional investigations in connection with Part 2 of the selected plan would be in the depth and detail necessary to evaluate effects, make trade offs, and select the best long-range plan. These would include detailed technical and environmental investigations of open-water disposal. Model tests of all offshore sites would be accomplished, as would detailed studies of socioeconomic impacts associated with siting a disposal area in a particular location. Other investigations would be conducted as needed. The ultimate selection of one area will cause irreversible impacts and substantive commitments of finite natural resources in the study area. No matter which location is eventually selected, serious and determined objections will likely occur. The objections will likely lead to challenges of the rationale for the plan formulation and selection process. Therein lies the critical need for the additional investigations recommended; i.e., the need to fully evaluate all impacts before selecting one particular plan.

9. The further detailed discussions of this section and the report will concentrate on features of the selected plan to increase the capacity of Craney Island Disposal Area.

Evaluated Accomplishments

10. Four accomplishments will result from the proposed plan. They are:

(1) Provision of a confined area for the future disposal of polluted material generated in maintenance of existing channels and anchorages, permit dredging activities, and dredging by the U. S. Navy.

(2) Provision of approximately 400 acres of property, accessible by deep water.

(3) Ultimate provision of approximately 2,000 acres of vacant property in the center of a core metropolitan area.

(4) Provision of a means whereby a long-range disposal area plan can be selected for the Port of Hampton Roads.

11. Hampton Roads, including the Ports of Norfolk, Portsmouth, Chesapeake, Newport News, and Hampton, comprises Virginia's greatest port complex. Deep-draft navigation has long been a key stimulus to its commercial, agricultural, and industrial development. Domestic and foreign commerce in the port amounted to slightly over 71 million tons in 1970. The movement of this volume of waterborne commerce, together with the presence of major naval facilities, has made Hampton Roads one of the nation's leading ports. In fact, it is by far the largest port exporting bituminous coal from the United States. For this maritime economy to grow and accommodate the diversified needs, the deep-draft channels in Hampton Roads must be maintained. In this connection, an adequate confined disposal area for future dredging operations must be provided. The selected plan will serve this need for the immediate future and, ultimately, for the long term.

Effect on the Environment

12. As the initial and immediate action phase of the selected plan, raising the existing levees would cause only a minimal adverse effect on the surrounding biological communities. As previously stated, life is sparse on the existing levees whose brief period of existence combined with the continual activity of levee construction have not been conducive to biotic development. Animal life is predominated by the gulls and other shore birds common to the Hampton Roads area. Evidence of the presence of a variety of small mammals, but in low concentration, has been noted. These forms, such as the rodents, gain access to Craney Island easily from the adjacent fields near the levee site. The gradual addition of more material with the subsequent burial and increased height of the present levees should have no major impact on the present environment.

Design

13. The site for the initial and immediate action phase of the selected plan is located on the existing Craney Island Disposal Area. The project would consist of an interior retaining levee, approximately 36,000 feet in length and 12 feet in height, paralleling the existing boundary limits and located within the confines of the disposal area. The resulting project would encompass an area of approximately 2,500 acres and have a capacity of approximately 42,000,000 cubic yards. This includes an allowance for a combined consolidation of 3 feet in the spoil material and the underlying marine clay foundation, based on experience with settlement in the existing site.

14. Before construction of the proposed levees to elevation +29 feet m.s.l., the already authorized +17 feet m.s.l. project limits would be relocated to a stable alignment. This new alignment would be located inland a distance not less than 250 feet from the centerline of the existing perimeter road. The slope approaching the +17 feet m.s.l. fill could be constructed in either benched increments, 25 horizontal and 3 vertical, or a uniform slope approximately 1 on 8. This relocation would apply to the north, east, and west levees.

15. After relocation of the +17 feet m.s.l. levees, interior retaining levees could be constructed to elevation +29 feet m.s.l. and encompass the entire perimeter area, including the southern end of the existing disposal area. The centerline of the proposed levees would be located about 1,000 feet inland from the existing exterior levees paralleling the north, east, and west levees. The proposed retaining levee would also parallel the southern limits of the existing disposal area, maintaining a line with the present boundary of the disposal area.

16. The feature of levee relocation was based on concerns for the stability of an elevated site. Major determinants in this regard were the maximum elevation to which the site could be raised and the inland distance which the higher levees would be shifted. Initial testing indicated that elevation +29 feet m.s.l. was the maximum height to which the area could safely be raised. Later explorations of the site were conducted to locate and test a stable and safe levee alignment for an elevated area at +29 feet. These tests indicated that relocation of interior retaining levees a distance of at least 750 feet from the centerline of existing perimeter levees would provide the desired stability. Additional inland relocation would increase the stability factor. Accordingly, the decision was reached to recommend relocation of the east, north, and west levees a distance of 1,000 feet inland, prior to increasing their elevation to +29 feet m.s.l.

Construction

17. Assuming authorization and funds availability, relocating and elevating the levees would be a gradual action, to be accomplished over the project's estimated 11-year life. Obtaining construction materials should present no major problem since existing dredged material would be used to construct the interior levees. Such construction would be contingent upon an on-site selection of select fill.

Operation and Maintenance

18. Like the existing Craney Island Disposal Area, operation and maintenance of the elevated disposal area would be under the supervision of the District Engineer. Utilization of the area would be coordinated with the dredging requirements of the district, local interests, and other government agencies. The estimated annual operation and maintenance costs associated with the proposed improvement are presented in a subsequent section of this Technical Appendix. It should be noted, however, that even though the Corps would supervise the operation and maintenance of the facility, the Federal Government would only fund the operation portion. Operation of the facility would include coordinating and scheduling disposal permits, controlling daily water surface elevations within the disposal area, operating and maintaining the mooring facility for Corps dredges, planning equipment rental, and managing all accounts associated with the project. Maintenance funds, as well as those funds required for construction of the interior levees, would be the financial responsibility of local interests.

19. Users of the disposal area, other than the Commonwealth of Virginia and the Corps of Engineers, would be charged a fee for deposition of spoil. Two fees would be levied, both based on the relative capacity of the site which private dredgers use. The first fee would be for recovery of the initial investment and maintenance by the state, while the second would be to cover operation costs of the Corps.

HAMPTON ROADS

RECOMMENDED

Raise Existing Levees to Elev. 29' msl

RAISE EXISTING LEVEES

1000'

750'

250'

N

NORFOLK HARBOR

ELIZABETH RIVER

NORFOLK

SPUR LEVEE

REHANDLING BASIN

CRANEY ISLAND

NANSEMOND RIVER

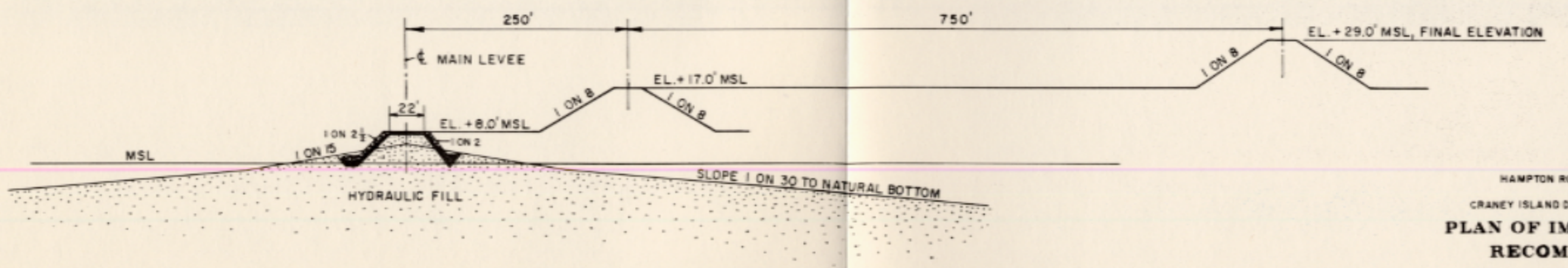
SUFFOLK

PORTSMOUTH

CRANEY ISLAND CREEK

SCALE IN FEET

1000 0 1000 3000 5000



TYPICAL SECTION THROUGH LEVEE

SCALE: NONE

HAMPTON ROADS CHANNELS AND CRANEY ISLAND DISPOSAL AREA, VIRGINIA

PLAN OF IMPROVEMENT RECOMMENDED

NORFOLK DISTRICT, CORPS OF ENGINEERS

MARCH 1974

FILE: H-10-13-146

PLATE E-1

CAPE CHARLES

FISHERMANS ISLAND

CHESAPEAKE BAY

BACK RIVER

HAMPTON

HORSESHOE AREA OFF BUCKROE BEACH

BRIDGE-TUNNEL

CHESAPEAKE BAY

CHESAPEAKE BAY

THIMBLE SHOAL CHANNEL

OCEAN

ATLANTIC

DISPOSAL AT SEA

N

JAMES RIVER

NEWPORT NEWS

U.S. 258 & 17

ROADS

HARBOR

CHANNEL TO NEWPORT NEWS

WESTWARD EXTENSION

PHASE III

PHASE II

RAISE EXISTING LEVEES

PHASE I

HAMPTON RIVER

NORFOLK HARBOR

ELIZABETH RIVER

NORFOLK

U.S. 17

HANSEMOND RIVER

SEABOARD COAST LINE RAILROAD

NORFOLK, FRANKLIN AND DANVILLE RAILROAD

VA. 337

WESTERN BRANCH

PORTSMOUTH

SEABOARD COAST LINE R.R.

I-264

EASTERN BRANCH

SOUTHERN BRANCH

U.S. 13 & 460

U.S. 58

NORFOLK SOUTHERN RAILWAY

U.S. 58 EXPRESSWAY

VIRGINIA BEACH

SUFFOLK

D COUNTY

NORFOLK AND WESTERN RAILWAY

CHESAPEAKE

SCALE IN FEET

5000 0 5 10 15 20,000

HAMPTON ROADS CHANNELS
AND
CRANEY ISLAND DISPOSAL AREA, VIRGINIA
ALTERNATIVES NEEDING
ADDITIONAL STUDY

NORFOLK DISTRICT, CORPS OF ENGINEERS
SEPTEMBER, 1974

FILE: H-10-13-153

PLATE E-2

SECTION F

ECONOMICS OF SELECTED PLAN

ECONOMICS OF SELECTED PLAN

TABLE OF CONTENTS

LIST OF TABLES

SECTION F.

ECONOMICS OF SELECTED PLAN

1. The purpose of this section of the appendix is to centralize the discussion of economic material, costs as well as benefits. The material presented concerns the facets of the proposed improvement which can be quantified in dollar values.

Methodology

2. Normally, the tangible economic justification of a proposed improvement can be determined by comparing the equivalent average annual charges (i.e., interest, amortization, operation, and maintenance costs, etc.) with an estimate of the equivalent average annual benefits which would be realized over the period of analysis selected. The average annual benefits should equal or exceed the annual costs if the Federal Government is to contribute toward the project.

3. In the formulation phase of this report, the various plans were evaluated in terms of costs, as well as environmental and social impacts. On this basis, five plans were selected as the most promising solutions. These were:

- Raising the elevation of the existing Craney Island Disposal Area.
- Westward extension of the Craney Island Disposal Area.

- Disposal in lower Chesapeake Bay.
- Inland disposal in Suffolk (formerly Nansemond County).
- Ocean disposal.

The Commonwealth of Virginia further evaluated these plans in terms of its future needs. As indicated in previous sections of this report, the state recommended the continued use of Craney Island by first raising the levees and ultimately constructing the westward extension, which is to be built in two parts. This office concurred in the continued use of Craney Island by increasing its elevation. Selection of a long-term alternative is being deferred, pending the completion of additional studies.

4. The selected plan was formulated without actually computing any tangible benefits. Moreover, the long-term plan to be selected later will be similarly formulated, selected, and recommended. However, in order to show that the selected plan is economically feasible, a measure of benefits was developed and compared with the project cost. Benefits and costs for the selected plan were made comparable by conversion to an equivalent time basis, using an appropriate interest rate. An interest rate of 5-7/8 percent applicable to public projects and a project life of 11 years were used. The net effect of converting benefits and costs in this manner was to develop equivalent average annual values.

5. A number of economic and physical forces could limit the economic life of a disposal area in Hampton Roads. The more prominent of these include changes in the rate of shoaling, changes in the annual rate of filling, obsolescence, changing requirements for project services, and inaccuracies in making overly long projections. A normal economic life

of navigational projects, which has direct bearing on the need for a disposal area, is 50 years. Ultimately, the selected plan of this report, together with the plan to be selected later, will provide a long-life plan of this magnitude. Based on an estimated capacity of 42 million cubic yards and current annual deposition of 3.8 million cubic yards, the actual project life of the selected plan described in section E would amount to 11 years.

6. The development of costs and benefits generally followed the practice of the Corps of Engineers in navigation studies. The value of all goods utilized in developing the disposal area was estimated on the cost side. The benefit analysis was somewhat unique in that no easily quantifiable savings were available to attribute to development of a disposal area. Two possibilities for a benefit analysis were explored. Each involved the basic assumption that maintenance would be discontinued, with shoaling gradually reducing the navigable depths in the channels. Each analysis should be viewed as only a "measure" or "proxy" not a comprehensive and detailed attempt at identifying all tangible and intangible benefits. The solutions considered are outlined briefly in the following paragraphs.

7. One solution would be to analyze the effects which a gradual reduction in channel depths to 40, 35, and 30 feet would have on reducing the commerce of certain commodities, such as coal, grain, containerized cargo, and oil. As channel depths decreased, shippers would be forced to utilize other ports with deeper channels or revert to the use of smaller vessels which are more costly to operate. The loss of cargo to other ports would certainly produce economic effects in Hampton Roads and throughout Virginia, while the increased shipping costs would be experienced by all parties concerned -- producers, shippers, and buyers. Prevention of losses such as these, through channel maintenance, could be expressed in terms of dollars and benefits.

8. Because of the Navy's heavy concentration in Hampton Roads of personnel, materials, and equipment, the Navy and the nation have critical needs for maintaining certain channel depths in Hampton Roads. Another possible benefit analysis would concentrate on the absolute minimum channel depth at which the needs of national defense would not be imperilled. At that depth, 42, 40, or 37 feet, or whatever, it is assumed that channel maintenance would definitely continue. The economic effects on one or more "key" commodities of such a reduction in channel depth from the present 45-foot limit would be analyzed and presented as discussed in the previous paragraph.

9. In this connection an analysis could be made which would concentrate entirely on the key commodity in Hampton Roads (in this case coal) and assume a constant quantity of exports. The benefit analysis would result by computing the increased costs of shipping this commodity in smaller vessels on shallower channels. This analysis would not seek to determine the intricate side effects of such action, but would only "measure" that portion of the benefits relating to increased shipping costs.

10. Either of these solutions would show ample proof of the economic justification of continuing channel maintenance. Undoubtedly, there are other possibilities not mentioned for proving that channel maintenance is favorable on a benefit to cost comparison. Mention of each of the possibilities, and a detailed breakdown of the methodology which could be used in developing such an analysis, is not the intention of this report. Also, the analysis presented herein is viewed as only a partial "measure" of the total benefits of channel maintenance. The analysis was based on shipments of coal only, and the assumption that channels shoaled to a depth of 40 feet. The volume of coal shipments

utilized was a constant, equaling the projected rate of coal exports to Europe and Japan in base year 1980. An explanation of the benefit analysis begins with a later paragraph entitled "Fleet Size Distribution."

Costs

CONSTRUCTION COSTS

11. In reality, there would be no initial construction cost involved in Part 1 of the selected plan. The levees to be elevated would be constructed and raised gradually, over the plan's 11-year life. This is not to say that no charges are involved in the selected plan. The annual action of gradually building the levees higher would necessitate an annual expenditure. In addition to this amount, other expenditures would be necessary to satisfy operation, maintenance, and replacement costs. An explanation for each of these charges is presented in a later paragraph. Price levels as of February 1974 were the basis for estimates of cost. A summary of cost data for Part 1 of the selected plan is presented in table F-1.

11a. Estimated costs for accomplishing the necessary and recommended additional studies of Part 2 amount to $4 million. A breakdown of these was presented in section D.

ANNUAL COSTS

12. The annual cost for increasing the elevation of levees is estimated to be $195,000. This estimate was based on previous experience with construction of access routes and interior retaining levees at the existing disposal site. Present worth of this annual expenditure over the plan's 11-year assumed life is $1,550,000. An interest rate of 5-7/8 percent was used. The following table summarizes the charges for the selected plan of improvement.

Table F-1. SUMMARY OF ESTIMATED CONSTRUCTION COSTS AND OTHER ANNUAL COSTS

Item	Raise existing Craney Island elev. 17 to 29
PROJECT DATA:	
Elevation, ft., m.s.l.	
Initial	17
Ultimate	29
Area	2,500
Capacity - million cubic yards	42
Useful life	
Based on 3.8 million/year	11
Length of levee, ft.	38,000
Year increment to be constructed	1979
Year increment to be filled	1990
ANNUAL CHARGES: ($)	
Interest on initial investment	-
Amortization on initial investment	-
Replacement	46,000
Maintenance-Interior levee construction	195,000
Operation and normal maintenance	153,000
Total Annual Charges on Construction	$394,000

Benefits

13. Benefits to be derived from provision of a disposal area in Hampton Roads are both tangible and intangible. Tangible benefits are (a) the value to waterborne commerce activity of maintaining existing project channel depths in the harbor, and (b) provision of a convenient yet economical means of disposing of spoil. Intangible benefits would be derived by containing polluted spoil and preventing its reentry into the marine environment. Such intangibles,

though difficult to quantify, would likely take the form of decreased threats to human life, public health, and the marine environment. Estimates of monetary benefits were based on a 1980 base year analysis and computed utilizing the most recent vessel operating costs available.

FLEET SIZE DISTRIBUTION

14. The benefit analysis for this study was related to shipments of coal to European and Japanese ports, the gradual increase in the size of vessels utilized to transport this coal, the annual rate of shoaling in the major channels of Hampton Roads, and the effect which continued shoaling without maintenance dredging would have in "reversing" the future fleet size distribution for coal-carrying vessels.

15. The dry bulk commodity of immediate concern in this study was coal. Projections of coal shipments from Hampton Roads were the basis for fleet size distribution and consisted of annual movements of 12,700,000 net tons to Japan and 32,300,000 net tons to Europe. All estimates were in 1980 base year figures and were taken from findings in a study by Robert R. Nathan Associates. The Nathan Study, entitled, "U. S. Deepwater Port Study," and dated August 1972, was prepared for the Institute of Water Resources.

16. The following tables present a three-year summary of the fleet size distribution and percentage of total tonnage transported in each vessel group for coal shipments to Japan and Europe.

Table F-2. FLEET SIZE DISTRIBUTION FOR BULK COAL VESSELS - JAPAN

Tonnage group (d.w.t.)	Percentage			
	1969	1970	1971	Average
0 - 24,999	12	12	11	12
25,000 - 34,999	12	15	14	14
35,000 - 44,999	20	17	20	19
45,000 - 54,999	40	32	40	37
55,000 - 64,999	8	14	4	9
65,000 - 74,999	5	2	2	3
75,000 - 84,999	2	5	7	4
85,000 - 94,999	1	3	1	2
95,000 - 99,999	0	0	1	0
100,000 - 149,999	0	0	0	0
150,000 & greater	0	0	0	0

Table F-3. FLEET SIZE DISTRIBUTION FOR BULK COAL VESSELS - EUROPE

Tonnage group (d.w.t.)	Percentage			
	1969	1970	1971	Average
0 - 24,999	27	30	25	28
25,000 - 34,999	12	13	18	14
35,000 - 44,999	21	22	20	21
45,000 - 54,999	28	18	20	22
55,000 - 64,999	4	8	3	5
65,000 - 74,999	6	7	10	8
75,000 - 84,999	2	2	3	2
85,000 - 94,999	0	0	0	0
95,000 - 99,999	0	0	1	0
100,000 - 149,999	0	0	0	0
150,000 & greater	0	0	0	0

Table F-4. LOADED DRAFTS FOR VARIOUS CLASSES OF BULK CARGO CARRIERS

Tonnage group (d.w.t.)	Range of draft requirements (feet)
0 - 24,999	< 33
25,000 - 34,999	33 - 35
35,000 - 44,999	35 - 38
45,000 - 54,999	38 - 40
55,000 - 64,999	40 - 42
65,000 - 74,999	42 - 44
75,000 - 84,999	44 - 45
85,000 - 94,999	45 - 46
95,000 - 99,999	46 - 47
100,000 - 149,999	47 - 56
150,000 & greater	56 - 66

17. Tables F-2, F-3, and F-4 are indicative of several interesting factors. Between 1969 and 1971 alone, the percentage of coal leaving Hampton Roads in vessels with deadweight tonnages between 35,000 and 65,000 and loaded drafts of 35 to 40 feet was 65 percent of the total for Japan and 45 percent for Europe. More notable, however, is the gradual trend to larger vessels. The percentage of coal moving in vessels of the 65,000 d.w.t. class and greater, with loaded drafts exceeding 40 feet, increased from 8 percent (Japan) and 8 percent (Europe) in 1969 to 11 and 14 percent in 1971. A corresponding decrease in the percentage of coal moving in the smaller vessels took place between 1969 and 1971. In 1969, 12 percent (Japan) and 27 percent (Europe) of the tonnage moved in vessels of less than 25,000 d.w.t. By 1971, the percentages had decreased to 11 percent for Japan and 25 percent for Europe. It is assumed that, in the future, vessels engaged in

transporting coal from Hampton Roads will gradually become larger, so that the size of most will approach and even exceed the project channel depths of the harbor (-45 feet m.s.l.). Larger vessels whose drafts greatly exceed these project depths will be forced to light load to the available depth and "top off" (finish loading) elsewhere.

18. The information presented thus far was assembled to acquaint the reader with an understanding of the background reasoning which led to a computation of benefits. The benefit analysis resulted from the following:

- A detailed study of the Nathan report and other reports which dealt specifically with projections of the "future" in coal exports from Hampton Roads. These studies supported the basic assumption that, in year 1980, a total of 45,000,000 tons of coal will be exported from Hampton Roads to Japan and Europe.

- A historical study of fluctuating levels in the annual export of Hampton Roads coal.

- Analysis of the increasing size (deadweight tonnage and loaded draft) of the world's bulk fleet.

- Analysis of the number and size of bulk cargo vessels on order or under construction throughout the world.

Several other factors were pertinent to the benefit analysis. These included the following:

- Previous experience which indicated that the annual rate of shoaling in major channels of Hampton Roads is about 0.8 feet.

- Vessel unit operating costs (expressed in July 1972 dollars) supplied by the Board of Engineers for Rivers and Harbors.

19. With the assumption that no further maintenance dredging would take place in Hampton Roads, the current rate of shoaling would reduce the project depths of major channels from 45 to 40 feet in 6.25 years. Thus, if unrestricted shoaling began in the 1980 base year, only a 40-foot channel would be available in 1986 and only a 35-foot channel in 1992. Unrestricted shoaling would, in effect, cause a gradual reversal in the current fleet size distribution. Vessels too large to navigate the smaller channels when fully loaded would be forced to partially load. Otherwise, shippers would be forced to revert to the use of smaller vessels. In either case, the final result would be the same -- an increase in the unit shipping cost. Maintaining project channels at their present depth of 45 feet, rather than allowing their shoaling to 40 or 35 feet would realize benefits by preventing an increase in the unit shipping cost. For the purposes of this study, it was assumed that the coal projections and fleet size distribution would remain constant over the life of the project.

20. Samples of the methodology used in developing unit shipping costs follow. The samples pertain to a 50,000 d.w.t. bulk cargo vessel operating between Europe and Hampton Roads. The first sample is based on a vessel's operation on a 45-foot channel, while the second is based on a channel which has shoaled to 40 feet. It was assumed that fully loaded vessels would sail at maximum high tide and take advantage of

about two feet of additional channel depth. This means the 45-foot analysis in reality is based on a 47-foot channel, and the 40-foot analysis on a 42-foot channel. The end result provides for conservative unit cost figures.

SAMPLE 1 - 50,000 D.W.T. VESSEL -- CHANNEL DEPTH 45-FEET

Round trip (nautical miles)	=	7,988
Cruising time at 16.0 knots vessel speed (hours)	=	499
Cost at sea (499 hrs x $380/hr)	=	$189,620
Cost in port (60 hrs x $305/hr)	=	18,300
Any other charges (tolls, etc.)	=	0
Total round-trip cost	=	$207,920

Cost per net cargo ton in a 45-foot channel:

Maximum loaded draft (feet)	=	39
Required clearance (feet)	=	5
Total required channel depth (feet)	=	44
Existing channel depth (feet)	=	47
Shut-out draft (feet and inches)	=	0 feet 0 inches
Immersion factor (net tons/inch)	=	176
Shut-out tonnage (net tons)	=	0

Conversion factor = 1 d.w.t. (2240 lbs) = 1.12 net tons (2000 lbs)

Total net tonnage = (50,000 x 1.12)	=	56,000
Fuel tonnage required (net tons)	=	1,404
Cost per net cargo ton = $207,920/(56,000 - 0 - 1,404)	=	$ 3.81

SAMPLE 2 - 50,000 D.W.T. VESSEL - CHANNEL DEPTH 40-FEET

Round trip (nautical miles)	=	7,988
Cruising time at 16.0 knots vessel speed (hours)	=	499
Cost at sea (499 hrs x $380/hr)	=	$189,620
Cost in port (64 hrs x $305/hr)	=	19,673
Any other charges (tolls, etc.)	=	0
Total round-trip cost	=	$209,293
Cost per net cargo ton in a 42-foot channel:		
Maximum loaded draft (feet)	=	39
Required clearance (feet)	=	5
Total required channel depth (feet)	=	44
Existing channel depth (feet)	=	42
Shut-out draft (feet and inches)	=	2 feet = 24 inches
Immersion factor (net tons/inch)	=	176
Shut-out tonnage (net tons)	=	4,224
Conversion factor = 1 d.w.t. (2240 lbs) = 1.12 net tons (2000 lbs)		
Total net tonnage = (50,000 x 1.12)	=	56,000
Fuel tonnage required (net tons)	=	1,404
Cost per net cargo ton = $209,293/(56,000 - 4,224 - 1,404)	=	$ 4.15

21. Fleet size distributions in base year 1980 were prepared for coal shipments to Japan and Europe from a 45-foot channel in Hampton Roads. Another distribution was prepared for a shoaled channel in the port whose depth would be reduced from 45 to 40 feet. With these distributions, the assumption of a total of 45,000,000 tons of coal being shipped to Japan and Europe, and the unit shipping cost, a computation of additional shipping costs or benefits was performed. Results of these calculations are shown in the following tables.

22. The tables reflect the annual benefits to be realized by maintaining project channel depths in Hampton Roads at 45 feet rather than letting them shoal to 40 or 35 feet. The tables do not reflect the savings to be realized annually as the channels shoal to say, 43 or 41, or 38 feet.

Table F-5. ESTIMATED ANNUAL LOSS OF TRANSPORTATION BENEFITS ON POTENTIAL MOVEMENT OF 12,700,000 NET TONS OF COAL TO JAPAN FROM HAMPTON ROADS, VIRGINIA

D.W.T. Tonnage group (1,000)	Project Channel Depths in Hampton Roads: 45.0 feet %	45.0 feet Tons (1,000)	45.0 feet Unit cost ($/ton)	45.0 feet Total cost ($1,000)	40.0 feet %	40.0 feet Tons (1,000)	40.0 feet Unit cost ($/ton)	40.0 feet Total cost ($1,000)
25	1.0	127	18.12	2,301	1.0	127	18.12	2,301
30	2.0	254	15.74	3,998	2.0	254	15.74	3,998
40	2.0	254	12.84	3,261	2.0	254	12.87	3,269
50	10.0	1,270	11.06	14,046	25.0	3,175	11.97	38,005
60	15.0	1,905	9.94	19,545	0.0	0	11.41	0
70	0.0	0	11.74	0	0.0	0	12.24	0
80	0.0	0	11.04	0	0.0	0	11.15	0
90	0.0	0	10.45	0	0.0	0	10.45	0
100	5.0	635	9.88	6,274	5.0	635	9.88	6,274
110	5.0	635	9.34	5,931	5.0	635	9.34	5,931
120	5.0	635	8.87	5,632	5.0	635	8.87	5,632
130	10.0	1,270	8.55	10,859	10.0	1,270	8.55	10,859
140	10.0	1,270	8.27	10,503	10.0	1,270	8.27	10,503
150	20.0	2,540	7.97	20,244	20.0	2,540	7.97	20,244
175	10.0	1,270	7.58	9,627	10.0	1,270	7.58	9,627
200	5.0	635	7.29	4,629	5.0	635	7.29	4,629
TOTALS	100.0	12,700		116,850	100.0	12,700		121,272
ROUNDED				117,000 (a)				121,000

(a) Total Annual Savings on a 40.0-foot channel = $117,000,000 - $121,000,000 = -$4,000,000.

Table F-6. ESTIMATED ANNUAL LOSS OF TRANSPORTATION BENEFITS ON POTENTIAL MOVEMENT OF 32,300,000 NET TONS OF COAL TO EUROPE FROM HAMPTON ROADS, VIRGINIA

D.W.T. Tonnage group (1,000)	Project Channel Depths in Hampton Roads: 45.0 feet %	45.0 feet Tons (1,000)	45.0 feet Unit cost ($/ton)	45.0 feet Total cost ($1,000)	40.0 feet %	40.0 feet Tons (1,000)	40.0 feet Unit cost ($/ton)	40.0 feet Total cost ($1,000)
25	5.0	1,615	6.54	10,562	5.0	1,615	6.54	10,562
30	15.0	4,845	5.61	27,180	15.0	4,845	5.61	27,180
40	10.0	3,230	4.51	14,567	10.0	3,230	4.54	14,664
50	20.0	6,460	3.81	24,613	20.0	6,460	4.15	26,809
60	10.0	3,230	3.37	10,885	25.0	8,075	3.77	30,443
70	10.0	3,230	3.18	10,271	26.0	8,075	3.81	30,766
80	15.0	4,845	3.00	14,535	0.0	0	3.58	0
90	10.0	3,230	2.94	9,496	0.0	0	3.49	0
100	5.0	1,615	2.97	4,797	0.0	0	3.56	0
110	0.0	0	2.89	0	0.0	0	3.46	0
TOTALS	100.0	32,300		126,906	100.0	32,300		140,424
ROUNDED				127,000 (a)				140,000

(a) Total Annual Savings on a 40.0-foot channel = $127,000,000 - $140,000,000 = -$13,000,000.

SUMMARY OF BENEFIT ANALYSIS

23. The following steps and assumption were the basis for the benefit derivation:

- It was assumed that at an annual shoaling rate of 0.8 feet per year, 6 years would be required for the 45-foot channel to shoal to 40 feet.

- For this 6-year period, no benefits were analyzed for shipping on the channel as it would become gradually more shallow.

- Year seven was the first year to which total annual savings of $17,000,000 were credited.

- Four years of savings at this annual rate were credited to the selected plan.

24. Conversion of all benefits to present worth, based on a discount rate of 5-7/8 percent and a project life of 10 years, indicated that $6,000,000 would be saved annually by preventing the shoaling of the channels to 40 feet.

25. As previously stated, the selected plan was not formulated on the basis of computed monetary benefits. However, it should be noted that the benefits computed in this section would be the same for any plan of disposal selected.

Justification

26. The estimated annual cost of the selected plan has been indicated as $394,000. With estimated annual benefits of $6,430,000, the plan is well justified, with an economic ratio (B/C) of 16 to 1.

SECTION G

DIVISION OF PLAN RESPONSIBILITIES

DIVISION OF PLAN RESPONSIBILITIES

TABLE OF CONTENTS

LIST OF TABLES

SECTION G

DIVISION OF PLAN RESPONSIBILITIES

1. The purposes of this section are two-fold: (1) to present details regarding eventual disposition of the existing Craney Island Disposal Area, and (2) to identify the probable character of non-Federal cooperation and cost allocation for Part 1 of the selected plan of future disposal.

2. Craney Island, the present disposal site for dredging activities in Norfolk Harbor, was authorized by the River and Harbor Act of 1946. The following excerpt is from House Document 563, 79th Congress, 2d Session.

> "The District Engineer recommends: (1) That the existing project for Norfolk Harbor, Va., be modified to provide for the construction of a toll disposal area of approximately 2,500 acres in Hampton Roads adjacent to and north of Craney Island, Va., including necessary appurtenances and rehandling facilities at a total estimated first cost of $6,343,600, with an estimated cost of $608,900 per year for operation and maintenance of this part of the Norfolk Harbor project; (2) that cooperation in this part of the Norfolk Harbor project shall be contributed by the users of the recommended disposal facilities, who shall pay to the United States a fixed unit toll for rehandling dredged material into the disposal area, the amount of which shall be established upon completion of construction of the disposal facilities and the procurement of a rehandling dredge and attendant plant; and (3) that before actual construction is begun, the United States shall obtain from the State of Virginia, by appropriate legislation or other procedure, all right, title, and interest in submerged lands to be permanently occupied by the disposal area, and nullification, for the operational or useful life of the disposal facilities, of all rights of oyster cultivation in the submerged lands adjacent to the disposal area that may be adversely affected by its operation."

This disposal area has a design capacity of approximately 125 million cubic yards at elevation +17 feet m.s.l. with the current rate of annual deposition. Craney Island will be filled by about 1979.

3. In reference to the above House Document, the following three features are essential points of interest:

- The Commonwealth of Virginia was required to convey to the United States title to the submerged lands which underlie the disposal site. While Virginia has asserted that the title will automatically revert to it when the disposal site is filled, it is believed that the reverter clause in the deed to the United States is ineffective and therefore the United States will retain ownership.

- The requirement of local cooperation for Craney Island is limited to that particular spoil disposal plan. Therefore, requirements for local cooperation at new disposal sites will have to be specified in the report on them.

- The original report for Craney Island Disposal Area directed that dikes and other necessary facilities be built with Federal funds. However, this Federal investment, including interest and amortization, was to be "recovered" through the imposition of a users' toll. In determining the toll, the estimated value of the completed site ($2.5 million) was subtracted from the amount of investment, interest, and amortization to be recouped. Thus, this $2.5 million should be realized upon the disposition of Craney Island according to original intent of the authorizing document.

4. It should be noted that the Craney Island operation is "self-liquidating" only in the sense that the Corps, as a major user of Craney Island, has been conducting a paper transaction by charging the user toll for its portion of the deposits against dredging maintenance costs and project costs, while crediting the Craney Island revolving account. In other words, there is no actual cash income to the Federal Government for that portion of Craney Island's capacity being used by the Corps. In any event, the Federal Government has paid for a major portion of the cost for levees and spillways at the existing project.

5. Six alternative approaches to acquiring new sites and disposing of Craney Island have been considered. These were developed early in the study when one objective of the planning process was to select a plan with a 50-year useful life. Certain of the provisions are not directly relevant to the current plan to elevate the existing site and accomplish additional studies. They all, however, influenced the selected approach. They include the following:

- One alternative would be to give Craney Island to the state at no cost in return for the state providing the United States with title to a new site. In line with the current arrangements, dikes, pipelines, etc., would be paid for by the Federal Government, but this investment would be "recovered" by levying user fees. Under this approach, no effort would be made to insure that the fair market value of Craney Island was received by the United States. This exchange of a new site for a completed site, without respect to the value of each, would require specific legislation which would also have to waive the requirement of House Document 563 that the Federal investment in Craney Island be recovered, since the fair market value of Craney Island would not necessarily be received upon its disposition.

● As a second alternative, legislation could be proposed under which the state would provide the United States with title to the new site, while dikes, pipelines, etc., would again be paid for by the Federal Government, the cost to be recovered by imposition of user fees. However, Craney Island would be transferred to the state only upon the condition that the United States receive the fair market value of that land. Where the value of the lands for the new site was equal to the value of Craney Island, a simple exchange of lands pursuant to 33 U.S.C. 558b (1970) could be perfected, since this statute gives the Corps the authority to trade lands it has in exchange for lands required for a navigation project. However, if the value of the lands provided by the state was less than the value of Craney Island, then the difference would have to be made up, presumably in cash, and specific legislation would be needed in order to transfer Craney Island to the state.

● A third alternative would be to repeat the original Craney Island arrangements. The rationale is that Craney Island has set a precedent for the manner in which spoil disposal in Norfolk Harbor is to be funded and accomplished. There are three basic elements in this alternative.

(1) The state would deliver title to the United States for all lands, easements, and rights-of-way needed for new sites, and would not be reimbursed for the value of the lands given to the United States.

(2) Dikes, pipelines, etc., would be paid for by the Federal Government, but this investment would be "recovered" by imposition of user fees.

(3) When completed, Craney Island would be subject to the provisions of the Federal Property Act, 40 U.S.C. 484 (1970). Treating Craney Island in this manner would mean that any enhancement in the value of the site which has accrued because of the deposition of spoil would inure to the benefit of the Federal Government. In dealing with the property, the first step would be to determine whether the property was excess to Department of Army needs. If it was, then it would have to be determined if it was surplus to the needs of other Federal agencies. This would require contacting other Federal agencies; for example, the Department of the Interior might have use for the land as a park or wildlife refuge or the Department of the Navy might desire the site for a depot, etc. If Craney Island, or some part of it, were surplus property, then it would be reported to the General Services Administration and disposed of by them. Whoever wished to acquire Craney Island would then have to deal with the General Services Administration, and such a party would pay a price based upon the provisions of the Act. The state would have first option on the land if it agreed to put it to one of several specified uses, such as low income housing, park land, or civil defense needs.

- The fourth alternative would recognize that current practice differs from the arrangements under which Craney Island was authorized. Under this approach, for both new and maintenance work:

(1) Local interests would be required to provide all necessary lands, easements, and rights-of-way and all the costs of dikes, pipelines, etc. Local interests would not, however, deliver title to the needed lands to the United States.

(2) Since local interests would have retained title to Craney Island and would have enjoyed all enhancement in real estate

values had this approach been adopted when Craney Island was authorized, then by analogy it should be returned to the state at no cost. This could be accomplished with a law specifically addressing the point. This law would also have to waive the requirement that Craney Island be "self-liquidating," since the $2.5 million estimated value of the site would not be recovered.

(3) The new area would be administered by the Corps and normal operating expenses would be borne by the Corps during the life of the disposal site. Maintenance funds, including those for the interior levee construction, however, would be the responsibility of local interests. Private dredgers should be charged for their use of the area. Two fees could be charged, both based on the relative capacity of the site which private dredgers use. The first fee would be for recovery of the initial investment and maintenance by the state, while the second would be to cover operation costs of the Corps. The former would be returned to the local interests while the second would go to the Corps.

- A fifth approach would be a combination of the third and fourth alternatives. Since in Norfolk Harbor there has been a historical commitment by the Federal Government to build the dikes with Federal funds, the rationale is that a similar arrangement should continue for that part of the dredging operations in Norfolk Harbor which is attributable to the maintenance dredging of currently authorized projects. New work and the maintenance thereof would be handled under the current practice. To accomplish this arrangement, the following could be done:

(1) Local interests would be required to provide all necessary lands, easements, and rights-of-way and all the costs of dikes, pipelines, etc. Local interests would not, however, deliver title to the needed lands to the United States.

(2) The Federal Government would pay back to the state, in the form of user fees, that part of the state's investment in dikes which was proportional to the amount of the area's capacity taken up by

the disposal of maintenance dredging spoil from projects currently authorized. The state would not, however, be reimbursed for the disposal of spoil from new projects or from subsequent maintenance of those new projects.

(3) Craney Island would be given to the state and the new site would be administered according to the arrangements outlined in the fourth approach.

● A sixth approach, which was eventually selected, evolved from a consideration of all those previously mentioned. Major provisions of this arrangement are as follows:

(1) Local interests would be required to provide the costs of dikes, pipelines, etc., in accordance with current policy for general navigation projects.

(2) Local interests would not furnish lands or deliver the title to lands involved since the area to be elevated is Federally owned. In essence, the Federal Government would retain title to all portions of the Craney Island Disposal Area which were intended for continued use in disposal.

(3) The elevated disposal area would be administered by the Corps and normal operating expenses would be borne by the Corps during the useful life of the site. All deposition by non-Corps and non-Commonwealth parties would be subject to a charge for use of the area. Two fees could be leveed, both based on the relative capacity of the site which these parties would use. The first fee would be for recovery of the initial investment and maintenance expenses incurred by the state. The second charge would be to cover the operation costs of the Corps. The former charge would be returned to local interests (Commonwealth of Virginia), while the second would go to the Corps.

(4) When a determination was made that Craney Island Disposal Area would no longer function in its present capacity, the area would be returned to the Commonwealth of Virginia, upon payment by the Commonwealth of $2.5 million.

(5) The necessity to relocate containment levees inland would create a strip of land along the northern and eastern levees of the disposal area. The land would be 1,000 feet wide, with an area of approximately 400 acres. Concurrent development on this land would be allowed, even while filling of the elevated site was taking place.

6. As previously described, there would be no first costs required to construct the selected plan. An annual expenditure would be necessary to accomplish the gradual increase in levee elevation, and for maintenance of the disposal area. The total annual expenses involved would be apportioned as shown in the following table.

Table G-1. ANNUAL EXPENDITURES OF THE SELECTED PLAN

Item	Federal	Non-Federal	Total
Annual operation	$153,000	-	$153,000
Annual maintenance			
Interior levee construction	-	$195,000	195,000
Replacement	-	46,000	46,000
TOTAL	$153,000	$241,000	$394,000

NORFOLK HARBOR . VIRGINIA
REPORT OF SURVEY INVESTIGATION
THE CRANEY ISLAND DISPOSAL AREA
Replacement or Extension

APPENDIX 2

Pertinent

Correspondence

PREPARED BY THE
NORFOLK DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

PERTINENT CORRESPONDENCE

TABLE OF CONTENTS

COMMONWEALTH OF VIRGINIA
OFFICE OF THE GOVERNOR

MAURICE B. ROWE
SECRETARY OF COMMERCE AND RESOURCES
910 CAPITOL STREET
RICHMOND 23219

December 21, 1972

Lieutenant Colonel Robert E. Ayers
District Engineer
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510

Dear Colonel Ayers:

This will acknowledge receipt of your letter and enclosures of November 27 which we have had an opportunity to review and discuss with you in my office on December 19.

You have requested the comments of the Commonwealth pertinent to the following:

A. The Corps' memorandum of alternative plans considered for replacement of existing Craney Island.

B. The items of local cooperation and whether the State will provide them.

C. The State's wish with respect to the raising and the continued use of the existing Craney Island.

In regard to your memorandum, this is to advise that we will continue to review and evaluate, in conjunction with members of your staff, the plans and anticipated environmental factors associated with the alternatives under consideration for the replacement of the existing Craney Island. The Commonwealth, however, does have certain reservations about the inclusiveness of the alternatives presently under consideration and the advisability of excluding certain alternatives previously considered. We suggest, because of these reservations, that detailed studies of the alternatives presently before you, any others brought to your attention, especially rail haul to Southwest Virginia, disposal at sea and groundwater problems associated with the use of the Nansemond County site, be undertaken to assure that the site finally chosen will balance the economics of use with the impact on the environment.

With respect to your second request, the Commonwealth, cognizant of the requirements of § 577 of Title 33 U.S.C., hereby states its intent to provide the required items of State and local cooperation.

In regard to the raising and continued use of existing Craney Island, it is the Commonwealth's desire to have the property revert to Virginia at the end of the original project period. Should circumstances require, however, that the project life be continued for a short term beyond the original project period, the Commonwealth would be receptive to receipt of such a proposal.

I trust that this letter is responsive to your inquiries but should you have additional questions, please do not hesitate to contact this office. The Commonwealth is interested in working with you in reaching a solution to this problem of mutual concern.

With kindest regards, I am

Sincerely,

Maurice B. Rowe

COMMONWEALTH OF VIRGINIA
OFFICE OF THE GOVERNOR

MAURICE B. ROWE
SECRETARY OF COMMERCE AND RESOURCES
910 CAPITOL STREET
RICHMOND 23219

December 18, 1973

Colonel Robert Ayers
District Engineer
U. S. Corps of Engineers
Norfolk District
803 Front Street
Norfolk, Virginia 23510

Dear Colonel Ayers:

Reference is made to the letter from Governor Holton to Mr. J. Robert Bray, Counsel, Virginia Port Authority, dealing with response to House Joint Resolution 136 as it relates to the Craney Island dredged disposal site.

The Governor approved the recommendations and urged that negotiations proceed for the Commonwealth's acquisition of the present Craney Island site. He further authorized a coordinated agency approach to support planning for the continued use of the present Craney Island site on a short-term basis and the development of long-term answers for disposal of dredged materials. It will be most important for this planning to move forward under the direction of the Corps of Engineers with proper support by the Office of the Governor and appropriate state agencies.

The report, as prepared by the task force study group, will be printed for distribution to members of the General Assembly and other interested parties. Please be assured that we are most interested in developing the proper joint effort to proceed with both the federal and state participation and commitment to achieve the most desirable results for proper and long-term disposition of dredged spoils.

With kind regards, I remain.

Sincerely,

Maurice B. Rowe

MBR/sl

NAOEN-R

12 July 1972

Regional Director
U. S. Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Peachtree - Seventh Building
Atlanta, Georgia 30323

Regional Director
Environmental Protection Agency
Curtis Building
Sixth and Walnut Streets
Philadelphia, Pennsylvania 19106

Gentlemen:

On 1 June 1972, a public meeting was held in Norfolk, Virginia on studies of Hampton Roads Channels, Virginia and Craney Island Disposal Area - Norfolk Harbor, Virginia. I regret that you were unable to have a representative in attendance at the meeting. In the event you did not receive a summary of our studies, I am including same with this letter. I am also inclosing a copy of the District Engineer's remarks at the meeting pertinent to the alternative for raising levees at the existing Craney Island. The complete transcript of the meeting should be available in the near future should you desire to review it.

The Craney Island study is being conducted to provide a suitable replacement for Craney Island Disposal Area, for the accommodation of dredge material. At the meeting's conclusion, the Norfolk District Engineer favored the alternative disposal site in Nansemond County, an opinion which was concurred in by representatives of the State of Virginia. The following paragraph was excerpted from the State of Virginia's presentation at the meeting:

> "Through meetings, conversations, and communications with the representatives of state agencies including the Division of Water Resources, the State Health Department, the State Water Control Board, the Commission of Outdoor Recreation, the Division of Industrial Development, the Marine Resources Commission, the Virginia Port Authority, the Department of Highways, the Commission

NAOEN-E 12 July 1972

Regional Director, U. S. Fish and Wildlife Service
Regional Director, Environmental Protection Agency

"of Game and Inland Fisheries, the Virginia Institute of Marine Science, the Historic Landmarks Commission, the Division of Mineral Resources, the Division of Forestry, the Air Pollution Control Board and the Governor's Council on the Environment, the Division of State Planning and Community Affairs arrived at the point where one site could be tentatively chosen. The Nansemond County site, after careful consideration, appears to be the best available alternative. At best, it is the consensus of a majority of State agencies involved that the Nansemond County site represents the least environmentally damaging alternative based on presently available information."

On 21 and 22 June 1972, representatives of your respective offices met representatives of the Norfolk District and conducted a field inspection of the following alternative disposal sites:

a. Willoughby Bay

b. Existing Craney Island Disposal Area

c. Westward Extension

d. Nansemond County

The proposed plan for the Nansemond County alternative would utilize the existing rehandling facilities at the Craney Island Disposal Area. The dredged material would be pumped through pipelines across the filled portion of Craney Island Disposal Area to the confined rehandling basin on the west side of the disposal area. This area would be about 500 acres in size. Dredged material would be screened of oyster shells and other debris before being injected into a long pipeline by a rehandling unit and pumped to the Nansemond Area. Several pipeline rights-of-way would be preserved in this plan; other than these and the rehandling area, the filled Craney Island Disposal Area would be available for development. The pipeline would be about 15 miles in length, utilizing five booster stations. The line, as envisioned, would run from a rehandling basin formed from part of the west side of existing Craney Island, alongside the existing rail line, to the northern tip of the Nansemond County Disposal Area. Drainage would be either (a) westward through the disposal area, thence through spillways and long culverts, or similar facility, to the Nansemond River; (b) similar to plan (a), except that the discharge point would be northwest from the disposal area and some 4.8 miles downstream on the Nansemond River at Globe Point

NAOEN-E 12 July 1972
Regional Director, U. S. Fish and Wildlife Service
Regional Director, Environmental Protection Agency

where the natural salinities are more nearly equal to those of the dredged, drainage water; and (c) a pipeline bringing the water back to the existing Craney Island Disposal Area.

As shown on the inclosed map (inclosure 2), the Nansemond County disposal Area would be developed in sections as needed, in lieu of developing the entire area at one time.

Your comments on the various alternatives will greatly assist our efforts to complete technical, economic, and environmental studies, prepare a draft of the feasibility report and prepare a draft of the 5-point environmental impact statement. Hence, we are requesting your comments on the following:

a. Nansemond County Alternative

b. Willoughby Bay Alternative

c. Westward Extension Alternative

d. Raising levees at existing Craney Island Alternative

e. The environmental aspects associated with the dredge water drainage entering the Nansemond River at mile point 12.3 and also at Globe Point (mile point 8.0). Would there be environmental benefits to be realized by increasing the salinity of the Nansemond River through discharge of the dredge water drainage?

Your earliest possible reply to the requested items of information would be appreciated.

Sincerely yours,

3 Incl
1. Notice of Public Meeting
   28 Apr 72, w/Summary
2. Map - Disposal Area Alt
3. District Engineer's remarks
   re raising levees

W. H. TATUM
Chief, Engineering Division

Copy furnished w/incl:
Mr. Edward Bradley
Bureau of Sport Fisheries and Wildlife
Raleigh, North Carolina 27606

Raising existing levees: Possibly, the least objectionable alternative would be to raise the levees at the existing disposal area, thereby increasing its capacity and prolonging its useful life. The design height of the existing levees at Craney Island Disposal Area is plus 18 feet mean low water. By continuing fill operations beyond the present design height to an elevation of plus 30 feet mean low water, that is, by raising the existing levees an additional 12 feet, the capacity would be increased by about 60 million cubic yards, and the useful life by about 15 years. The levees could be built up gradually as needed.

By this plan, no changes in present dredging or disposal methods would be required. The existing rehandling facilities for hopper dredges and scows would be adequate. The slightly increased energy

requirement for pumping into the area, due to the increased lift, would present no practical difficulty, since most of the material pumped is silty material of a very liquid nature.

The total first cost of this plan is estimated to be 6 million dollars or a dollar twenty cents per cubic yard.

It was recognized in studying this alternative that before recommending this plan, it would be necessary to analyze the threat of massive slides which could occur, if the land fill were overloaded. A detail study would be made if this plan is selected.

The advantages of this plan are that the existing rehandling facilities could be used, no additional land would be required, present dredging methods could be continued, and the cost is relatively small. The fact that no additional land would be required makes this plan particularly attractive from an environmental point of view.

Thank you.

(Applause)

COLONEL TORMEY: I would like at this time to go into some environmental considerations, but before perhaps it would be worth a few minutes to cover this supplementary sheet that was distributed

this morning on the Craney Island Disposal Area. This has a date of 1 June 1972, and the supplementary sheet gives you first some physical characteristics of Craney Island.

The total acreage here, of course, is 2,500 acres, and the ultimate capacity now appears to be 125,000 million cubic yards, because there's been a greater consolidation of the material than had previously been anticipated. So there is more load going in there now than they had previously thought.

The elevation of the completed project will be 18 feet of mean low water. This is below sea level -- approximately sea level; a little bit lower than sea level.

The total length of the levy is -- around the water periphery of Craney Island -- is about 31,000 feet, and as I earlier stated with a stone. Only two elevations of eight foot stone abutment on those. That abutment comes up to eight feet.

With regard to the foundation conditions at Craney Island, in the construction phase a sand blanket was put down before the levee was built. People who observed this construction did note the formation of a mud wake at one time when the

builder got ahead of his sand blanket when underlying Craney Island. To a depth of about a hundred feet is marine clay. This is a very gray-looking muck that has a very low strength of any kind. It has a little bit of cohesive strength. The object of the sand blanket was to distribute the load of the levee out over a greater area.

The elevation of the underlying compacted sand is minus 110 feet.

Now, this marine clay samples have generally been classified by the laboratory as gray, fat marine clay grading into silty clay or silty sand at depths of about minus 100 feet mean low water. Samples near top of holes contained some organic materials. All samples contained shells in varying amounts.

The last point here with regard to Craney Island is the limitations on its future use. It has been planned -- the state has gone into planning on this and we know that the City of Portsmouth is interested in this, its future use, but we know that a larger structure is going to require foundations reaching down through that layer of weak clay to the underlying sand strata, and the stability of Craney Island depends on that very

low cohesive strength that you have of marine clay there.

Analysis by the critical-circle method which actually plots a long arc in which a failure would occur, indicates you do have adequate safety up to the present designed level of 18 feet. We really don't know how much higher you can go. You might say you can go up 12 more feet and may not be able to. If you did, the type of material that is being placed in there has a density of about 120 pounds per cubic foot. A hundred to a hundred twenty. This is two thirds the density of concrete, so a 12-foot layer would be the equivalent of an eight-foot solid slab of concrete.

In other words, it is very heavy material put in, and, then assuming you could do this without causing a failure, you obviously could not put anything else on there without going through piles. In other words, almost any type of structure that you would then put on top of it would require these deep pile foundations.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
John W. McCormack Post Office and Courthouse
BOSTON, MASSACHUSETTS 02109

JAN 19 1973

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

Dear Sir:

In response to a letter from the Chief of your Engineering Division dated July 12, 1972, the Bureau of Sport Fisheries and Wildlife has reviewed the Craney Island Disposal Area alternatives currently being considered by your agency. These alternatives would provide alternate spoil sites to accommodate dredged material resulting from a maintenance of the Norfolk Harbor project, Virginia. This study was authorized by a resolution of the Committee on Public Works, U. S. House of Representatives, adopted October 3, 1968. This letter constitutes our report, prepared and submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). It has been coordinated with the Virginia Marine Resources Commission and the National Marine Fisheries Service and has the concurrence of the Virginia Game and Inland Fisheries (letters attached).

Based on information furnished in your letters of April 28, 1972, and July 12, 1972, and a June 21 - 22, 1972, meeting between representatives of the Bureau of Sport Fisheries and Wildlife, Environmental Protection Agency, Virginia Commission of Game and Inland Fisheries, and your office, we understand you are of the opinion that of the alternatives considered, the following four offer the most promise:

1. Raising the levees of the existing Craney Island Disposal Area;

2. A westward extension of Craney Island Disposal Area;

3. The Willoughby Bay alternatives; and

4. The Nansemond County alternative.

The Craney Island Disposal site, consisting of a two-mile square area, adjacent to the waters of Hampton Roads is enclosed by stone-faced levees and has a design capacity of approximately 125 million cubic

yards when filled to the design elevation of +18 feet mlw. Current projections are that the existing spoil area will be filled to capacity by 1970.

It is our understanding that by raising the levees an additional 12 feet, the capacity of the spoil area would be increased by approximately 55 to 60 million cubic yards, thus extending its useful life by approximately 15 years. This alternative would not require additional lands nor would any of the adverse environmental effects associated with spoil disposal area construction occur.

A westward extension of the Craney Island Disposal Area, as proposed by the Corps of Engineers, will result in the conversion of several thousand acres of water bottoms to land areas, thus destroying several thousand acres of marine habitat. Recent investigations by the Virginia Institute of Marine Science[1/] indicate that waterbottoms in this area are heavily silted. Although the occurrence of oysters is extremely low and not of economic concern at this time, the future economic potential for this natural resource does remain a possibility.

Although we consider the westward extension a viable alternative, it would constitute another unsightly and unesthetic fill operation in the Hampton Roads area and would provide only a temporary solution to the perpetual disposal problem. An extension in the specific shape and contour which model studies indicate to be favorable to present flow patterns and the marine environment may be more desirable. It is possible that construction of a properly designed fill configuration to the west could alleviate present shoaling problems in the adjacent waters by diverting reflected wave actions away from critical points of erosion. This, in our opinion, will require a more detailed study before a decision can be made. Model studies currently being conducted by the Virginia Institute of Marine Science may validate this possibility.

From a biological standpoint, the waterbottoms of Willoughby Bay are slightly more productive than the waterbottoms west of Craney Island. The 1,000-acre to be filled has not been utilized for shellfish production for a number of years. Sport fishing occurs at the mouth of Willoughby Bay and off the point of Willoughby Spit.

Spoil disposal in the designated section of Willoughby Bay would result in the loss of the benthic community in this area. Although this would not, at present, constitute critical damage to the marine ecosystem, we consider Willoughby Bay to be the least desirable alternative under consideration. This area has far greater recreational and biological potential than the Craney Island Flats.

1/ Hanen, D. S. and J. G. Loesch, 1972, Hampton Roads Tunnel Corridor Survey Report for the Virginia Department of Highways. Virginia Institute of Marine Science. Unpublished manuscript.

Although isolated from the pristine areas to the south by U. S. Highway 13 and the Norfolk and Western Railroad, the Nansemond County disposal site essentially constitutes the northernmost quadrant of the Dismal Swamp. Fill along these easements has caused the southern sector to drain at an abnormal rate. However, reaches farther north have retained their swamplike character and although portions of the area have been logged over the years, a heavy stand of loblolly pine with some hardwood and cypress intermingled is now evident.

Placement of dredged spoil material in Nansemond County in a configuration similar to that presented in the Corps' sketch dated July 12, 1972, would incur the loss of approximately 7,200 wooded acres. The Corps of Engineers' population density estimates for white-tailed deer and black bear indicate that the area has an extremely high habitat value for these big game species. Loss of this habitat and the loss of the forest resource would cause significant adverse environmental effects. Other problems can be foreseen. This type of fill will be extremely difficult to revegetate. Upon completion of the project, sterile saline soil and consolidation will act to retard recovery of the area for an indeterminate number of years thereafter. Salinity may also create problems during the useful life of the project. Spoil material dredged from roads will be approximately 15 ppt more saline than the upper Nansemond River. Supernatants should be returned to waters of similar salinity, preferably in the vicinity of Craney Island. Otherwise, adverse alteration of the salinity gradient in the Nansemond River will occur with resultant undesirable consequences to aquatic life. The disposal area will also present an extremely unsightly and unesthetic vista.

Those presenting arguments for filling this area have stated that the area is being engulfed by spreading urbanization. Before this Bureau could condone the use of this natural area for spoil disposal, it must be shown that the area is being encroached upon to such a degree that continuance in its present state is impossible.

Based on environmental considerations and in view of the potential damages to fish and wildlife resources, we recommend the raising of the existing Craney Island levees as being the least objectionable alternative. We recognize that a major disadvantage of raising the existing levees is that it would be a short-term solution to the problem of spoil disposal in the Hampton Roads area. However, it is salutary to reflect that each of the proposed alternatives, including the Nansemond County proposal with its 45-year project life, is also a short-term solution to what appears to be a perpetual disposal problem.

The ultimate solution will not, in our opinion, be the containment of spoils and the unending search for new disposal areas, but will be dependent upon the discovery of beneficial uses of dredged material or at least methods to render polluted materials suitable for deep water

ocean disposal. Although some advances have been made in this direction such as the use of suitable spoil for beach replenishment, much more needs to be done. Noteworthy of studies being conducted is a study by the Virginia Institute of Marine Science, to determine if pollutants such as nutrients, pesticides, and metals can be effectively removed from dredged material, thus allowing offshore disposal. In conjunction with this study, research is urgently needed to assess long-term detrimental effects of open water dumping of spoils in the ocean system.

The additional time interval created by raising the Craney Island Disposal area levees may provide sufficient time for technology to overcome the problems associated with ocean disposal of contaminated materials.

The action recommended by the Bureau would serve as an interim, short-term solution, thus allowing an environmentally acceptable, long-range spoil disposal plan to be researched and developed. It would also provide time for such areas as Buckroe Beach to be tested in the Chesapeake Bay Model.

We appreciate the opportunity to comment on the alternatives to the Craney Island Disposal Site and look forward to reviewing a five-point environmental impact statement.

Please advise us of your final decision and keep us informed of the progress of your study.

Sincerely yours,

Richard E. Griffith

Regional Director

Attachments

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

April 4, 1973

Mr. W. H. Tamm
Chief, Engineering Division
Norfolk District
Corps of Engineers
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510

Dear Mr. Tamm:

We have reviewed the Craney Island Disposal Area alternatives being considered by the Norfolk District, as you requested. The following comments concerning the alternatives are of a preliminary, informational nature only and are intended to assist you in further project analysis. Our agency will furnish final, detailed comments following receipt and review of the Environmental Impact Statement, when published.

It is our understanding from data furnished with your letter and from several discussions with members of your staff, that four alternatives are under primary consideration. These are:

1. Nansemond County alternative

2. Willoughby Bay site

3. Westward extension of Craney Island

4. Raising levees at existing Craney Island Disposal Area

Current projections by your office indicate that existing capacity at Craney Island will be filled by 1979.

1. The Nansemond County alternative envisions the filling of between 5000 and 7000 acres of inland area, mostly freshwater wetlands. This site is geographically a portion of Dismal Swamp, although it is physically separated from the main body of Dismal Swamp by a highway and railroad. This separation does not, however, change the composition of the site. Our evaluation of this alternative can be best summed up by the following excerpts from the Administrator's decision statement regarding EPA policy to protect the Nation's wetlands:

"The Nation's wetlands, including marshes, swamps, bogs, and other low-lying areas, which during some period of the year will be covered in part by natural non-flood waters, are a unique, valuable, irreplaceable water resource."

"Fresh-water wetlands support the adjacent or downstream aquatic ecosystem, in addition to the complex web of life that has developed within the wetland environment. The relationship of the fresh-water wetland to the subsurface environment is symbiotic, intricate, and fragile."

"It shall be the Agency's policy to minimize alterations in the quantity or quality of the natural flow of water that nourishes wetlands and to protect wetlands from adverse dredging or filling practices."

2. The Willoughby Bay alternative consists of filling approximately 1000 acres of open bay. Construction of levees to an elevation of +18' MHW would result in creation of a spoil capacity of about 55 to 60 million cubic yards. This would make an effective life span of about 15 years. The detrimental effects at this site would consist of irretrievable loss of 1000 acres of bay bottom, loss of sheltered bay water for recreational use, and aesthetic intrusion for travellers on I-64, now under construction, as well as residents of Willoughby Spit. The short life span of a disposal area at this site would also seem to be a deciding factor.

3. Westward extension of Craney Island would have similar effects to those listed in the Willoughby Bay comment. However, the effects here would be lessened inthat there is now an existing structure; there are relatively few residents whose view and use of the adjacent waterway would be restricted. Construction of this facility would provide space for about 115,000,000 cubic yards of spoil and would have a useful life of some 30 years. A channel should be provided for water access by mainland residents and for drainage from stream systems. Of the four alternatives, this would provide for fairly large capacity at a relatively low cost with acceptable environmental impact.

4. Raising levees at existing Craney Island Disposal Area. This alternative would be the least environmentally damaging. It would require no further commitment of resources and would utilize an area already degraded. Despite the short useful life span, estimated to be an additional 15 years and a capacity of 55 to 60 million cubic yards, this alternative seems the most viable and the most environmentally acceptable.

Careful consideration should be given to combining use of alternatives 3 and 4. While the stated disadvantage of alternative 4 is its relatively short useful life, utilization of alternative 3 in conjunction with alternative 4 could expand the capacity/life to some 45 years. Modifications in the plan for constructing a westward extension which would permit sectional expansion as additional disposal area is required rather than completing the entire extension at one operation should be studied. One or more "cells" could be added to the existing disposal area which would tend to minimize the ecological disadvantage listed in the study. Project costs could also be distributed over a longer period of time with minimal initial outlay.

Use of alternatives 3 and 4 in this combination would also allow for future changes in technology. Hopefully, a better utilization of spoil material will be found. By building the extension in sections, a more flexible design which could be modified to suit hydrological, aesthetic or ecological considerations.

In addition to the four alternative actions discussed, there is one that could provide a truly long term disposal area. This would be off Buckroe Beach, in the area known as the horseshoe. We understand that considerable study would be required before consideration could be given to this site.

Wherever the final site is located, provisions should be made for transfer of spoil materials directly from the transporting vessel to the contained disposal area. This would eliminate the dumping of the spoil into what is essentially open water, then rehandling by pumping from the dump into the containment.

Sincerely yours,

Nicholas M. Ruha
Environmental Resource
Specialist

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Region
Federal Building - 14 Elm Street
Gloucester, Massachusetts 01930

August 6, 1974

Col. R.E. Ayers
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510

Dear Colonel Ayers:

We have reviewed your report concerning the replacement or extension of the Craney Island Disposal Area in Norfolk Harbor, Virginia, which was transmitted with Mr. Tamm's letter of July 2, 1974.

We concur with the recommendation providing for the continued use of Craney Island as a disposal receptacle by raising existing levees to an elevation of +29 feet m.s.l. At this time, however, we hesitate to encourage the proposal for a westward extension of the Island as this would entail removing approximately 2,380 acres of marine bottom and associated water column. Because this extension is not contemplated for use until 1988-1990, and with the active pursuit of providing new disposal techniques being carried on by the Waterways Experimental Station, we recommend that the decision to extend Craney Island be held in abeyance pending the development of less damaging alternatives.

Sincerely yours,

William G. Gordon
for Russell T. Norris
Regional Director

City of Portsmouth

Virginia

Established 1752

May 24, 1974

R. D. OTTAVIO
City Clerk

CORINNA B. JEFFREYS
Deputy City Clerk

Colonel Robert E. Ayers
District Engineer
Department of Army
Norfolk District Corps
of Engineering
803 Front Street
Norfolk, Virginia 23510

Dear Sir:

At a meeting of the Portsmouth City Council held on May 14, 1974, I was directed to forward the enclosed resolution regarding the Craney Island Disposal Area.

Yours truly,

R. D. Ottavio
City Clerk

RDO/cbj

encl.

A RESOLUTION EXPRESSING THE STRENUOUS OPPOSITION OF THE COUNCIL OF THE CITY OF PORTSMOUTH TO THE PROPOSED WESTWARD EXPANSION OF THE CRANEY ISLAND LAND FILL.

WHEREAS, Federal and State officials have proposed a substantial westward expansion of the Craney Island Land Fill; and

WHEREAS, such an expansion would seriously degrade the property values and desirability of adjacent neighborhoods; and

WHEREAS, the proposed enlargement of the land fill area would exacerbate Portsmouth's existing tax base difficulties and create numerous other social and economic problems.

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Portsmouth, Virginia, that this body firmly and unequivocally expresses its strong and continuing opposition to any expansion of the Craney Island Land Fill, since such an expansion is certain to have disastrous consequences for the City of Portsmouth; and

BE IT FURTHER RESOLVED that appropriate Federal and State officials are hereby earnestly requested to thoroughly review all plans for such proposed expansion, giving full consideration to the legitimate interests of the City of Portsmouth; and

BE IT FURTHER RESOLVED that Federal and State officials are requested to repeal and withdraw any previous approval that may have been granted to such project; and

BE IT FURTHER RESOLVED that the City Clerk be, and he hereby is, directed to forward certified copies of this resolution to all cognizant public officials.

Adopted by the Council of the City of Portsmouth, Virginia, at a meeting held May 14, 1974.

Teste:

City Clerk

AUDUBON NATURALIST SOCIETY
OF THE CENTRAL ATLANTIC STATES, INC.
8940 JONES MILL ROAD WASHINGTON, D. C. 20015
TELEPHONE: 301—652-9188

August 1, 1973

District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk
803 Front Street
Norfolk, Virginia 23510

Dear Sir;

We have been alerted to your interest in using part of Dismal Swamp as a dumping site for dredge spoil (the Nansemond City site). At a time when the many virtues of the swamp are beginning to be recognized, this seems a thoroughly misguided plan. The threat of pollution from such dumping is real; prevention of runoff and seepage would require extraordinary measures which might or might not succeed. However, any dumping at all in Dismal Swamp sets a dangerous precedent for the future of this area.

Wetlands all along the east coast are threatened, and fewer and fewer areas are wild anymore. We urge you to reject the Nansemond City site for dumping. Renovate and enlarge the Craney Island dumping site as necessary, but leave Dismal Swamp as is for posterity.

Yours truly,

Mary B. Hollinshead

Mary B. Hollinshead
Vice President for Conservation

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

REFERENCE OR OFFICE SYMBOL	SUBJECT
NAOEN-D	Nansemond City Disposal Area - Groundwater Conference

TO/THRU: Chiefs, Des Br / Engrg Div — FROM Chief, Geol & Fdn Sec — DATE 11 June 1973 — CMT 1

JUN 20 1973

TO: Files

1. On 5 June 1973, Norfolk District convened a meeting to discuss the technical feasibility of the proposed Nansemond City Disposal Area. The following participants were in attendance:

Joseph C. Davis, Jr.	Va. Division of State Planning
Charles Martin	Va. Water Control Board (Bureau of Water Control Management)
Richard Bower	" " " " "
S. M. Rogers	Marine Resources Commission
R. Todd Coyle	Virginia Port Authority
Bill Craft	" " "
Gordon T. Bennett	U.S.G.S., Washington, D. C.
Robert L. Wait	U.S.G.S., Richmond, Va.
W. E. Forrest	" " "
Benny Swafford	OCE, Washington, D. C.
George E. Weber	Norfolk District
Frank Wootton	" "
John C. Bowman	" "
Owen Burford	" "
Carl S. Anderson, Jr.	" "
H. E. Strawsnyder, Jr.	" "

2. Mr. Weber, Chief of Design Branch, Norfolk District, opened the meeting stating that the initial meeting in October 1972 resulted in recommendations to study the possibility of saline contamination of aquifers in the proposed Nansemond City Disposal Area. He said the purpose of the present meeting was to discuss the findings of this study. Mr. Weber then asked Mr. Bowman to elaborate on the technical report prepared as a recommendation of the October 72 meeting.

3. Mr. Bowman's discussion included explanations of the field explorations performed since the October 72 meeting and recommendations derived from these data. Mr. Bowman stated that protection of the shallow aquifers from saline contamination would definitely be required and recommended the following treatment measures:

a. Construction of an impermeable cutoff through the upper aquifers and ten feet into the Yorktown Formation. This cutoff would be constructed by placing a 5 foot wide bentonite slurry cutoff wall around the entire treatment area.

b. Construction of dike with an impermeable clay core around the disposal area contiguous with the bentonite slurry cutoff wall.

c. Construction of drainage, settling and pumping facilities sufficient to pump excess saline water from the disposal area back to a marine environment.

d. Establishment of permanent piezometric measuring and water sampling stations outside the disposal area to monitor the effectiveness of the cutoff wall.

Mr. Bowman advised that the results of the investigation show the proposed disposal project is technically feasible. He concluded that the saline protective measures directly attributed to the cutoff wall and corresponding exploration and monitoring will cost approximately $10,000,000.

4. After a brief presentation of the proposed disposal alternatives by Mr. Wootton, the meeting was opened for discussion. This discussion included the following questions, answers and statements:

a. Mr. Davis asked for an explanation of the construction procedures associated with the proposed cutoff wall. Mr. Anderson explained these procedures with the aid of appropriate diagrams.

b. Mr. Bennett asked the following questions:

1. What are the proposed influent and effluent pumping quantities? This question initiated discussions featuring explanations of the pumping procedures, pumping rates and percent solids by Mr. Burford.

2. What is the vertical hydraulic gradient in the underlying strata? Mr. Anderson explained that the artesian head which has originated in the Petersburg area, no longer flows in the Nansemond area. To further qualify his statement he explained that the artesian head of the Cretaceous aquifer now exists at a depth of approximately 17 feet beneath the surface.

3. Mr. Bennett also stated that a hydrologic budget for the storage area should be computed and that additional monitoring devices in the form of tri-level piezometers should be installed. Mr. Swafford agreed with these findings and also recommended construction of scavenger wells as added insurance against salt water seepage. There was general acceptance of these proposals by all present.

c. Mr. Wait introduced several suggestions which should be considered in the design stage. These suggestions pertained to the potential effect of the saline water on the clay minerals which make up the Yorktown formation and the local surface clays to be used for dike construction. The effects of salt concentration on the compaction, strength and permeability of these clays will be considered in the final design.

NAOEN-D 11 June 1973

SUBJECT: Nansemond City Disposal Area Groundwater Conference

5. Mr. Martin and Mr. Bower, Va. Water Control Board, Bureau of Water Control Management, stated they concurred with Norfolk District's conclusion that the Nansemond City Dredge Disposal Plan was technically feasible. Other attendees voiced no objections to the District's conclusion of feasibility of the plan, and the meeting was adjourned.

John C. Bowman

JOHN C. BOWMAN
Chief, Geol & Fdn Sec

CF:
WRP

NORFOLK HARBOR . VIRGINIA
REPORT OF SURVEY INVESTIGATION
THE CRANEY ISLAND DISPOSAL AREA
Replacement or Extension

APPENDIX 3

Report of the Virginia Port Authority

to

the Governor and the General Assembly of Virginia

on

Hampton Roads Area Future Dredge Disposal Site

PREPARED BY THE
NORFOLK DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

HAMPTON ROADS AREA

FUTURE DREDGE DISPOSAL SITE

REPORT OF THE

VIRGINIA PORT AUTHORITY

TO

THE GOVERNOR

AND

THE GENERAL ASSEMBLY OF VIRGINIA

House Document No. 3

COMMONWEALTH OF VIRGINIA
Virginia Port Authority
Norfolk
1973

HAMPTON ROADS AREA FUTURE DREDGE DISPOSAL SITE

Report of the
Virginia Port Authority

Norfolk, Virginia
September 1973

To: HONORABLE LINWOOD HOLTON, *Governor of Virginia*
and
THE GENERAL ASSEMBLY OF VIRGINIA

I. INTRODUCTION

At the 1972 session of the General Assembly of Virginia, the Virginia Port Authority was directed to consider the need for a future disposal site convenient to the Hampton Roads area at which spoil and other waste materials from dredging, port development, and other activities can be disposed of safely and conveniently. House Joint Resolution No. 136 reads as follows:

> WHEREAS, for many years the Craney Island area was used as the disposal area for spoil from dredging operations conducted in and around the Hampton Roads area; and
>
> WHEREAS, this area has been substantially filled and is no longer available for large deposits of spoil, and the continued economic health and advancement of the Hampton Roads area is dependent upon a disposal area for the spoil generated by dredging and other activities in connection with the development of channels and ports; and
>
> WHEREAS, it is necessary for a disposal area to be found and it would appear that the area near the Virginia Capes might be employed for this purpose; now, therefore, be it
>
> RESOLVED by the House of Delegates, the Senate concurring, That the Virginia Port Authority shall consider the need for a disposal area convenient to the Hampton Roads area at which spoil and other waste materials from dredging, port development and other activities can be disposed of safely and conveniently. The Port Authority shall work closely with the Virginia Institute of Marine Science, the Army Corps of Engineers and other interested agencies and groups in the gathering of information and studying the need for a disposal area as well as selecting such an area. All agencies of the State shall assist the Port Authority in its work upon request.
>
> The Port Authority shall conclude its study and make its report to the Governor and the General Assembly not later than October one, nineteen hundred seventy-three.

In response to House Resolution No. 136, the Virginia Port Authority in December 1972, recognizing that the scope of the study and subsequent selection of the site to be recommended would affect many agencies and areas of Virginia, requested the Commonwealth's Secretary of Commerce and Resources to consider a joint State agency to examine dredge spoil disposal in the Hampton Roads area.

In January 1973, the Secretary of Commerce and Resources designated the following agencies to serve on a Craney Island Task Force: Commission of Game and Inland Fisheries, Division of Industrial Development, Division of State Planning and Community Affairs, Governor's Council on the Environment, Marine Resources Commission, State Water Control Board, Virginia Institute of Marine Science, and Virginia Port Authority. (Attorney General — legal consultant)

Inasmuch as the U. S. Corps of Engineers was authorized on 20 June 1969 by Congress to review the Corps of Engineers' Study of the Hampton Roads Harbor Channels, and this review has included extensive studies toward replacing the existing Craney Island Disposal Area when it has been filled to design capacity, and additionally, recent Federal legislation requires State financial participation in development of any future sites to contain dredging spoils, the Craney Island Task Force defined its general objectives as:

- Review and evaluate each of the feasible alternatives identified by the Army Corps of Engineers (COE) and any other approaches that the task force considers to merit study, as they affect the environment, development within the area, and other pertinent criteria.
- Recommend a site or a combination of sites for the future disposal area, and identify the procedure that the State should follow in fulfilling its obligations to the COE in the development of the site(s).

The report of the Craney Island Task Force was submitted to the Secretary of Commerce and Resources for the Commonwealth in September 1973. This report of the Virginia Port Authority is the consensus of findings and recommendations of the multi-State agency task force, and the full task force report is attached as an appendix for ready reference.

II. RECOMMENDATIONS

On the basis of the State task force study, it is recommended that the General Assembly adopt the following:

1. Of all alternatives available at the present time for future dredge spoil deposit, the continued use of the Craney Island site is the most practicable and acceptable, both ecologically and economically.

2. The continued use of the Craney Island site should be accomplished by:

   A. Raising the present design elevation to about 28 feet on the western portion so as not to interfere with plans for development of port facilities on the eastern portion. Such raising shall be contingent on an engineering determination that the substructure can bear the weight of the additional deposit without creating adverse side effects such as mud-waves or collapsing of navigational channels.

   B. Following the raising of the existing Island, additional capacity for dredge spoil should be obtained by extending the existing site to the westward incrementally as required, retaining a channel along the existing shore line and with a configuration to be determined by model tests.

Recognizing that the capacity and useful life of the existing Craney Island site depends upon final engineering studies regarding feasible design height, as well as when the Hampton Roads channels are deepened to 55 feet, it should be the intent to accommodate future dredge spoil by using the most beneficial combination of raising the existing Craney Island and constructing the westward extension.

3. Throughout this period, ocean disposal should be utilized for dredged material whose chemical and physical parameters meet the criteria established by the U. S. Environmental Protection Agency for open-water disposal.

On the basis of this report and considering the importance of adequate dredge spoil deposition to maintenance of Virginia as a leading port community, it is recommended that the General Assembly in adopting the findings of this report recognize the need in acquiring and planning for the future use of the present and expanded Craney Island site, and, therefore, it is recommended that the General Assembly adopt the following:

1. Support the Governor's Office in negotiations with the Federal Government for acquisition of the present site.

2. Support the Governor's Office in negotiations with the Federal Government to determine respective responsibility in expanding the Craney Island dredge spoil disposal site.

3. Direct the Virginia Port Authority and the Division of State Planning and Community Affairs to develop a plan for future use for the total development of the Craney Island area.

4. Recognizing that a large research effort is presently under way, on a nationwide basis, to seek solutions which will provide a positive approach to the total question of spoil removal, all State agencies having responsibility in these areas of research are

directed to participate, thereby providing the Commonwealth with the best possible solution to future dredge spoil disposal.

The named State agencies shall make a report to the General Assembly not later than October 1, 1975.

Future Disposal of Dredged Material From
Hampton Roads

REPORT OF THE CRANEY ISLAND TASK FORCE

To

The Secretary of Commerce and Resources
The Honorable Maurice B. Rowe

September 1973

SUMMARY OF RECOMMENDATIONS

The present dilemma of dredged material deposition faced by the Commonwealth and the Nation, and in this case the Port of Hampton Roads, is cogently summarized by the following passage from the U. S. Army Corps of Engineers Feasibility Report — Craney Island Study:

"Realistically, the need for another disposal area is not open to question. In the case at hand, the need for a disposal area is related to the need to maintain the navigation features of Hampton Roads. Maintenance of the harbors of Hampton Roads, in turn, is vital to the very existence of the ports themselves. However, this is not to say that a solution to the problem of spoil disposal can be simply advanced without regard for the environmental factors so important to man's health and well-being. There are other interrelated and often conflicting goals and needs which must be recognized and synthesized with that of harbor maintenance and spoil disposal. Hampton Roads is, in this respect, a good example of a subsystem in which the feedback of two included elements threatens the viability of the subsystem itself. It was dredging (and disposal) that allowed Hampton Roads to develop into a major port. Now, dredging and disposal has become more acute because of the developing and growing port cities. Industries and people are now competing for the land still available. This virtually precludes the possibility of a large land disposal area within 10 miles of the harbor. The water surface area remains constant while the number of people continues to grow. From a long range point of view, say the next 100 years, the filling of the harbor cannot be continued indefinitely. At the rate of 4 square miles every 20 to 25 years (which is the present rate, considering the Craney Island Disposal Area), Hampton Roads would eventually be completely filled. This points out that past methods of disposal are not satisfactory for the future. New solutions must be found."

Based on an approach which emphasizes the positive utilization of spoil material, the Craney Island Task Force first acknowledges that existing alternative solutions to the problem are marginally acceptable and it shall be the responsibility of both the Corps and the Commonwealth to work toward the "new solutions" which must be found. Thus, the recommendations stress first the need to direct our full attention to the positive solution of the problem while at the same time offering options if the answers are not readily forthcoming.

I. The Commonwealth, in cooperation with the federal government, should initiate studies for the positive utilization or harmless disposition of dredged material in several areas to include:

   a. the creation of artificial islands for a predetermined, desirable and needed use.

   b. the impact of dumping dredged material into open water.

   c. the likelihood of recycling dredged material for construction materials manufacture.

d. the utilization of dredged material for land improvement for both development and agriculture.

e. the possibility of rendering contaminated dredged material harmless.

II. While these studies are being conducted, the existing Craney Island should be filled to its design capacity. When filled, and if no new solutions are found, the existing disposal area should be raised to a height determined to be feasible by the COE.

III. If it appears that no viable alternative is available by the mid 1980's, when it is likely that a decision on the next phase must be made, the existing Craney Island should be extended incrementally to the west. By building incrementally in two stages, each with a life of approximately ten years, the option of possibly not having to fully extend the fill area is created.

IV. During all phases, ocean disposal of uncontaminated material should be employed.

V. The Governor's Office should begin negotiating with COE officials to determine the exact responsibilities of each party in meeting the maintenance needs of Hampton Roads.

If all alternatives are fully utilized, dredged material from Hampton Roads could be handled for approximately fifty years; however, by making a separate commitment at each ensuing stage, the option to employ a positive solution remains open. The thrust now must be directed toward finding that solution.

FUTURE DISPOSAL OF DREDGED MATERIAL FROM HAMPTON ROADS

In a memorandum dated January 23, 1973, the Honorable Maurice B. Rowe, Secretary of Commerce and Resources in the Governor's Cabinet, established a Craney Island Task Force.

> The responsibility of this group will be to assist the Division of State Planning and Community Affairs in developing acceptable and feasible recommendations on the disposal of dredging spoils from Virginia's ports and access channels.

State agencies represented on this task force are the Governor's Council on the Environment, Commission of Game and Inland Fisheries, State Water Control Board, Virginia Port Authority, Virginia Institute of Marine Science, Marine Resources Commission and Division of Industrial Development. The Office of the Attorney General serves as the legal consultant.

The purpose of the task force, as outlined in Secretary Rowe's memorandum, is to present to the U. S. Army Corps of Engineers the recommendation of the Commonwealth of Virginia for replacing the existing Craney Island Disposal Area when it has been filled to design capacity.

Initially, the general objectives of the Craney Island Task Force were to:

- Review and evaluate each of the feasible alternatives identified by the Army Corps of Engineers (COE) and any other approaches that the task force considers to merit study, as they affect the environment, development within the area, and other pertinent criteria.
- Recommend a site or a combination of sites for the future disposal area, and identify the procedure that the State should follow in fulfilling its obligations to the COE in the development of the site(s).
- Determine the costs to the State for the acquisition and development of the disposal area in as much detail as possible.
- Develop a scheme for the funding of the project, giving consideration to the possibility of a State appropriation, a State bond issue, assumptions by the Virginia Port Authority, or other alternative approaches.

Because of the nature of the task force recommendations to the COE, the last two objectives have not been considered in-depth and do not constitute a part of this report.

Background [1]

---

[1] Division of State Planning and Community Affairs, *Craney Island Study*, (Division of State Planning and Community Affairs, Richmond, Virginia, May 1971)

Historically, dredge spoil material removed from the harbor at Hampton Roads has been deposited in various low areas behind bulkheads and in the harbor itself at Fort Wool; in the James River above Newport News; on Craney Island and the land just west of that island; and in the inshore waters of the Chesapeake Bay. Ultimately, the need for an appropriate disposal area of large capacity became apparent, resulting in a Congressionally approved proposal to build a contained area projecting north from the U. S. Navy's fuel depot at Craney Island. Thus, the Craney Island Disposal Area, with the cooperation of the Commonwealth, was conceived to contain the material removed in harbor improvement and maintenance for a period of twenty years.

Construction began on August 19, 1954. Preliminary work which preceded actual construction included site analysis, engineering considerations and specifications, contractual arrangements and funding. The results of these studies indicated that the waters 4,000 feet west of the Norfolk Harbor deepwater channel, site of the planned fill area, varied in depth from the shoreline to a maximum of 12 feet. The harbor bottom was composed of sand from the shore to a point about 3,000 feet north of the existing Craney Island and, at this location, the bottom composition changed to marine clay with depths up to 100 feet.

These characteristics required the utilization of special construction techniques during the early phases of construction. The base of each levee was built up with sand pumped from a hydraulic dredge. The hydraulic sand fill was built to a height of 3.5 feet above mean sea level and had a slope of 1 on 15 down to 3.5 feet below mean sea level. Beyond this point the slope was reduced to 1 on 30 all the way to the natural bottom. The flat slope was needed to spread the weight of the levee over a wide area of the very unstable harbor bottom. The west and north levees were completed first to allow depositing of material prior to the completion of the east levee. The final levees were completed in January 1957 at a design height of 6.5 feet above mean sea level. As mentioned, some material was being deposited before the project was completed; however, it was not until mid-1957 that substantial amounts of spoil were being received within the completed enclosure.

The extensive tests made of the harbor bottom prior to construction indicated that there would be substantial consolidation of the marine clay bed under the weight of the levee and any subsequently deposited spoil material. It was estimated that consolidation of up to 7.5 feet could be expected. The actual settlement that has taken place has not been uniform. The most that has occurred in any one year and in any one place totaled 2.8 feet. At some locations, total settlement did attain the projected 7.5 feet. The resultant changes to the design height of the main levee were corrected by maintenance personnel. Most of this consolidation took place during the first seven years of the life of the main levee. Since 1964, much of the subsidence has ceased and the levees have remained practically stable.

As spoil material was placed behind the levees, this consolidation also became an important factor in calculating the design life of the fill area. As designed, it was estimated that the ultimate capacity would be in the vicinity

of 100,000,000 cubic yards. Due to compaction of the underlying marine clay bed, this figure has been periodically revised upwards. It is now believed that the area, when brought to design specifications, will hold more than 125,000,000 cubic yards of material. As of March 1972, about 100,000,000 cubic yards has been deposited. Based on current projections, the area will be filled by approximately 1980. This estimate is computed on the assumption that the average annual fill rate of 4,000,000 cubic yards generated by presently authorized maintenance dredging projects will continue, and that no major new work will be undertaken in the intervening period.

When completed and stabilized, the Craney Island Disposal Area will have the following configuration if the original design is maintained:

Shape	Trapezoidal — offshore dimension east-west, 9,000 feet; inshore dimension east-west, 11,000 feet;
Area:	2,546 acres plus or minus
Elevation:	Main levee — +6.5 feet above m. s. l. Step levee — +16.5 feet above m. s. l. (Step levee approximately 100 feet inside main levee.)
Material:	marine clay shells silt sand

With approximately 6 to 8 years remaining before the projected capacity of Craney Island is reached, it is imperative that a strategy be developed to allow for the continual maintenance and improvement of Hampton Roads. In recent years there has been an increasing emphasis placed upon the role of local and state governments in taking positive action to provide the facilities needed to ensure that their ports and waterways are maintained for their benefit. A survey of some of the major U. S. ports has shown that in almost all cases it is the responsibility of the non-federal interests to provide the land and associated structures (dikes, spillways) for spoil disposal areas. This will necessitate a strong commitment on the part of the Commonwealth to work toward a solution which will enhance both the economic viability and environmental quality of the region and, indirectly, that of the entire State.

Possible Solutions

The Corps of Engineers has initiated an effort to determine a suitable alternative to the present Craney Island after it has been filled to its design capacity. For more than three years, various investigations have been made concerning approaches and locations which may be acceptable for spoil

removal. A broad spectrum of alternative solutions, ranging from inland disposal by rail haul to disposal at sea by pipeline, has been studied by the Corps. Criteria against which each concept was independently measured consisted of (1) engineering and economic feasibility, and (2) social and environmental impacts.

Upon subjection to the above two criteria, several of the original alternative proposals (from a list of twelve alternatives) were eliminated by the COE from further consideration, and the following five proposals were deemed worthy of additional study (see attached location map):

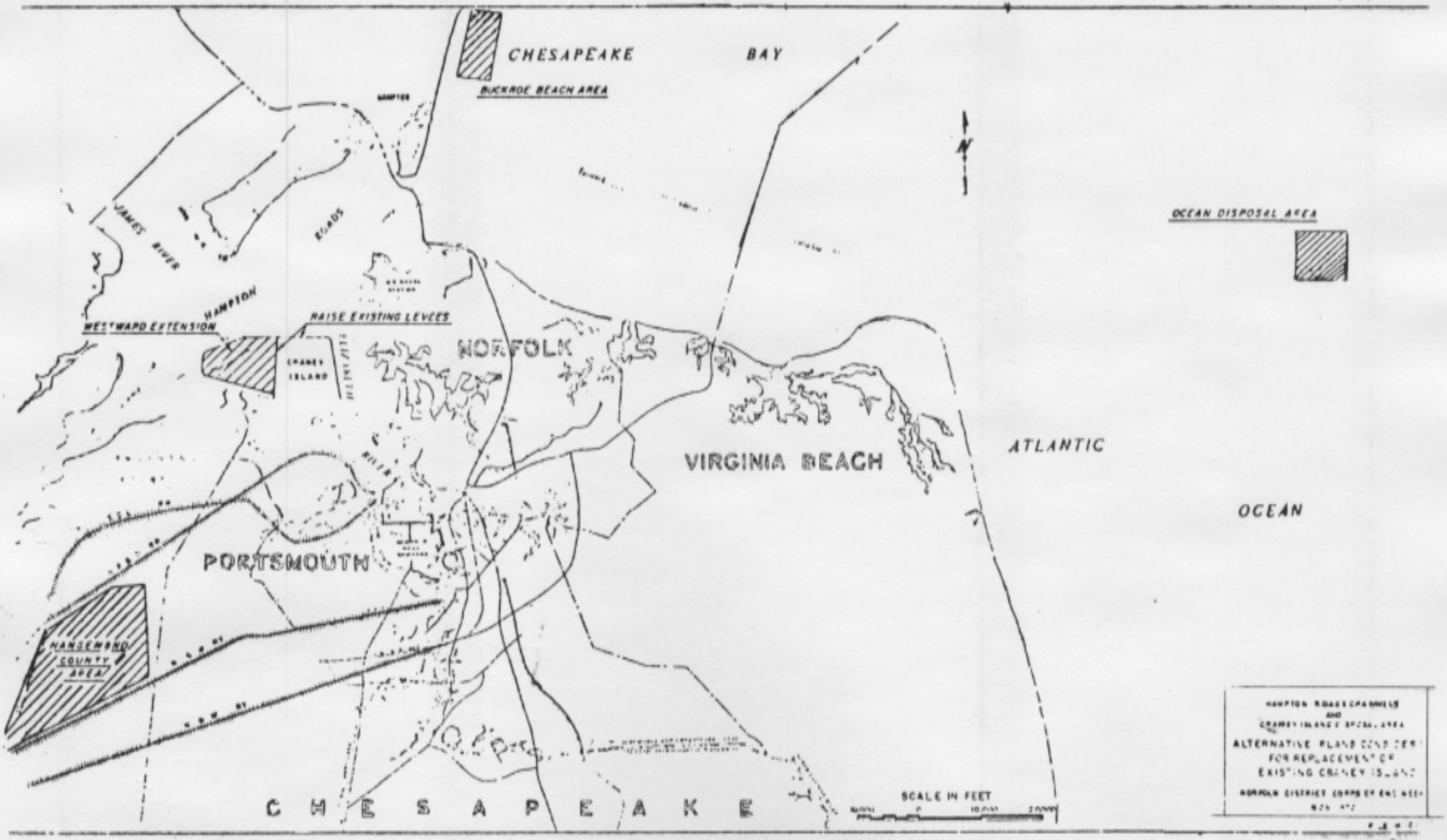
a. Raising the existing Craney Island Disposal Area to an elevation of +29 feet above mean low water (m. l. w.).

b. Constructing a westward extention to the Craney Island Disposal Area.

c. Disposal in Chesapeake Bay offshore of Buckroe Beach.

d. Disposal in Nansemond City east of Suffolk and north of U. S. Highway 58/460.

e. Ocean disposal east of Cape Henry, Virginia.


CHESAPEAKE BAY
BUCKROE BEACH AREA
OCEAN DISPOSAL AREA
JAMES RIVER
HAMPTON ROADS
WESTWARD EXTENSION
HAMPTON
RAISE EXISTING LEVEES
CRANEY ISLAND
NORFOLK
VIRGINIA BEACH
ATLANTIC
OCEAN
PORTSMOUTH
NANSEMOND COUNTY AREA
C H E S A P E A K E
SCALE IN FEET
HAMPTON ROADS CHANNELS AND CRANEY ISLAND SPOIL AREA
ALTERNATIVE PLANS CONSIDERED FOR REPLACEMENT OF EXISTING CRANEY ISLAND

More detailed studies of these five alternatives were made by the COE based on the following two basic assumptions:

a. That any overall disposal-area plan must have an economic life expectancy of 50 years.

b. Additionally, there must be space available in the new disposal area for dredge spoil generated by the proposed deepening of the channels of Hampton Roads to a depth of 55 feet. Thus, the annual 4 million cubic yards of maintenance dredging should be increased by 50 million cubic yards, or about 1 million cubic yards per year for the 50-year life of the project.

Based on these two assumptions, twelve alternative plans for the replacement of the existing Craney Island were developed by the COE. These plans comprise one or a combination of the foregoing five proposals studied in depth by the COE. In computing the cost of these twelve plans, cost apportionment was based on the State furnishing the following:

a. Lands, easements, and rights-of-way

b. Levees and structures associated with the diked area

The Task Force Alternatives

The Craney Island Task Force investigated the five proposals given additional study by the COE, and at this time the task force essentially has no new viable solutions to offer beyond those already studied. One major modification of one of the proposals may be considered a different approach which will be subsequently addressed in the task force's recommendations. A description of the five COE alternatives follows.[2]

a. *Raising the Existing Craney Island Disposal Area*

This plan would raise the levees at the existing disposal area, thereby increasing its capacity and prolonging the useful life. The design height of the existing step levees at Craney Island is 16.5 feet above m. s. l. By continuing fill operations beyond the present design elevation to 28.5 feet m. s. l. (i. e., raising the existing levees an additional 12 feet), the capacity would be increased by about 40 to 45 million cubic yards and the useful life by about 9 years. The levees could be built up gradually as needed or all at once. The increase in capacity was calculated under the assumption that three feet of settlement and compaction will take place during filling of the area. This plan would not entail changes in present dredging or disposal methods. The present rehandling facilities for hopper dredges and scows would be adequate. A slightly increased energy requirement for pumping into the area, resulting from the greater lift, would present no practical difficulty, since most of the material pumped is of a very liquid silty consistency.

[2] U. S. Army Corps of Engineers Feasibility Report — Craney Island Study

The total first cost of this plan is estimated by the COE to be five million dollars, which includes the initial construction cost of levees and spillways and accounts for the salvage value of the filled land. (Costs for contingencies, engineering and design, and supervision and administration were added to obtain the total estimated cost.) Based on experience at the existing facility, probable annual operation and maintenance and replacement costs are estimated to be $300,000. The annual charges for interest and amortization, based on a rate of 5-1/2 percent, are $700,000.

The average annual dredging cost for this alternative is computed to be $4,600,000. This includes $3,600,000 for maintenance dredging plus $1,000,000 for expected new work. The total estimated annual charges are then $5,600,000 or about $1.20 per cubic yard.[3]

b. *A Westward Extension of the Craney Island Disposal Area*

An extension to the west of the existing Craney Island Disposal Area would be similar to the present disposal area. A channel would be provided between the shoreline and levee to provide water access for the residents along the waterfront and allow drainage from Streeter and Hoffler Creeks.

Various shapes for the addition are possible, but in general it would extend westward, gradually tapering from the north, with the westernmost point near the mouth of the Nansemond River at Pig Point. An accompanying sketch shows the two most probable shapes, which are labeled Plan B1 and Plan B2. The configuration of Plan B1 was suggested by the Virginia Institute of Marine Science on the basis of hydrodynamic soundness. Plan B2 allows for greater storage capacity with no increase in the length of levee required. Model tests of the two shapes made at the COE Waterways Experiment Station in Vicksburg, Mississippi, showed that the proposed westward extension of the Craney Island Disposal Area by construction of either Plan B1 or Plan B2 dike configuration would have no significant effects on current velocities, salinities, or tidal heights in the area.

In both cases, about 31,000 feet of levee would be required. In Plan B1, the levee would enclose about 1,750 acres and in Plan B2 about 2,380 acres. The water depth in the area averages 9.5 feet, and a levee with an ultimate height of 16.5 feet would provide a storage capacity of 79,000,000 cubic yards in Plan B1, 115,000,000 cubic yards in Plan B2. These capacities correspond to effective lives of 16 and 24 years, respectively. Neither plan would interfere with harbor

[3] For each plan, the costs of construction, operation, maintenance, replacement and all other necessary items were estimated, and using the appropriate interest rate, were reduced to yearly (annual) costs. Added to these were the costs for various methods of dredging throughout the year. These annual costs were then divided by the estimated annual maintenance dredging requirement, plus an allowance for new work — about 4.8 million cubic yards — to obtain an overall average cost per cubic yard. For example, the yearly costs associated with the plan to raise the existing levees are estimated to be $5,600,000. Dividing this amount by the 4.8 million cubic yards yields a rounded figure of $1.20 per cubic yard. These derived costs, of course, reflect the larger figures, but they offer a more convenient method to compare alternatives from a cost standpoint.

traffic, since the area west of the existing disposal site is aside from harbor channels and small craft routes.

The area is suitably located with respect to dredging and disposal activities. Its sheltered and centralized location would facilitate the continuance of the economical dredging and disposal methods now employed. By extending shore pipeline to the new area, the existing rehandling facilities could be used.

This alternative would accomplish maintenance of the navigation features as follows: (1) initial removal of in-place shoal material by current methods; i. e., hopper dredge, hydraulic pipeline and bucket scow; and (2) transfer of the material, using the existing rehandling facilities, to the diked area for final disposal. Essentially, the rehandling operation would be the same as at present, with the exception that about two miles of additional shore pipeline would be needed from the rehandling area to the new disposal area. In hydraulic pipeline dredging, the outfall end of the pipe would be inside the disposal area; i. e., the rehandling facilities would not be used.

Since Plan B2 would have a larger storage capacity than Plan B1, only its cost has been computed. The estimated cost of maintaining navigation by Plan B2 (115,000,000 cubic yards) is $5,900,000 per year or $1.20 per cubic yard over the plan's 24-year life.

A Westward Extension of the Craney Island Disposal Area

Plan B1 ----------

----------Plan B2

Another approach to the westward extension alternative would be to expand the Craney Island Disposal Area incrementally or section by section instead of enclosing and filling in the total area at the outset as proposed in Plans B1 and B2. Though such a procedure would not create a disposal area with an initial capacity comparable to the COE plans, neither would it require the immediate enclosing of another large area in the Hampton Roads Harbor with the subsequent destruction of marine resources and recreational opportunity. The premise behind this proposal is that research activities investigating new uses for dredge spoil and methods of disposal may be successful and make it unnecessary to proceed with the construction of the entire large spoil disposal area as now proposed.

c. *Disposal Area Off of Buckroe Beach*

This plan would build a dredge-spoil island off Buckroe Beach in Chesapeake Bay in an area known as the Horseshoe. The area is somewhat removed from harbor facilities where the majority of dredging is required. Rehandling operations would be situated on the south side of the island where they would be protected from northern exposure. The entire facility, located offshore, would avoid conflict with existing development and costly disruption of present use, and would allow continued access to the present shoreline. Drainage of the adjacent land area would not be affected.

About 63,000 feet of levee would be required and would enclose approximately 6,100 acres. With the water depth averaging 15.5 feet, a levee with an eventual height of 16.5 feet would provide a storage capacity of 340,000,000 cubic yards over an effective life of 71 years. This contains an allowance for three feet of settlement during filling. Current dredging methods could be continued. The plan calls for the construction of a rehandling area for scows and hopper dredge pumpout facilities, similar to those at the Craney Island Disposal Area.

Maintenance of navigation features would be accomplished by (1) removal of shoal material by current methods; namely, hopper dredge, hydraulic pipeline, and bucket-scow dredging; and (2) transfer of the material through rehandling facilities to the diked area for final disposal. The estimated cost under this plan is $11,900,000 per year or $2.50 per cubic yard over its 71-year life.

d. *Disposal in Nansemond City*

It is technologically feasible to transport dredged material by pipeline over long distances. Such a capability allows the consideration of alternative disposal areas far removed from the harbor itself. The nearest onshore area feasible is approximately 5,000 acres located in the eastern sector of the City of Nansemond (formerly Nansemond County). The area is bounded by U. S. Highway 460 on the southeast; a pipeline on the southwest; the Atlantic Coastline, and Norfolk, Franklin and Danville Railroads on the west and north; and by the Nansemond City-Chesapeake City boundary line on the east. The site is not accessible by navigable waterways; however, it is possible to connect Craney Island to the Nansemond area by pipeline. The projected pipeline would

be 16 inches in diameter and about 55,000 feet in length, and would utilize five successive booster stations. As envisioned, the line would run from a rehandling basin formed from part of the west side of Craney Island (around 500 acres) alongside the existing rail line to the northern tip of the proposed disposal area. Drainage would be southeastward through the disposal area to the Nansemond River, or be returned to Craney Island via the pipeline.

In this plan, about 58,000 feet of levee would be required. It would be a single, non-riprapped, earth-raised type and would encompass about 5,000 acres. The area elevation averages +20 feet m. s. l. which, with a levee of final height +47 feet m. s. l., would provide a storage capacity of about 240,000,000 cubic yards. This allows for three feet of settlement, and the capacity corresponds to an effective life of 50 years.

The existing rehandling facilities at the Craney Island Disposal Area would be used for hopper dredge pumpout and scow unloading. The dredged material would be pumped through pipelines across the filled portion of Craney Island to the confined rehandling basin on the west side of the disposal area. The material would then be injected into a long pipeline by rehandling unit and pumped to the Nansemond site by successive booster stations. Several pipeline rights-of-way would be reserved in this plan; other than these and the rehandling area, the filled Craney Island Disposal Area would be available for development. Also, it is conceivable that the useful life of the Nansemond area could be significantly prolonged by removing native material from the site and using it for construction fill or topsoil.

The estimated cost of maintaining navigation features by this plan is $9,200,000 per year, or $1.90 per cubic yard over its 50-year life.

The area is heavily timbered and relatively flat. Numerous drainage canals have been cut through the area, primarily to regulate water levels and to afford fire prevention measures. The surface soils are mostly peat and are generally less than five feet thick. Subsurface mineral deposits of any economic value, with the exception of a thin stratum of sand, are not known to exist. The site of the proposed disposal area is, in actuality, the northern part of the Great Dismal Swamp. Present commercial land use consists of timber and related industry. Three hunt clubs currently use the area during the winter months, the largest of which has about 60 members who take about 60 deer per year from the forest.

The COE in April 1973 completed a *Hydrogeologic Study of Nansemond City Disposal Area*.[4] Based upon an evaluation of this investigation, the COE judges that is feasible from an engineering standpoint to provide the necessary protective measures to prevent contamination of the subsurface environment surrounding the proposed disposal area. The COE acknowledges that such safeguards must be a part of any plan to utilize this site for the deposition of Hampton Roads dredge spoil.

---

[4] See Appendix A

e. Ocean disposal

Several methods of disposal at sea were considered by the COE. With present technology, a long pipeline could be built with successive booster stations that would carry the dredged material from the Craney Island Disposal Area out to sea; however, it is recognized that maintenance and other related engineering problems could make this approach essentially infeasible. The material could also be carried to sea in barges filled from Craney Island, or conveyed by a specially designed dredge, or by hopper dredge. The cost of the different plans considered was estimated to range from $1.60 per cubic yard to $3.00 per cubic yard. All plans for disposal at sea share a common disadvantage; namely, the potentially adverse environmental effects of ocean dumping.

One plan would employ a hopper dredge and bucket dredge with the material disposed at sea. The hopper dredge would be filled to overflow, whereupon dredging would cease and the load would be carried to sea for dumping. Where possible, all work would be done by hopper dredge; the dredging around piers and slips and other confined places would be done by bucket dredge discharging into attendant barges. The barges would be towed to sea when loaded, two at a time, and the material dumped.

The estimated cost under this plan is $11,700,000 per year or $2.40 per cubic yard, which includes both the dredging and transportation of the material.

A second plan would accomplish maintenance dredging in three steps: (1) initial dredging by current methods; (2) temporary storage in a diked harborside rehandling area (a portion of the Craney Island Disposal Area); and (3) rehandling, which consists of removing the material from the rehandling area with transport by tug and barge to sea for final disposal.

The shoal material would be removed from the rehandling basin area by a semi-portable rehandling unit, which would inject the material into a short pipeline emptying into barges. The filled barges would then be conveyed by tug to sea for final disposal. Several pipeline rights-of-way at Craney Island would be reserved; other than these and the rehandling area, the filled disposal area would be available for development.

The cost estimate for this plan is $15,300,000 per year or $3.20 per cubic yard over the 50-year period of analysis.

Disposal at sea by pipeline would entail the following three steps: (1) dredging by current methods; (2) temporary storage in a diked harborside rehandling basin (Craney Island); and (3) rehandling, which consists of removing the material from the temporary disposal area with transport to sea by pipeline for final disposal. The rehandling phase would be accomplished by a government owned and operated rehandling unit that would inject the material into a long pipeline to be pumped to sea by successive booster stations. The booster stations would be unmanned and remotely operated and controlled from the rehandling unit.

The estimated cost of maintaining navigation features by this plan is $10,800,000 per year or $2.30 per cubic yard over the 50-year period of analysis. The chief drawback of this scheme is its inflexibility, a large initial investment, and a long period required for amortization.

A fourth plan would be implemented by using a specially designed dredge and a bucket dredge, with the dredged material being carried out to sea by barge for disposal.

The special dredge, as designed by personnel of the Philadelphia District, COE, is essentially a hopper dredge without hoppers. Operation of this special dredge would require 10 barges, 10 tenders, and 9 tugs. The dredge would operate in the dredging area and pump the shoal material directly into the hopper barges placed alongside the dredge. The dredged material would be taken to sea in these barges, which are of the bottom dumping, hydraulically operated type. Barges would be used in pairs for this operation.

The cost estimate for this plan is $7,700,000 per year or $1.60 per cubic yard over the 50-year period of analysis.

Recommendations of the Task Force

The Craney Island Task Force, having evaluated the various alternatives for their social, economic, environmental, and aesthetic impacts, submits the following recommendations for the replacement of the existing Craney Island Disposal Area.

The Craney Island Disposal Area should be filled to its design elevation of approximately 18 feet above mean sea level, which at the present rate of dredged material deposition will be accomplished in 1979-80. When this stage of the Craney Island project is reached and a better alternative remains to be found, the disposal area should be further filled to an elevation of 28-30 feet above mean sea level, or to whatever final elevation is determined to be technologically feasible by the Corps of Engineers. Raising the existing Craney Island Disposal Area to an elevation of 28-30 feet above mean sea level will increase the capacity of the disposal area by 40-45 million cubic yards and extend the useful life by about 9 years.

Due to the unstable condition of the underlying harbor bottom, it is now unlikely that intensive use of the completed disposal area will be possible. Thus, the demand to develop the site, based upon its original design configuration, is largely negated. One proposal, however, remains viable and, with little difficulty, can be realized even if Craney Island continues to be filled and its resulting final elevation is beyond that which was originally proposed.

Port development along the eastern shore of Craney Island can be effectuated, since associated shore structures are not intense and a relatively small upland area would be required. To raise the level of Craney Island as proposed, new levees will have to be set back from existing levees. With minor design modifications during or after filling, port facilities can be built without significantly effecting the amount of spoil deposited. This particular utilization of the completed disposal facility should be anticipated.

If by 1988-90, after the Craney Island Disposal Area will have been elevated to its maximum feasible height, it is determined that the science of spoil removal will be unchanged, a decision should be made to begin extending to the west, incrementally or in a section-by-section mode. Each enlarging section could be designed to accept a quantity of dredged material that would extend the life of the Craney Island Disposal Area approximately 8-10 years.

It is acknowledged that the time frames used in these first two recommendations were derived from using average rates of dredged material accumulation over an extended period of time. When a decision to proceed with the deepening of the channel at Hampton Roads to fifty-five feet is actually made, the life span of these recommended actions could be shortened by as much as five years.

It is not likely that any work on such a project would begin before the onset of that period when the existing Craney Island was being raised above its present designed capacity; therefore, with approximately 50 million cubic yards of contaminated material attributable to the deepening, the life of this phase of the proposal could be immediately effected. The actual impact upon the stated projections based upon an average spoil deposition figure will depend upon the level of funding authorized for deepening purposes and the availability of equipment to do the work. The fifty million cubic yards of material may be dredged and deposited in as little as 3 or 4 years or in as much as 10 years.

Should the life of a raised Craney Island be substantially shorter than the nine years alluded to earlier, it will merely necessitate an earlier commitment to initiate work on a portion of the westward extension. Rather than possibly having to proceed with construction in the vicinity of 1985-87, it may become evident that action will have to be taken as soon as 1981-83. This only emphasizes the necessity to begin the earnest implementation of research to find new solutions.

Beginning now, during which time the existing site is being utilized to its fullest potential, research should be initiated into the feasibility of building an island or islands from dredged material in the lower Chesapeake Bay, which would ultimately be put to a use desired by the region or the State.[5] Once a policy determination was made concerning the exact nature of the project, the Commonwealth of Virginia might actively solicit the participation of private interests and investment capital. This island could be specifically designed for the purposes of commercial, industrial, or recreational development, and serve as more than just a depository for dredged material thereby offering a clear incentive to plan for and fund such an effort. Much basic study and research should precede a definite commitment.

During this period and possibly as a continuing practice, ocean disposal should be utilized for dredged material whose chemical and physical

[5] See Appendix B

parameters meet the criteria established by the U. S. Environmental Protection Agency for open-water disposal.

Presently, even the ocean disposal of nonpolluted dredged material is questionable since the ultimate environmental impact is not known. Therefore, the task force recommends that the Virginia Institute of Marine Science (VIMS) submit a dredged material research proposal for funding to the Office of Dredged Material Research of the U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, to evaluate the effects of ocean dumping on the marine ecosystem. Further, VIMS could participate in a program to develop new uses for dredged material, such as recycling for construction materials manufacture and land improvement for agriculture.

By following these recommendations, a solution is offered for the deposition of spoil that should have a minimal danger of significantly degrading existing environmental quality while creating additional time for the State and the COE to seriously study the total question of spoil removal. The problem must be addressed more from a positive approach of utilization and not from solely the negative aspect of finding a location to store substantial amounts of a nuisance material.

It is upon this basis that the Nansemond City Site and the Buckroe Beach Site were rejected as conceived, and the raising of the existing Craney Island, incrementally moving to the west, if necessary, and nonpolluting ocean dumping were recommended as an appropriate, staged means for spoil removal. The Nansemond City Site was rejected because of the potentially significant adverse socioenvironmental impact with no desirable resultant effect to justify this degradation. The area in question is a valuable forest and wildlife resource, and its proximity to the urban population of Tidewater Virginia gives this natural area irreplaceable qualities as open space and potential recreational land.

Another compelling consideration was the potential detrimental impact of polluted saline dredged material on the aquifer underlying the Nansemond site and the surrounding area, and the costly and as yet untested measures that would be required to adequately protect the subsurface environment from this toxic material and its effluent. To destroy this natural area for a purpose which, at best, is an expedient solution, cannot be justified and would not be in the best future interests of the Commonwealth.

Similarly, the Buckroe Beach Site, as now formulated, was rejected because it too would be creating merely another disposal area with no envisioned use or positive approach to the spoil removal problem. To adversely affect the marine environment without achieving a resultant benefit that can be attributed to such a decision, is difficult to justify. In addition, continued filling of the inner harbor, without first attempting to assess all the long term consequences, both good and bad, is somewhat irresponsible.

Local Cooperation

The entire issue of harbor maintenance and improvement and the directly

related problem of spoil removal must be of concern to the Commonwealth. It is likely that a future State commitment, beyond just providing bottom lands or other sites will be necessary to facilitate harbor maintenance and improvement. COE regulations [6] set forth the nature of local responsibility in rather explicit terms, although it is recognized that specific legislative action concerning a particular project could alter such COE requirements.

Action on ultimately expanding the capacity of the existing Craney Island by first elevating the area and then possibly beginning a westward extension must deal with this question of local cooperation. Several arrangements [7] have been suggested by the COE, but based upon the nature of the task force recommendations, there will be a need for still further negotiations on this issue. It appears, however, that some form of alternative "e" will prevail. To officially settle this question, the Governor, or his designees, should meet with COE officials to reach a definitive understanding of the responsibilities of each party based upon certain actions or events.

---

[6] See Appendix C

[7] See Appendix D

APPENDICES

A. COE RECOMMENDATIONS CONTAINED IN THE *HYDROGEOLOGIC STUDY OF NANSEMOND CITY DISPOSAL AREA*

"It is recommended that use of the Nansemond Disposal Area for marine waste disposal be contingent upon adoption of the following design measures:

a. A 5 foot wide bentonite slurry cutoff wall to be constructed around the perimeter of the disposal area, extending from the surface 10 feet into the impermeable upper beds of the Yorktown Formation.

b. An impermeable dike to be built around the disposal area contiguous with the bentonite slurry cutoff wall.

c. Drainage, settling, and pumping facilities sufficient to pump excess saline water from the disposal area to a marine environment.

Future Investigations — This study proves the feasibility of disposing of dredge spoil in the study area with adoption of the design measures stipulated. It should be emphasized, however, that although this study is adequate for project feasibility, additional exploration is required before proceeding with design. It is recommended for project design that borings be conducted on a minimum spacing of 500' around the perimeter of the disposal area and through the disposal area where sectioning will be required. Permanent piezometric measuring and water sampling stations should be established at 1000' intervals around the perimeter and immediately outside of the disposal area to monitor the effectiveness of the cutoff wall. Additional permeability studies should also be conducted for project design. An early seismic refraction survey of the area is recommended as a possible substitute or supplement to the exploration borings."

Besides the above measures, it was suggested that scavenger wells might be necessary to maintain a lowered water table within the area and further reduce the possibility of saline effluent penetrating the foundation beds of the Yorktown Formation underlying the site and/or infiltrating the bentonite slurry cutoff wall.

It is readily conceded by those with expertise in geology and geohydrology that the investigations conducted to date are of a preliminary nature only, and that before actual site preparation could begin more field and laboratory tests would be essential. (It should be noted that the current proposal is to divide the site into four sections, with the drainage, settling and pumping facilities to be located in the approximate center of the whole area. The spoil disposal operation would be confined to one section at a time; initially, the cutoff wall and dike would encompass just the section receiving spoil and the central drainage and pumping area. The COE estimates that about 11 million cubic yards of material would be deposited over a 300-day period (per annum). The rate of return of saline water to the marine environment (probable discharge at Craney Island) would be about 8,000 gallons per minute, 3,000 gallons of which would be diverted as sealing water for the incoming pipeline booster pumps.)

B. ABSTRACT OF A PROPOSAL SUBMITTED BY DR. JOHN M. ZEIGLER, ASSISTANT DIRECTOR, VIRGINIA INSTITUTE OF MARINE SCIENCE, AND MEMBER OF THE CRANEY ISLAND TASK FORCE

The objective of this proposal is to use for a profit the spoil dredged from the Norfolk-Newport News-Hampton Roads area and connecting channels to build an island or islands out in the lower Chesapeake Bay, whose use will be for tourism and housing, thereby deriving an income and profit far greater than the cost of spoil removal. In short, the use of the island will be designated *before* it is built and therefore its exact location, design and characteristics will be governed by *economics* and planning relevant to tourism or high cost housing.

The benefits will be:

1) A long term solution to spoil removal, not only maintenance but channel and port improvement.

2) A major assist to the cash flow which will be required of the Commonwealth of Virginia for site preparation.

3) Development of a major industry in the area.

4) Time saved. This would be a State decision and would not require Congressional approval in contrast to a Corps of Engineers decision, which would.

Inasmuch as this proposal is primarily a business proposition, it is recommended that planning and financing be done through the private sector as much as possible, but close coordination with all concerned State agencies would have to be maintained throughout.

The proposed schedule is as follows:

Phase I:

Economic and planning study to determine the market, restraints and costs. Could be completed within six months. At that time a go or no-go decision could be given.

Phase I & II:

Technical evaluation and planning to begin concurrently with the economic study but on a relatively low level during Phase I, principally to arrive at a physical and engineering systems analysis design which can apply to the economic decision. (It is assumed that an economic evaluation will eliminate some potential sites and have preference for others.) The design criteria should be ready by the end of Phase II; i. e., the end of 12 months. Stockpiling of site construction materials.

Phase II & III:

Assuming that design criteria have been far advanced during Phase II, far enough that the type of construction materials are known, construction can

begin in Phase III. Since we are dealing with a relatively small area (a single year's supply of spoil or about 80 acres) it would seem that the site could be ready to receive spoil by the end of this phase (18 months).

Phase IV:

Assuming the legal and financial agreements have been worked out between state officials and private interests during Phase I and II (one year), construction of the spoil site could begin in the third six month period. In short, there is a chance that spoil could be deposited at the new site within eighteen to twenty-four months and for as long thereafter as desired.

Phase V:

Tourism construction to begin as soon as the site warrants. This is a function of spoil type and would itself be part of the study. However, it is assumed that all structures would be on piling and the spoil would be required to support only roads or light structures.

This proposal would not entail delay to a final solution by "muddying the waters" so to speak by introducing something new to study. We already have most of what we need on hand. It is not a proposal intended to compete in the sense that you must choose it now and forever be bound by the decision.

If the Commonwealth waits for a Corps of Engineers approved plan it will be years before the plan makes its way through the various legal requirements and receives Congressional approval.

If, on the other hand, the Commonwealth makes its own decision, based on sound economics, there is hope that the Corps could use it at once. No Congressional approval is required. Craney Island will last long enough to permit the new site to be made ready.

It is intended that this proposal will demonstrate that not only is the plan economically beneficial to the State but that it can be started years before any other plan.

C. COE REGULATIONS RELATING TO LOCAL COOPERATION

Local Cooperation in General Navigation Projects

Favorable recommendations in navigation reports will include a general provision that local interests agree to meet the following requirements of local cooperation, among others, when applicable and appropriate. Items (1), (2) and (3) are generally required by the physical and economic nature of most improvements; items (4), (5) and (6) depend upon local conditions and special local benefits.

(1) When lands, easements and rights-of-way will or may be required for both construction and subsequent maintenance, the following wording will be acceptable:

"Provide without cost to the United States all lands, easements and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of spoil, and also necessary retaining dikes, bulkheads and embankments therefor or the costs of such retaining works."

(a) When spoil disposal areas will not be needed for construction or maintenance, the following wording may be used:

"Provide without cost to the United States all lands, easements, and rights-of-way required for construction of the project, and for construction and maintenance of aids to navigation, upon the request of the Chief of Engineers."

(b) When spoil disposal areas will be needed only for construction, the basic wording in (1) would be used, eliminating the unnecessary references to spoil areas for "subsequent" maintenance or disposal; similarly, when such areas will be needed only for maintenance, the refererices to areas for "initial" disposal of spoil will be eliminated.

(2) Hold and save the United States free from damages due to the construction works, when special conditions and contingencies and the possibilities of damages can be foreseen and warrant this provision, as, for example, when the possibility of damage to property such as wharves, buildings, agricultural lands, etc., from dredging, changes in ground water levels, wave action, caused by the construction works and effects thereof may result in claims against the Federal Government. Local interests cannot be expected and should not be required to be responsible for damages resulting from construction operations, such as blasting, or negligence of the construction contractor. Likewise, local interests cannot be expected and should not be required to hold and save for indefinite periods against unspecified or unpredictable contingencies. Inclusion of a blanket hold and save clause will be the exception rather than the rule. A separate letter of explanation will accompany the report, if necessary, setting forth the circumstances for the manner of treatment of this matter in the report.

(3) Provide and maintain at local expense adequate public terminal and transfer facilities open to all on equal terms in accordance with plans approved by the Chief of Engineers where appropriate.

(4) Provide and maintain without cost to the United States depths in berthing areas and local access channels serving the terminals commensurate with the depths provided in the related project areas.

(5) Accomplish without cost to the United States such alterations as required in sewer, water supply, drainage, and other utility facilities, as well as their maintenance except that this may be modified when appropriate in major projects involving artificial waterways (cuts in fast land and in summit sections).

(6) Provide a cash contribution toward the project, if appropriate, expressed as a percentage of the Federal construction costs in view of special or local benefits. (Contributions because of enhanced land values due to dredged fill will be computed in accordance with EM 1120-2-113.)

D. *SCHEMES CONSIDERED FOR COST SHARING — CRANEY ISLAND DISPOSAL STUDY*

a. One alternative is to give Craney Island to the State at no cost in return for the State providing the United States with title to new sites in perpetuity. This exchange of a new site for a completed site would require specific legislation which would have to waive the requirement of House Document 563 that the Federal investment in Craney Island be recovered since the fair market value of Craney Island might not be received upon its disposition. In connection with construction of a new disposal area, the Federal government would pay for dikes, pipelines, etc., with the investment being recovered by levying user fees.

b. As a second alternative, the State would provide the United States with title to the new site. Dikes, pipelines, etc., would again be paid for by the Federal government and recovered by levying user fees. However, Craney Island would be transferred to the State only upon the stipulation that the United States receive the fair market value of that land. Pursuant to 33 U.S.C. 558b (1970), the Corps has the authority to trade lands it has in exchange for lands required for a navigation project. Therefore, where the value of the lands for the new site is equal to the value of Craney Island, a simple exchange of lands can be made. If the value of the lands provided by the State were less than the value of Craney Island, then the difference would have to be made up, presumably as a cash contribution, and specific legislation would be needed in order to transfer Craney Island to the State.

c. The rationale for a third alternative is that Craney Island has set a precedent for the manner in which spoil disposal in Norfolk Harbor is to be funded and accomplished. The State would deliver title to the United States for all lands, easements, and rights-of-way needed for the new site with no reimbursement required for the value of land. Once again, the Federal Government would pay for dikes, pipelines, etc. with the investment being recovered by levying user fees. When filled, Craney Island would be subject to the provisions of the Federal Property Act, 40 U.S.C. 484 (1970). Treating Craney Island in this manner would mean that any enhancement in the value of the site which has accrued because of the deposition of spoil would inure to the benefit of the Federal Government. In dealing with the property, the first step would be to determine whether the property is excess to Department of Army needs. If it is, then it must be determined if it is surplus to the needs of other Federal agencies. This requires contacting other Federal agencies; for example, the Department of the Interior may have use for the land as a park or wildlife refuge or the Department of the Navy may desire the site for a depot, etc. If Craney Island, or some part of it, is surplus property, then it is reported to General Services Administration and disposed of by them. Whoever wishes to acquire Craney Island would then have to deal with GSA, and such a party would pay a price based upon the provisions of the act. The State would have first option on the land if it agreed to put it to one of several specified uses, such as low income housing, park land, or civil defense needs.

d. Under the fourth alternative, the State would provide all necesary lands, easements, and rights-of-way but need not deliver to the United States. In addition, the State would pay for pipelines, dikes, etc., as required for construction of the new site. Since the State would have retained title to Craney Island and would have enjoyed all enhancement in real estate values had this approach been adopted when Craney Island was authorized, it appears logical that the title would be returned to the State at no cost. A law specifically addressing the point could accomplish this action. This law would also have to waive the requirement that Craney Island be "self-liquidating" since the $2.5 million estimated value of the site would not be recovered. Annual maintenance expenses would be borne by the Corps; however, private dredgers would be charged for their share of the use. Two fees would be levied, both being based on the relative capacity of the site which private dredgers use. The first fee would be for recovery of the initial investment by the State while the second would be to cover operation and maintenance costs of the Corps.

e. The final alternative would be a combination of the third and fourth alternatives. On the assumption that a historical commitment has been established for Norfolk Harbor by the Federal government to build the dikes with Federal funds the present arrangement could continue for that part of the dredging operations in Norfolk Harbor which is attributable to the maintenance dredging of currently authorized projects. New work and the maintenance thereof would be handled as part of the non-Federal cost sharing based on current regulations. To accomplish this arrangement, the following items are necessary:

State to provide all necessary lands, easements, and rights-of-way, and need not deliver title to United States.

Federal Government to pay back to State, in the form of user fees, that part of the State's investment in dikes which is proportional to the amount of capacity taken up by the disposal of maintenance spoil from existing authorized projects.

State would not be reimbursed for disposal of spoil and subsequent maintenance from new work.

Existing Craney Island would be given to State and new site administered according to above.

Of all the alternatives discussed, indications are that the fourth alternative is probably the only one that will be acceptable to OMB. It should be noted that the fifth alternative could possibly become a viable approach in the one situation in which the recommended plan for the replacement of Craney Island is a westward extension. This is based on the fact that the westward extension is simply a continuation of the current spoil disposal practice, and higher authority might be persuaded by the argument of a historical commitment on the part of the Federal government.