FINAL FEASIBILITY REPORT

MAIN REPORT

CRANEY ISLAND EASTWARD EXPANSION

NORFOLK HARBOR AND CHANNELS HAMPTON ROADS, VIRGINIA

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

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DEPARTMENT OF THE ARMY
NORFOLK DISTRICT CORPS OF ENGINEERS
FORT NORFOLK 803 FRONT STREET
NORFOLK VIRGINIA 23510-1096

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EXECUTIVE SUMMARY

The Norfolk District, U.S. Army Corps of Engineers (USACE), and the Virginia Port Authority (VPA) are conducting a Feasibility Study of expansion of the Federally-owned Craney Island Dredged Material Management Area (CIDMMA) in response to the resolution of the U.S. House of Representatives Committee on Transportation and Infrastructure, dated 24 September 1997. This resolution specifically authorizes that the study *"shall give specific attention to rapid filling to accommodate anticipated port expansion and to the operation of the existing facility while extending the useful life of CIDMMA."* This Final Feasibility Report presents the analyses and plan formulation used to select a Recommended Plan, which is the Locally Preferred Plan (LPP), supporting Appendixes, and the Final Environmental Impact Statement.

The CIDMMA was originally authorized in 1946, completed in 1958, and is expected to achieve the end of its useful life in 2025. CIDMMA is authorized to accept all navigation related dredged material from the Norfolk Harbor area, including material from the USACE, the U.S. Navy, VPA, and private users within the harbor.

Norfolk Harbor is one of the busiest ports in the Nation, serving as the center of substantial industrial, commercial, and military activity. The port contains one of the largest concentrations of naval installations in the world. It is the eighth largest container port in the Nation, and the third largest on the East Coast of the United States in terms of container cargo volume. Norfolk Harbor is a major international gateway to the Midwest. More than 55 percent of the containerized cargo handled at Norfolk Harbor originates in or is destined for locations outside Virginia.

Norfolk Harbor has experienced a 39 percent growth in containerized cargo volume between 2001 and 2004. Similar growth in containerized cargo volume has also been experienced at other major U.S. containership-ports on the East and West Coasts. Strong growth is expected to continue into the near future. The anticipated growth in containerized cargo volume outpaces planned improvements in Norfolk Harbor's container handling capacity, which is constrained by existing real estate. By 2011, the containerized cargo volume forecasted for Norfolk Harbor will exceed its planned

container handling capacity. Similarly, other major U.S. East Coast containership-ports will experience container handling capacity constraints during the 50-year planning horizon.

In the without project condition after 2011, overflow cargo which would use Norfolk Harbor if container handling capacity were available, will have to switch to alternative ports that have available container handling capacity. The overflow volume of containerized cargo that must shift will increase over time as the volume of trade grows. An economic analysis was conducted to estimate the cost to the Nation (i.e., increased transportation costs) of shifting Norfolk Harbor's overflow cargo to alternative ports. The cost to the Nation over the 50-year planning horizon is the average annual equivalent (AAEQ) of $331 million. This value is the additional origin-to-destination transportation costs incurred by the shift of some cargo to alternative ports.

Rapid filling and expansion of the CIDMMA allow for extending the useful life of the disposal facility and accommodating containership port expansion on top of a portion of the fully utilized disposal area. Port facility construction would be fully financed by the VPA. In addition, the land created by the project would be transferred to the ownership of the Commonwealth of Virginia, so that no private entity could appropriate the facility for private benefit. In addition, the opportunity for Federal participation in construction of the access channel exists.

Feasibility-level investigations conducted for this study include engineering, environmental impact, and economic analyses. Engineering analyses include studies concerning development of the disposal facility, port infrastructure development, and vessel handling simulations under with project conditions. Environmental impact analyses include National Environmental Policy Act compliance investigations and development of an Environmental Impact Statement and an environmental mitigation plan. In addition, cultural resource investigations were conducted at potential CIDMMA expansion locations. Economic analyses include a benefit-cost analysis, which calculated

project costs and National Economic Development (NED) benefits (transportation cost savings), and a least-cost analysis of dredged material disposal options.

Plan formulation and evaluation was conducted in accordance with USACE policy and guidance and in accordance with the Congressional resolution identified above. The plan formulation process involved the screening and evaluation of numerous alternatives which led to the identification of two final plans, an eastward expansion in combination with the strengthening of the west dike and an eastward expansion alone. The following table presents the AAEQ costs and benefits of the final two plans.

CIDMMA EXPANSION AVERAGE ANNUAL EQUIVALENT PROJECT COSTS AND BENEFITS (1)

	Costs	Benefits	Net benefits	Benefit-to-cost ratio
Eastward Expansion with West Dike Strengthening	$78,766,000	$339,828,000	$261,062,000	4.3
Eastward Expansion	$75,389,000	$333,568,000	$258,179,000	4.4

(1) All costs and benefits evaluated in October 2005 price levels, AAEQ calculations conducted over 50 years at 5.125 percent.

The eastward expansion with west dike strengthening, the plan with the greatest net NED benefits, is a 580-acre eastward expansion of CIDMMA that would accommodate port expansion on top of the disposal facility, plus additional strengthening and raising of the western dike in 2028. This plan has a benefit-to-cost ratio of 4.4, which includes all associated costs and NED benefits. A slightly less costly plan, which provides more than 99 percent of the same net benefits, is preferred by VPA and is the Recommended Plan in this Final Feasibility Report. This LPP is the same 580-acre

eastward expansion of CIDMMA with accommodations for port expansion, but it does not include the strengthening and raising of the western dike in 2028. The benefit-to-cost ratio for the LPP is 4.4. Both plans would require construction of the access channel with the NED plan have a depth of 50-feet.

The Recommended Plan (the LPP), identified in this Final Feasibility Report provides for:

- Extending the useful life of CIDMMA out to 2028 with a potential further extension to 2042, if the decision to strengthen and raise the western dike is made at a later time;
- $331 million AAEQ NED benefits (transportation cost savings) due to the additional container handling capacity provided by VPA's port expansion at the CIDMMA; and
- $2.3 million AAEQ NED benefits due to reduced dredged material placement costs afforded by additional dredged material disposal capacity.

The USACE Civil Works program provides for Federal interest in general navigation features associated with navigation improvements. Excluded are interests in the development of port lands, facilities, and infrastructure. Under existing law and policy, the USACE cost-sharing responsibility for the recommended Eastward Expansion Plan is limited to the present value of the least-cost long-term dredged material placement method, identified as a west dike strengthening without any lateral expansion. Additionally, Federal participation in the access channel is based on depth. Up to 20 feet is cost shared 90 percent Federal and 10 percent non-Federal, 21 feet to 45-feet is cost shared 75 percent Federal and 25 percent non-Federal, while depths greater than 45 feet are cost-shared 50 percent Federal and 50 percent non-Federal. All depths require an additional 10 percent contribution by the non-Federal sponsor over a period of thirty years.

In accordance with the CIDMMA's original Congressional authorization, Federal cost-sharing for the expansion portion of the Recommended Plan will be recovered

through the application of tolls. Because the Recommended Plan provides less additional dredged material disposal capacity than the least-cost disposal method, it is necessary to evaluate the discounted present value of the least-cost disposal method on a cost-per-unit basis. This will allow the proper distribution of the tolls. The least-cost disposal method would create a capacity of 67.2 million cubic yards (mcy), providing of unit cost of $1.003 per cubic yard. The Recommended Plan creates a capacity of 12 mcy. This provides for a Federal cost-sharing interest of $12,042,000 in the Recommended Plan on the basis of least-cost disposal. The Federal participation in the access channel would be approximately $13,810,000, after the non-Federal interest's 10-percent repayment. The total project cost for the access channel and cell construction is $671 million. The cost-sharing of the Recommended Plan, the plan with the most net remaining benefits, is severely curtailed by policy and in no way represents the enormous amount of economic benefits that would be realized by the project.

There is strong support from the Commonwealth of Virginia for the recommended 580-acre eastward expansion of Craney Island as indicated by VPA's letter of support dated 27 July 2006.

The Norfolk District and VPA prepared a Final Environmental Impact Statement (EIS) to present information the recommended 580-acre eastward expansion of CIDMMA and development of a container terminal. A notice of availability of the Draft EIS was published in the *Federal Register* on 23 September 2005. The 45-day comment period for the Draft EIS ended on 7 November 2005. Seventy letters and over 200 comments were received. These comments were analyzed and considered in preparing this Final EIS, and responses to comments appear in the document. The Final EIS addresses the direct, indirect, and cumulative impacts of the proposed development on human and environmental issues identified during the public interest review, including onsite and offsite alternatives. All factors that may be relevant to the proposed development were considered. Among those factors include air quality, dredged material management, surface transportation, economics, aesthetics and light, wetlands, cultural resources, fish and wildlife resources, land use and coastal zone management, navigation,

hydrodynamics, recreation, water quality, public safety, hazardous materials, social characteristics, environmental justice, noise, and, in general, the needs and welfare of the people. The Final EIS provides relevant information to Federal, state, and local agencies as well as the public on the potential impacts of the proposed project.

Cumulative impacts from the potential expansion action and other nearby past, present, and reasonably foreseeable future actions were identified and evaluated in the Final EIS. An 11-step methodology promulgated in 1997 by the Council on Environmental Quality was utilized as the framework for the cumulative effects assessment study. A compensatory mitigation plan was developed with input from a Mitigation Subcommittee consisting of representatives from 12 Federal and state agencies and 3 local interest groups. The committee convened on 15 occasions between June 2002 and May 2005. A cost effectiveness/incremental cost analysis was conducted, resulting in a total of 22 plans that were determined to be cost-effective, including 3 "Best Buy" plans. The selected mitigation plan is one of the "Best Buy" plans and includes sediment remediation, wetlands restoration, and oyster restoration as its major components. The costs of the mitigation plan are included in total project costs.

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INTRODUCTION

The Craney Island Dredged Material Management Area (CIDMMA) is a Federally-owned and U.S. Army Corps of Engineers (USACE)-operated dredged material placement area that has been in continuous operation since 1957, serving the dredging needs of Norfolk Harbor (see Plates 1 and 2). Originally designed for a life span of 20 years, with a capacity of 96 millions cubic yards (mcy), the useful life and capacity of CIDMMA has been extended through innovative operations management (partitioning of drying areas) and structural modifications (strip drains and dike raising). CIDMMA currently holds over 225 mcy of dredged material deposits and is expected to continue operations until 2025, under current dredged material in-flow projections.

Norfolk Harbor is currently the eighth largest container port in the U.S. and the third largest on the U.S. East Coast in terms of volume of containerized cargo. The port has experienced strong growth in recent years, which is expected to continue into the near future. This growth in the volume of twenty-foot-equivalent units (TEU's), the standard metric for measuring containerized cargo volume, outpaces the planned improvements in the port's container handling capacity, which is constrained by the port's existing real estate. By 2011, the TEU volume forecasted for the port will exceed the port's planned container handling capacity.

Based on Norfolk Harbor's anticipated shortfalls in container handling capacity and dredged material placement capacity, the Virginia Port Authority (VPA) and the USACE, Norfolk District, are conducting a Feasibility Study of alternatives that meet these two pressing needs. The goal of this document is to provide a complete presentation of study results that identify, evaluate, and recommend to decision makers an appropriate, coordinated, implementable solution to the identified water resource problems and opportunities.

STUDY AUTHORITY

This study is authorized by resolution of the U.S. House of Representatives Committee on Transportation and Infrastructure dated 24 September 1997, which reads:

> "Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That the Secretary of the Army is requested to review the report of the Chief of Engineers on the Norfolk Harbor and Channels (Deepening), contained in House Document 99-88, 99th Congress, 1st Session, and conduct a study of eastward expansion of the Federally owned CIDMMA. Such study shall be directly coordinated with the sponsor, the Commonwealth of Virginia, through the Secretary of Transportation represented by the VPA, and *shall give specific attention to rapid filling to accommodate anticipated port expansion and to the operation of the existing facility while extending the useful life of CIDMMA*, and shall take into account all relevant environmental issues and the subsequent transfer of the expanded area of CIDMMA to the Commonwealth of Virginia." (*emphasis added*)

STUDY PURPOSE AND SCOPE

The purpose of this Feasibility Report is to provide a final response to the study authority presented in the Congressional resolution. The study authority identifies three issues to be addressed in the Feasibility Study, which are:

- Eastward expansion of CIDMMA;
- Rapid filling to accommodate anticipated port expansion; and
- Extending the useful life of CIDMMA.

In addition, the Feasibility Study follows-up on preliminary findings resulting from the Section 905(b) Reconnaissance Phase of the analysis, which identified national defense needs as a potential project objective. The Feasibility Study also assesses the extent of potential Federal participation in implementation of the plan recommended in this Feasibility Report.

The Feasibility Study, as presented in this report, proceeds along two tracks:

- Assessment of alternative plans that meet the dual purpose cited in the authorizing resolution (port development and CIDMMA useful life expansion); and
- Identification and evaluation of the least-cost dredged material disposal option, which is used to calculate the Federal cost share of the recommended plan, under existing laws and policies.

The report first presents the assessment of alternative plans that meet the dual purpose of the study authority (Pages 42-100), and second presents the least-cost disposal analysis in order to calculate the Federal cost share of the recommended plan (Pages 117-125).

The scope of the study includes all existing and future conditions that may affect CIDMMA operations and port operations within Norfolk Harbor. The scope of the analysis does not include dredged material placement operations and port operations at other marine harbors, with the exception of those operations at other marine harbors that affect or are affected by operations at Norfolk Harbor.

STUDY AREA

Norfolk Harbor (sometimes referred to as the Port of Hampton Roads) is located in the southeastern part of the Commonwealth of Virginia at the southern end of Chesapeake Bay, midway on the Atlantic Seaboard (approximately 170 miles south of Baltimore, Maryland, and 220 miles north of Wilmington, North Carolina). The harbor is formed by the confluence of the James, Nansemond, and Elizabeth Rivers. The land area surrounding the harbor encompasses about 1,500 square miles and includes the cities of Chesapeake, Norfolk, Portsmouth, Suffolk, and Virginia Beach, as well as Isle of Wight County on the southside and Hampton and Newport News on the northside. The 2004 population of this area was about 1.6 million people. The CIDMMA is centrally located within Norfolk Harbor and is bordered by the Elizabeth River to the east, the James River to the north and west, and the city of Portsmouth, Virginia, to the south.

NATIONAL OBJECTIVE

The National Environmental Policy Act (NEPA) of 1969 and the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" (U.S. Water Resources Council, 10 May 1983) provide the basis for Federal Policy concerning multi-objective planning. The Federal objective of water and related land resources project planning is to contribute to National Economic Development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Water and related land resources project plans are formulated to alleviate problems and take advantage of opportunities in ways that contribute to this objective.

Contributions to NED are increases in the net value of the national output of goods and services expressed in monetary units. Contributions to NED are the direct net economic benefits that accrue in the planning area and in the rest of the Nation. NED benefits are transportation cost savings that typically result from general navigation features, such as channels, dredged material disposal facilities, turning basins, etc. Transportation cost savings are calculated as reductions in the cost of transporting goods from their ultimate origin to their ultimate destination.

Federal water resources planning is responsive to state and local concerns, and state and local participation is critical to proper water resources planning. The non-Federal sponsor, the Commonwealth of Virginia, acting through the Secretary of Transportation, represented by the VPA, participated extensively in all phases of the study process.

PRIOR STUDIES AND REPORTS

In response to the Congressional resolution cited previously, a Section 905(b) analysis (Reconnaissance Phase Report) was conducted in 1999, and recommended Federal participation in a Feasibility-level analysis of the eastward expansion of CIDMMA. The Reconnaissance Phase Report identified three areas of Federal interest in the eastward expansion: (1) increased dredged material disposal capacity, (2) growth in

commodity movements and waterborne transportation cost savings, and (3) national defense (see page 11 of the Section 905(b) Analysis). Prior to the 1997 Congressional resolution, numerous studies and reports were conducted concerning dredged material disposal at CIDMMA. A listing and brief description of these studies and reports may be found in Parts 1 and 2 of Appendix E.

EXISTING WATER PROJECTS

Twenty-five significant navigation projects have been constructed within the Norfolk Harbor, ranging in depth from 6 feet to 50 feet when measured at mean low water (MLW). The major deep-draft channels serving Norfolk Harbor are authorized to a depth of 55 feet below MLW. The 50-foot outbound element of the main channel was constructed in 1989 and the 50-foot anchorage was completed in October of 1999. The 50-foot inbound channel element is currently under construction, and completion is expected in 2006. Other deep-draft channels, anchorages, and turning basins in Norfolk Harbor are maintained at depths varying from 24 to 50 feet below MLW. A listing and brief description of USACE water resources projects within the study area may be found in Parts 3 and 4 of Appendix E.

EXISTING AND FUTURE WITHOUT PROJECT CONDITION

Several analyses have been conducted to characterize existing and expected future conditions in the study area. These analyses are briefly discussed below.

ENVIRONMENTAL, SOCIO-ECONOMIC, AND CULTURAL CONDITIONS

Area Description

The Hampton Roads metropolitan area, located in southeastern Virginia, includes the cities of Hampton, Newport News, Norfolk, Portsmouth, Chesapeake, Suffolk, and Virginia Beach (see Plates 1 and 2). These cities are the second largest urban grouping in the Commonwealth of Virginia and one of the leading population centers in the South. Hampton Roads Harbor is recognized as one of the finest deep-water natural harbors in the world. It is formed by the confluence of the James, Nansemond, and Elizabeth

Rivers. It is located at the southern end of the Chesapeake Bay, approximately 300 miles south of New York, 180 miles southeast of Washington, D.C., and is only 18 miles from the open sea. Because of its accessibility to the Chesapeake Bay and Atlantic Ocean, it is convenient to ports worldwide.

Topography

The Hampton Roads metropolitan area is extremely flat, low lying and featureless, with an average elevation of approximately 11 feet above mean sea level, except for isolated sand dunes along beach areas. The area is traversed by numerous bays and estuaries. Streams are shallow and their channels wide and meandering. Except for dredged channels, water depths in the inland bays and connecting waterways are generally less than 10 feet. Because of the elevations, the area is quite often subject to tidal flooding caused by hurricanes and northeasters that frequent the area. Flooding of the low-lying land adjacent to the entrances has caused loss of life, damage to property, and blocking of land traffic arteries. Much of the land in downtown sections of the cities on the perimeter of the harbor was formerly under water and has been developed by use of fill material.

Geology

The low-lying Coastal Plain is characterized by deposits typical of deltaic alluvial plains; substrata vary widely from one location to another, depending upon the recent depositional environment of the area. Sediments may be sandy, silty, clayey, or loamy (or a combination), with a great deal of variation within a relatively small area. The bedrock of the Coastal Plain is situated at a depth of about 13,000 feet beneath these sediments. Soils on the Coastal Plain are generally fertile, and wetlands, both tidally influenced and fresh water, are relatively abundant. They are a highly valuable resource, as they provide a vital link in the food chain for most marine organisms. The marsh areas provide shelter and breeding grounds for marine organisms, waterfowl, shorebirds, and some mammals.

Climate and Natural Forces

The climate of the Hampton Roads area is characterized by a moderate climate, tempered by proximity to the Atlantic Ocean and Chesapeake Bay. The average annual temperature is approximately 60 degrees Fahrenheit (°F), with ranges from 41° F average in January to 85° F in July. The average annual precipitation is approximately 42-1/2 inches and is fairly evenly distributed throughout the year. The area's geographic position with respect to the principal storm tracks is south of the average path of storms originating in the higher latitudes. It is also north of the usual track of hurricanes and other tropical storms.

Tides in the Hampton Roads Harbor and adjacent waters are uniformly semidiurnal with a mean range of 2.6 feet (spring range of 3.1 feet) at Newport News, 0.1 mile off the Newport News shipbuilding plant in the lower James River. Tidal currents in the harbor average about 0.9 knot during flood tides and 1.3 knots during ebb tides.

The prevailing wind direction is from the northeast; north in February, March, August, September, and October; and south or southwest for the remainder of the year at an average annual velocity of about 11 miles per hour. Wind velocities may exceed 50 miles per hour during hurricanes, passage of cold fronts, and severe thunderstorms. The stage of the tide in the Hampton Roads area is increased to damaging heights by strong northerly winds blowing down Chesapeake Bay and by strong easterly winds blowing into Hampton Roads from the Atlantic Ocean.

Water Quality and Hydrodynamics

Hampton Roads is designated as a Class II (a) water. Compliance with water quality criteria for such waters requires a minimum of 4.0 milligrams per liter (mg/l) dissolved oxygen, pH between 6.0 and 8.5, and temperature increases above background no greater than 4° F in summer and 1.5° F in winter. Special standard (a) is applicable to the waters of Hampton Roads as this standard applies to all waters capable of propagating shellfish, including those that are restricted or condemned by the State Department of

Health. The shellfish beds of Hampton Roads within the immediate vicinity of CIDMMA are condemned for harvest, but shellfish may be transplanted to acceptable areas for later harvest. The Elizabeth River, including the Eastern and Southern Branches, and the Lafayette River do not meet the Class II water quality standards (Virginia Department of Transportation [VDOT] Draft Environmental Impact Statement [DEIS], 1999).

Suspended sediment concentrations increase from an average of about 30 mg/l above Jamestown on the James River to more than 100 mg/l at the limit of saltwater intrusion. Concentrations decrease to 12 mg/l at the mouth of the James River. Although concentrations vary during the tidal cycle, this overall pattern persists through time.

The hydrological regime is likely responsible for retention of larvae within the lower James River estuary. Three-dimensional numerical modeling efforts have assessed the impact of various expansion alternatives of CIDMMA upon the circulation and sedimentation patterns of Hampton Roads and the Elizabeth River and vicinity. The results of the hydrodynamic modeling indicate that eastward expansion of CIDMMA generates the least disturbance to existing circulation and sedimentation patterns, as compared to any other expansion alternative.

Ecological Resources

Aquatic Resources. Resident species in the lower James River and portions of the Elizabeth River estuary including Hampton Roads include Atlantic silversides, Atlantic croaker, striped anchovy, spot, weakfish, hogchoker, bluefish, naked goby, oyster toadfish, skilletfish, blackcheek tonguefish, summer flounder, and black seabass. Bluefish, flounder, and seabass are all considered to be commercially important species, and striped bass, spot, and croaker are also popular game fish. Principal finfish uses of the lower James and its estuary are: (1) nursery and spawning grounds for both resident and anadromous fish, (2) adult feeding grounds, and (3) spawning grounds for important forage species, such as the bay anchovy and Atlantic silverside.

The lower James River supports the same anadromous species as those found in the upper portions of the river, but the individuals present occur at different life stages from those in the upper river. In general, anadromous fish larvae and juveniles move downstream (toward increasingly saline waters) as they mature, so that pre-adult and adult members of the species tend to be found in the lower reaches of the James. River herring in general seem to be better adapted to spawning in more saline waters, and so the lower James serves as a nursery ground for these, as well as American shad and striped bass.

Blue crabs are a commercially important estuarine species of the lower James and are harvested as both hard-shell and soft-shell crabs for the local seafood market, as well as exported from the Chesapeake Bay area.

Numerous benthic surveys have been conducted in the Hampton Roads area (Boesch, 1971, 1972, 1973; Dauer and Ewing, 1986; Dauer, 2001 and 2002; Seitz and Lipcius, 2002). The muck-type substrate that predominates is high in numbers of individual organisms but low in community diversity. Oyster distribution in Hampton Roads Harbor is severely limited by the presence of its major predator, the oyster drill along with the disease organisms MSX *(Haplosporidium nelsoni)* and "dermo" *(Perkinsis marinus)*, which are typically found in salinities of about 15 parts per thousand and greater. The James River, several miles upriver from the harbor, is one of the only remaining areas with measurable amounts of oysters. Oyster abundance in the Chesapeake Bay is at its lowest level in history. Scientists estimate populations are no more than 1 percent of historic levels (Mann et al., 2003). Another commercially valuable species is the hard clam, *Mercenaria mercenaria*, which has a patchy distribution in the Hampton Roads Harbor area. Micro- and macro-organisms in the planktonic community are numerous and include diatoms, dinoflagellates, foraminifera, skeleton shrimp, jellyfish, and stinging nettles, as well as larval forms of fish, crustaceans, and other organisms.

Essential Fish Habitat. The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires all Federal agencies to consult with the National Marine Fisheries Service (NMFS) on all actions, or proposed actions, permitted, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH). The MSFCMA specifies that each Federal agency shall consult with the NMFS when proposing any activity that may have adverse impacts on designated EFH. Most of the lower Chesapeake Bay and the CIDMMA vicinity contain EFH for eggs, larvae, juveniles, and/or adult life stages of various species, including windowpane flounder *(Scopthalmus aquosus)*, bluefish *(Pomatomus saltatrix)*, Atlantic butterfish *(Peprilus triacanthus)*, summer flounder *(Paralicthys dentatus)*, black sea bass *(Centropristus striata)*, king mackerel *(Scomberomorus cavalla),* Spanish mackerel *(Scomberomorus maculates)*, cobia *(Rachycentron canadum)*, red drum *(Sciaenops occelatus)*, dusky shark *(Charcharinus obscurus)*, and sandbar shark *(Charcharinus plumbeus)*. The area is designated as a Habitat Area of Particular Concern (HAPC) for the sandbar shark, which uses the lower Chesapeake Bay as a "pupping ground," where females give birth to live young. The lower James River and nearby areas near the mouth of the Chesapeake Bay cover approximately 29,500 acres of open water, and the total HAPC for the sandbar shark in the lower Chesapeake Bay is approximately 89,000 acres of open water.

Avian Resources. Of the approximately 50 species of birds on CIDMMA, several species are known to nest on the perimeter dikes. These include least terns, killdeers, red-winged blackbirds, song sparrows, meadowlarks, and mallards. In addition, numerous species of songbirds, shorebirds, and raptors use the dikes and adjacent areas for feeding and resting. A number of birds use CIDMMA as a resting stop during fall and spring migration (Beck, personal communication, 2002, 2005).

Endangered Species. One listed species and one candidate species are known to occur in the vicinity of CIDMMA. The piping plover *(Charadrius melodus)*, listed as threatened, is known to nest on the shores of CIDMMA. Piping plovers nest in sparsely to moderately vegetated areas of sandy beach, above the tide line. Least terns are a species of special concern in Virginia and have been reported as occurring on CIDMMA.

In 1991, nine Northern diamondback terrapins *(Malaclemys terrapin terrrapin)* were observed in a tidal creek adjacent to CIDMMA, although no nest was located (U.S. Fish & Wildlife Service [USFWS], 1994 and 1995). Five Federally-listed marine turtles may occur in the estuarine waters of the lower Chesapeake Bay and may infrequently be found in the lower James River and vicinity. The most common is the listed Federally-threatened loggerhead turtle *(Caretta caretta)*. The loggerhead is an oceanic and estuarine species that reaches its northern nesting limit along the barrier beaches of the Delmarva Peninsula and feeds within the barrier bays and Chesapeake Bay. It is present in the bay from spring through fall. The other marine turtles that may be found in the region include the Federally-listed as endangered leatherback *(Dermochelys coriacea)*, Atlantic hawksbill *(Eretmochelys imbricata)*, Atlantic ridley *(Lepidochelys kempii)*, and the endangered green turtle *(Chelonia mydas)*. These four species may feed in Virginia waters during the summer months but are rare (USFWS, 1992).

The NMFS provided a letter to the USACE dated 7 October 2005 concerning Endangered Species Act (ESA) section 7 consultation on the effects of the proposed CIDMMA east expansion project on listed species. NMFS noted with particular importance that the proposed expansion may affect sea turtle foraging habitat, and that increases in shipping traffic may increase potential vessel encounters with marine mammals, including the endangered Northern Right Whale (see Marine Mammals section below).

As documented in Part IV of the Final Environmental Impact Statement (FEIS), because of the total absence of submerged aquatic vegetation, and the degraded nature of benthic populations, including sea turtle's prey base of bivalves and crustaceans, the USACE has concluded that the expansion footprint is not a significant foraging area for sea turtles. The USACE transmitted a letter to NMFS dated 5 January 2006 indicating that the USACE had made a "not likely to affect" determination and requested NMFS concurrence with this conclusion.

Marine mammals are protected under the Marine Mammal Protection Act (MMPA). The Atlantic bottlenose dolphin *(Tursiops truncatus)* is not listed as Threatened or Endangered under the ESA but is listed as "depleted" under the MMPA. Depletion occurs when a population falls below its optimum sustainable level (VDOT, 1993). Bottlenose dolphins are seen in Virginia's waters and in Hampton Roads from May through October, with sporadic sightings in April, November, December, and other winter months (Virginia Marine Science Museum [VMSM], 1996).

The Harbor Porpoise *(Phocoena phocoena)* is a Federal candidate species and is a marine mammal protected under the MMPA. Harbor porpoises have been documented in Virginia's coastal waters from January through March and have been found stranded along the coast from March through May. Harbor porpoises are rarely sighted in the Hampton Roads harbor because of their shy behavior around boats and tendency to travel in small groups (VMSM, 1996, in VDOT, 2001).

With regard to the presence of North Atlantic Right Whale in the Chesapeake Bay region and the potential for impacts associated with vessel traffic, the nearshore and inshore shipping channels into the Chesapeake Bay are accessed by thousands of military, commercial, and recreational vessels entering the Port Hampton Roads and the Port of Baltimore. The U.S. Navy is required to report whale sightings in these areas, and commercial vessels participate in voluntary reporting when traveling in this region. As mentioned in Section III of the FEIS, sightings data is maintained by the National Oceanic and Atmospheric Administration (NOAA) and reported to mariners by the U.S. Coast Guard.

Given that the frequency of whale sightings in the shipping channel is very low (2 sighted in 28 years) and that navigation safety regulations require vessels to travel within the designated channels, the potential for vessels strikes as a result of the construction of the eastward expansion and the future operation of a marine terminal at this location is believed to be negligible. The USACE concluded in the FEIS, therefore, that increases in vessel traffic related to the proposed east expansion and container

terminal project are not likely to affect listed marine mammals. This conclusion was provided by the USACE to the NMFS in a letter dated 5 January 2006, and the USACE requested concurrence with this conclusion.

The non-Federal sponsor of this project, VPA, is presently a member of the Northeast Implementation Team (NEIT) for the Recovery of the North Atlantic Right Whale. The NEIT focuses exclusively on North Atlantic right whale ship strike reduction and support of the NOAA Ship Strike Reduction Strategy Working Group.

Socio-Economic Resources

Population. The seven cities and one county that make up the study area are part of the Norfolk-Virginia Beach-Newport News Metropolitan Statistical Area (MSA). The MSA includes nine cities and seven counties, one of which is located in North Carolina. This MSA (Virginia portion) is one of the slower growing metropolitan areas in the state, with an estimated 2004 population of 1,598,900 (Weldon Cooper Center, 2005). Since 1990, the MSA has had an average annual growth rate of 0.8 percent, compared to 0.6 percent for the study area and 1.3 percent for the state as a whole. All the jurisdictions within the MSA have had increasing populations, except Norfolk and Portsmouth, which have been declining since 1970 due to out-migration. In-migration has accounted for most of the increase in the fastest growing localities in the region.

Most of the population in the MSA (88 percent) can be found in the localities that compose the study area. Virginia Beach, with a 2004 estimated population of 432,300 (Weldon Cooper Center, 2005), is the largest city, while Norfolk and Chesapeake are the second and third largest in the state. Within the study area, Chesapeake and Suffolk had the highest annual growth rates, 2.3 percent and 2.7 percent, respectively, since 1990. Both Norfolk and Portsmouth have had negative rates (-0.8 percent and -0.5 percent), reflecting declining populations in those cities.

Projections through the year 2050 show growth in all cities and an average annual growth rate from 2000 to 2050 of 0.8 percent for the study area. All cities and the county

in the study area are projected to have increasing populations, although the majority of the growth is expected to occur in Chesapeake and Virginia Beach. (Projections for 2040 and 2050 were based on a continuation of the trend from 2000 to 2030 [Hampton Roads Planning District Commission, 2005].)

Land Use. Land use within the study area is a contrast between the highly developed cities of Portsmouth, Norfolk, Hampton, and Newport News, each of which contains less than 70 square miles of land, and the larger, much less developed cities of Suffolk, Chesapeake, and Virginia Beach, and Isle of Wight County, of which each consists of more than 248 square miles. Land use in Norfolk and Portsmouth is dominated by residential development, large sections of commercial, industrial, and governmental use, with very little vacant land existing in either city. Hampton and Newport News have somewhat similar land uses, although there is more vacant land in these two cities than the two on the south side.

Within Portsmouth, industrial land use is concentrated immediately south of CIDMMA and along the Southern Branch of the Elizabeth River. Commercial development is located along the major highways of the city. Residential development is scattered throughout the city, including the area to the southwest of CIDMMA. The last major undeveloped parcel in the city will be developed for private shipping terminal facilities.

Norfolk also has significant industrial development along its waterways, particularly the main stem of the Elizabeth River and its Eastern Branch. The Naval Station Norfolk occupies the northwestern corner of the city, and major commercial activity occurs in the city's downtown, located in the southwestern portion of the city.

The most significant industrial development on the peninsula is located at the southern end of Newport News where the Northrup Grumman Newport News Shipbuilding Corporation is located. Commercial development has tended to run along the major highways in the city, which run in a north-south direction. Development within

the city of Hampton has tended to spread from the south to north and along major highway routes as with the other cities.

In contrast to the four cities discussed above, in the rest of the study area much of the land is undeveloped. This category includes agricultural use as well as land used for timbering. However, this is changing as residential and commercial development expands into previously vacant areas. Chesapeake and Virginia Beach already have large areas of residential and commercial development, while Suffolk has a concentration of development in the older, central part of the city with new development primarily in the northern half of the city. Isle of Wight County is the least developed of the localities within the study area with most of the development in the towns located along the county's major highways.

Employment. The Norfolk-Virginia Beach-Newport News MSA is the second largest region of employment in the state, with 22 percent of the total for 2000. However, between 1990 and 2000, it has been one of the slower growing metropolitan areas of the state, with an average annual rate of growth of 1.1 percent, compared to a state average of 1.7 percent and a national average of 1.8 percent. Projections by the Hampton Roads Planning District Commission show employment growth for the MSA continuing, but at a slightly slower rate through the year 2050 with an average annual growth rate of 0.8 percent.

The two largest sectors of employment in the MSA are services and government, accounting for 55 percent of the region's jobs as of 2000 (Bureau of Economic Analysis, 2005). Other major sources of employment include retail trade, manufacturing, construction, and finance. With the exception of manufacturing, employment in all of these areas has shown growth since 1990. Manufacturing, which provides 7 percent of the area's employment, has had a slight decline since 1990. Much of the manufacturing revolves around shipbuilding and repair, with the largest private employer in the state, Northrup Grumman Newport News Shipbuilding, located in the MSA.

One of the important sources of employment activity for the region is the port complex and other activities with which it is associated. A 1998 survey commissioned by the VPA estimated that activities at VPA terminals generated 8,525 jobs in Hampton Roads. An additional 4,636 jobs are induced or jobs supported by the local purchases made by those directly employed by port activities. An additional 1,534 jobs are indirectly generated at firms dependent on the purchase of various supplies and services from local businesses.

Cultural Resources

Because of the long history of water traffic in the Hampton Roads harbor and vicinity, the waterways in this area are considered high probability areas for historical resources. Within the past 20 years, there have been many investigations of areas within the harbor for the presence of such resources. A remote sensing survey of the area to the east of CIDMMA was carried out in 2000 as part of this study. This survey resulted in the identification of over 400 anomalies. However, none of these targets were considered potentially significant in terms of historic resources, and, thus, no further work was recommended (Panamerican Consultants, Inc., 2000). The reports that resulted from this work have been coordinated with the Virginia Department of Historic Resources (VDHR).

The land area that could be affected as a result of port development includes an area that was previously investigated in 1999 as part of the VDOT Hampton Roads Crossing Study (Cultural Resource Group of Louis Berger and Associates, Inc., 2001). This survey resulted in the identification of six previously unrecorded archaeological sites, three of which were determined potentially eligible for listing on the National Register of Historic Places. None of these sites were located in the Craney Island connector highway and expansion of I-664, although one of the sites and a previously recorded cemetery lie adjacent to a section of I-664, the right-of-way of which would be used for the rail line expansion that would go to the terminal. Based on the FEIS associated with the Hampton Roads Crossing Study and current conceptual engineering

design, these sites would be avoided, and there would not be any impacts to them or any other known sites.

CIDMMA OPERATIONS

CIDMMA Existing Conditions

The CIDMMA was authorized by the Rivers and Harbors Act of 1946 covering an area of approximately 2,500 acres. Placement of dredged material at CIDMMA is limited to users within the geographical area of Norfolk Harbor and adjacent waters. In general, this includes the navigable waters of the ports of Norfolk, Portsmouth, Chesapeake, Hampton, and Newport News. Each project requesting use of CIDMMA is evaluated by the District on a case-by-case basis. The District determines if the project can legally use the facility, consistent with the project's authorizing documents.

In accordance with the authorizing document, CIDMMA is to be used for the benefit of the maintenance and development of navigation improvements serving Government and private interests. CIDMMA is authorized to handle all types of navigational dredged material, including material suitable and unsuitable for open ocean disposal. It cannot be limited to only unsuitable material without additional Congressional authorization.

If dredging is not related to navigation, i.e., road building, railroad crossings, interior lakes and ponds, etc., then disposal at CIDMMA will be denied. Also, CIDMMA cannot be used for disposal of material excavated from upland areas or for disposal of construction debris, except for limited special cases, such as beneficial use of concrete for rip-rap to protect exterior dikes from erosion.

The Norfolk Harbor Dredged Material Management Plan (DMMP) largely relies on CIDMMA as the predominant dredged material placement option. Four dredged material placement options are typically available under the DMMP:

- CIDMMA;
- U.S. Environmental Protection Agency (USEPA) designated ocean disposal site (the Norfolk Dredged Material Management Area), located approximately 47 miles from the CIDMMA and 17 miles east of the mouth of the Chesapeake Bay;
- Upland disposal; and
- Beneficial use.

Use of the ocean disposal site is typically limited to material that comes from areas outside of the harbor, beyond the Hampton Roads Bridge-Tunnel. Upland disposal is limited to materials that are unsuitable for CIDMMA, the ocean disposal site, or beneficial use. The beneficial use option is employed as material characteristics and use opportunities allow.

The current management strategy for operating CIDMMA was authorized on Section 148 of the Water Resources Development Act (WRDA) of 1976 (P.L. 94-587) that states the "Chief of Engineers, shall...extend the capacity and useful life of dredged material disposal areas such that the need for new dredged material disposal areas is kept to a minimum." The Engineer Research and Development Center (ERDC), formerly Waterways Experiment Station, published Technical Report EL-91-11, "Development of a Management Plan for CIDMMA," in December 1991.

ERDC recommended that Norfolk District sub-divide CIDMMA into three cells so that the dredged material could be placed in one cell while the other two cells dry out. The benefit of drying the dredged material is that significantly more volume is created for dredged material placement. The ERDC Management Plan also noted "...lift thickness in excess of 5 feet begin to significantly affect desiccation and consolidation behavior."

In addition to drying the material, another way of increasing storage capacity is by increasing the facility's dike height. The CIDMMA was built on top of clay layers that were naturally deposited within Hampton Roads. Soils investigations revealed that water

was trapped and under pressure in the marine clay under CIDMMA due to the weight of the facility and that this water limited the foundation's load bearing capacity. In order to relieve the pressure, strip drains were installed to create water exit pathways that improved foundation strength. Strip drains were installed from 1995 through 2001. With greater foundation strength, the dike elevations have been increased to heights greater than allowed without the installation of strip drains. Currently the dikes have been raised to elevations ranging from 36 to 40 feet above mean lower low water (MLLW). Under the current management program, the dikes are raised in anticipation of the next year's inflow.

Since its construction, CIDMMA has received an average of 4.8 mcy of dredged material annually. These deposits include both new work and maintenance of Federal channels and anchorages, as well as permit dredging from other Federal, state, municipal, and private users. The total annual volume varies from year to year (see the following table). For example, in 1970, prior to the subdivision of the site into three cells, more than 16 mcy of material were placed in CIDMMA. At the other extreme, less than 1 mcy were deposited in 1990. Some of this annual variation is due to the 2 to 3 year dredging cycle of the Craney Island Rehandling Basin, which receives material from vessels that do not have pump-out capabilities, such as bottom dumping scows.

Table 1. HISTORICAL AND TOTAL CIDMMA INFLOW (1957-2004)

Fiscal year	Volume (cubic yd)	Fiscal year	Volume (cubic yd)
1957	3,700,000	1982	6,170,000
1958	6,550,00	1983	2,690,000
1959	8,060,000	1984	10,070,000
1960	7,020,000	1985	1,890,000
1961	4,120,000	1986	3,710,000
1962	4,680,000	1987	2,830,000
1963	1,440,000	1988	12,800,000
1964	3,730,000	1989	3,100,000
1965	5,730,000	1990	930,000
1966	6,320,000	1991	3,910,000
1967	11,560,000	1992	1,530,000
1968	4,890,000	1993	3,960,000
1969	5,060,000	1994	1,440,000
1970	16,460,000	1995	2,630,000
1971	8,910,000	1996	5,370,000
1972	4,030,000	1997	1,060,000
1973	3,170,000	1998	2,000,000
1974	5,290,000	1999	2,940,000
1975	3,540,000	2000	1,990,000
1976	5,890,000	2001	3,110,000
1977	2,000,000	2002	3,030,000
1978	7,030,000	2003	3,610,000
1979	2,880,000	2004	3,000,000
1980	6,340,000		
1981	3,170,000	Total	225,630,000

CIDMMA Future Without Project Condition

In developing future deposition rate estimates for CIDMMA, the District queried Norfolk Harbor users that have historically placed large volumes of material into the CIDMMA, such as the USACE Norfolk District Operations Division, U.S. Navy, and the VPA. In addition, known future users, such as APM/Maersk, that will require dredged material volume capacity in the future were also queried. All of the queried users provided the approximate location of dredging, estimates of future dredged material

inflow quantities, and the anticipated timing of the inflows. Each source of the dredged material was reviewed to evaluate whether the location of dredging was within the authorized geographical limits to use the facility. Each quantity estimate was reviewed to ensure each user reported the estimates consistently. The inflow schedules were reviewed to ensure the scheduled deposits would not exceed the capabilities of the facility. In addition, the dredged material inflow estimates were periodically updated during the course of the Feasibility Study.

Future inflow estimates are also based on the assumption that CIDMMA would accept all material that was eligible for disposal, as is the actual practice. Furthermore, it is assumed that the District will continue to use dredged material beneficially whenever possible; however, based on the experience of recent years, it is assumed that little of the material placed into the existing site will be suitable for beneficial use.

Individual year-by-year inflow projections were developed for 2005-2022. For years beyond 2022, this analysis assumes that the historic average of 4.8 mcy per year will continue to be a reasonable estimate of the future deposition rate into CIDMMA, inclusive of maintenance and identified new work dredging. This estimate is consistent with the "Norfolk Harbor and Channels, Virginia, Long-Term Disposal (Inner Harbor)" draft information report, dated June 1990, that projected the deposits into CIDMMA to be 4 mcy annually without accounting for new dredging projects that have been initiated since 1990, such as the 50-foot inbound element and the new Maersk container handling facility.

The inflow projections indicate the CIDMMA will achieve its capacity in 2025. A sensitivity analysis was conducted to assess how construction of the authorized main channel deepening to 55 feet MLW might affect CIDMMA's useful life. The sensitivity analysis shows that CIDMMA's useful life would be reduced by only 1 or 2 years (2024 or 2023) if the 55-foot project were constructed. This relatively small impact on CIDMMA's useful life is due to the expectation that much of the 55-foot project's dredged material would not be placed at CIDMMA because of the location of the main

channel, which extends out of the harbor into the bay and ocean. In addition, sensitivity analyses were conducted on the in-flow estimate for the years beyond 2022, and it was found that in-flow during these later years has only a small impact on the projected useful life of the facility. The following table presents the current dredged material inflow forecast for CIDMMA, which includes all known future inflows.

The without project disposal strategy for Norfolk Harbor, which is the disposal strategy that excludes any capital investments at CIDMMA (other than those already planned for), is the continued use of CIDMMA until the facility achieves its holding capacity in 2025. In the years after 2025, Norfolk Harbor dredged material will be disposed at the U.S. Environmental Protection Agency (USEPA) designated ocean disposal site (the Norfolk Dredged Material Management Area), located approximately 47 miled from the CIDMMA and 17 miles east of the mouth of the Chesapeake Bay, as shown on Plate 1.

Table 2. FORECASTED AND TOTAL CIDMMA INFLOW (2005-2025)

Fiscal year	Volume (cubic yd)	Fiscal year	Volume (cubic yd)
2005	10,600,000	2016	4,600,000
2006	8,500,000	2017	4,700,000
2007	3,900,000	2018	2,500,000
2008	5,150,000	2019	2,650,000
2009	7,400,000	2020	4,100,000
2010	3,720,000	2021	2,500,000
2011	4,300,000	2022	2,650,000
2012	4,020,000	2023	4,800,000
2013	3,900,000	2024	4,800,000
2014	4,620,000	2025	4,800,000
2015	3,950,000		
		Forecast total (2005-2025)	98,160,000
		CIDMMA useful life total	323,790,000

NORFOLK HARBOR OPERATIONS

Existing Container Handling Capacity

The major U.S. East Coast ports have all experienced strong growth in TEU volumes over the past few years as seen in the following table. New data for 2004 indicate that TEU volumes at Norfolk and Charleston grew at 9.0 percent or better, and TEU volumes at Savannah and New York/New Jersey grew at 8.5 percent and 7.5 percent respectively. This growth is due largely to increased volumes of Asian imports, especially from China, which arrive at U.S. East Coast ports via the Panama Canal, as well as diversion of cargo from U.S. West Coast ports, due to congestion problems on the landbridge.

Table 3. TOTAL TEU VOLUME FOR SELECTED NORTH ATLANTIC PORTS

	2001	2002	Percent change	2003	Percent change
Savannah	1,077,486	1,327,939	23.2%	1,521,206	14.6%
PONYNJ (1)	3,313,275	3,749,014	13.2%	4,067,812	8.5%
Baltimore	477,581	508,068	6.4%	536,078	5.5%
Norfolk	1,303,797	1,437,779	10.3%	1,646,279	14.5%
Miami	955,671	980,743	2.6%	1,041,483	6.2%
Charleston	1,528,034	1,592,835	4.2%	1,690,846	6.2%

(1) PONYNJ: Port of New York and New Jersey.
Source: Containerization International (www.ci-online.co.uk).

Without Project Future Container Handling Capacity

In response to recent growth, and in anticipation of future growth, the VPA has developed a master plan (2040 Master Plan, VPA 2003) for structural and operational improvements that will increase the port's container handling capacity from 1,881,000 TEU's in 2005 to 2,487,000 TEU's in 2011. The plan contains a budget and schedule for

implementation of the improvements identified in the Master Plan. The original Master Plan published in 2001 is also updated as advanced technologies and practices are developed within the industry.

Terminal capacity is a function of many variables, all of which must be considered together. These factors were analyzed in developing the VPA Master Plan, which identifies the terminal capacities. The efficiency increases expected by the VPA were included in the development of future conditions. Overall, implementation of the VPA's Master Plan will double VPA's container handling productivity to approximately 5,000 lifts per acre. This improved productivity rate is an ambitious yet reasonable goal considering that the port typically services partial vessel loads (i.e., only a portion of the containers on the vessel are unloaded or loaded at Norfolk) and a variety of vessel sizes. The types of improvements that VPA is implementing or plans to implement are outlined below.

Operational improvements that have been implemented or that are in the process of implementation include:

- Extended gate hours;
- Saturday gate hours during peak shipping season;
- Enhanced computer equipment for container tracking and yard planning;
- A port-wide chassis pool that has improved trucker turn times and freed up acreage for storing containers (first U.S. port for implementation);
- Greater storage density (higher stacking); and
- Dwell-time reduction measures.

Operational improvements that are scheduled for future implementation include:

- Additional computer controls for yard equipment routing;
- Automation on yard and gate equipment; and
- Second and third shifts for gates.

- The structural improvements identified in the master plan, such as equipment and facility upgrades that have been recently implemented or that are in the process of implementation, include:
- Complete renovation of the Norfolk International Terminals (NIT) South wharf (4,230 linear feet [LF]) and the addition of 8 Suez-max Cranes;
- Renovation of 48 acres of container yard at NIT South; and
- Expansion of NIT North container yard (10 acres).

The structural improvements that are scheduled for future implementation include:

- Renovation of an additional 96 acres of container yard at NIT South;
- Expansion of NIT North container yard by 30 acres with the addition of one more berth with three new 100 gage cranes; and
- Renovation and expansion of rail yard to double railcar handling capacity. Double stacked trains are currently in use.
- Continuing efforts to reduce dwell time and increase land use intensity as new technologies become available

The VPA's Master Plan is a constantly updated program of identifying new efficiencies and innovations that may be applied at the port. In the future, new operational or structural improvements may be identified and implemented by the port that further increase productivity rates beyond today's reasonable expectations. However, it is highly unlikely that additional future improvements beyond those currently identified in the Master Plan would significantly increase productivity to a level that would have a major impact on the formulation of this project. Marginal additional improvements may be squeezed out by opportunistically stacking boxes higher as conditions allow or by increasing fees as an incentive to reduce dwell time, but all of the major operational and structural improvements that would significantly affect productivity have been identified and assessed in the development of the Master Plan.

Two examples of potential improvements that were considered in the development of the Master Plan but not recommended for full implementation due to other constraints include "six high" stacking and charging container storage fees to reduce dwell time. "Six high" stacking (using "one over five" machines) is considered to be the maximum practical for loads worldwide. (Empties are sometimes stacked up to seven or eight high, but this is not often or common.) Most loads at Norfolk are imports. Analysis conducted by the VPA indicate that "six high" stacking machines for random delivery of imports have a maximum average operating height of 4.17 and yield an actual storage density increase of 19 percent over the more common "five high" ("one over four") machines currently deployed at most ports. In addition, as stacking height increases, particularly for imports, service productivity goes down, so there is a dynamic capacity penalty associated with the static capacity increase. These factors were considered in the Master Plan.

Similarly, the Port's ability to increase capacity by reducing dwell time through the imposition of charges is limited by many factors, such as competition with other ports. Unless all ports increase storage fees, the boxes that can feasibly do so, particularly empties, will shift to a lower cost port. Many of the empties at East Coast ports are positioned there from the West Coast by rail. Therefore, the shipping lines can route the empty boxes to the cheapest port to some extent. However, for loaded containers it would be incorrect to assume that increasing demurrage charges would always reduce dwell time. Especially during peak import periods, retailers are willing to pay demurrage on loads.

Every U.S. container-port has to confront the problem of empty containers, which must be stored somewhere. Unless empty depots are developed inland and used by the owners of the containers, the ports will have to deal with a portion of their dwell time being used by boxes waiting between import use and export loading. The allocation of loading slots and the imposition of storage restrictions by the railroads have increased the use of ports as container storage facilities. Fee assessment on storage time is not considered an effective measure to significantly reduce container dwell time.

Incremental increases in projected TEU capacity are presented in the following table. These incremental increases in capacity include marginal improvements that have been introduced since publication of the 2040 Master Plan in 2003. After 2011, planned port infrastructure improvements (with the exception of the Craney Island Marine Terminal) will be completed, and growth in container handling capacity is expected to result only from marginal technological and operational improvements. The APM (Maersk-Sealand) additions to total port capacity (600,000 TEU's by 2011) are expected to grow throughout the remainder of the study period at an average rate (1.89 percent per year). This is based on the generally accepted rate of growth in container handling improvements stemming only from technological and operational improvements and does not include any capacity increases attributable to acreage expansion. Container handling capacity growth is ultimately capped at approximately 5,000 lifts per acre, or double the current productivity rate.

Table 4. CONTAINER HANDLING CAPACITY, 2005-2060 (WITHOUT PROJECT)

Year	TEU capacity	Source of capacity expansion
2005	1,881,000	NIT Improvements
2007	1,987,000	APM Facility Phase 1
2009	2,087,000	NIT Improvements
2011	2,487,000	NIT Improvements and APM Phase 2
2020	2,560,300	Marginal Improvements
2030	2,657,500	Marginal Improvements
2040	2,774,700	Marginal Improvements
2050	2,916,000	Marginal Improvements
2060	3,086,400	End of Planning Period

Source: VPA.

Norfolk Harbor Without Project TEU Forecast

Global Insight's World Trade Model (WTM) was used to develop the Norfolk Harbor TEU forecast. The WTM used in this analysis is an updated version of the same model used in numerous other USACE navigation studies, including the Norfolk Harbor 50-foot in-bound element, the New York/New Jersey Harbor Deepening Feasibility Study (the 50-foot study), and the New York/New Jersey Harbor Deepening Limited Reevaluation Report (LRR). Forecasted Norfolk Harbor TEU volumes are based on import and export forecasts for ports along the South Atlantic Region of the U.S. The South Atlantic Region TEU growth rates projected by the WTM are applied to the port's observed 2003 TEU volume to generate future TEU volumes at the port. In the early years of the forecast, import growth rates are much higher than export growth rates (see the following table). Import growth rates, however, gradually decline over time, while export growth rates remain steady, so that the import and export growth rates are close to parity by 2020.

Table 5. SHORT-TERM FORECAST IMPORT AND EXPORT TEU GROWTH RATES

	2005	2006	2007	2008	2009	2010	2020
Imports	8.9%	7.5%	6.8%	4.2%	4.9%	5.9%	3.6%
Exports	3.2%	3.9%	3.3%	3.2%	3.1%	3.1%	3.1%

The total TEU volumes projected for Norfolk Harbor are presented in the following tables. The forecast was conducted in 2004; therefore, actual 2004 data were not utilized in model development. Actual 2004 Norfolk Harbor TEU volumes and growth rates were greater than forecasted volumes and growth rates. The forecast predicts the future volume of trade that will be directed toward Norfolk Harbor regardless of

eastward expansion at CIDMMA. Therefore, these future TEU volumes are used in the analysis of both without and with project condition but are capped once throughput capacity is exceeded.

Table 6. SHORT-TERM HAMPTON ROADS TEU VOLUME FORECAST AND AVERAGE ANNUAL GROWTH RATES

	2004 (1)	2005	2006	2007	2008	2009	2010
Volume	1,774,401	1,898,397	2,019,163	2,134,176	2,216,987	2,313,304	2,430,603
Growth	7.8%	7.0%	6.4%	5.7%	3.9%	4.3%	5.1%

(1) Actual 2004 TEU volume was 1,808,933, and annual growth was 9.0 percent.

Table 7. LONG-TERM HAMPTON ROADS TEU VOLUME FORECAST AND AVERAGE ANNUAL 10-YEAR GROWTH RATES

	2010	2020	2030	2040	2050	2060
Volume	2,430,603	3,586,882	5,142,876	7,260,737	10,060,200	13,819,187
Growth	6.1%	4.0%	3.7%	3.5%	3.3%	3.2%

Norfolk Harbor's Existing and Without Project Future Hinterland

Norfolk Harbor's hinterland is defined as those areas of the U.S. that are either origins or destinations for containerized cargo serviced at Norfolk Harbor. Identification of Norfolk Harbor's hinterland is based on an in-depth analysis of 2002 Port Import Export Reporting Service (PIERS) data. PIERS data are collected from vessel manifests

and U.S. Customs Service vessel data. PIERS collects data from each arriving and departing vessel at each U.S. port. PIERS data identify many import and export commodity characteristics, such as the U.S. and foreign port, where the commodity was loaded or off-loaded.

The PIERS data associated more than 41,000 ZIP-5 codes with containerized cargo transiting the port. Those ZIP-5 codes identify the ports' hinterlands. These data were aggregated into 23 Hinterland Trade Clusters based on contiguous geography, clusters of import/export trades, state boundaries, and significant geographic features. The weighted average geographic centroid of each Hinterland Trade Cluster was determined by calculating a weighted average latitude and longitude value based on the lat/long center of each zip code and the volume of import and export cargo for each zip code. The nearest zip code area to the weighted average lat/long value was used as the geographic centroid. The following table presents the trade clusters, the geographic centroid, and the highway mile distance from Norfolk Harbor.

Table 8. HINTERLAND TRADE CLUSTER DESCRIPTIONS

Trade cluster	Central city	Truck miles from Norfolk Harbor
Baltimore/DC	Baltimore, MD	245
CA & South West	Bakersfield, CA	2,728
CHI, Northern IL & IA	Aurora, IL	934
Cleveland/Pittsburgh	Garrettsville, OH	518
Columbus/Cincinnati	South Solon, OH	578
Central IN	Brownsburg, IN	747
GA, AL & FL	Raiford, FL	650
Greater TX	Cameron, TX	1,420
Kansas City & KS	Glasco, KS	1,390
KY & OH Valley	Laconia, IN	696
LA & Southern MS	Abita Springs, LA	1,022
Lower MI	Grass Lake, MI	733
Memphis & AR	Memphis, TN	923
North Carolina	Albemarle, NC	295
NY / Philadelphia / NE	White Plains, NY	387
Pacific North West	Morton, WA	2,993
South Carolina	Harleyville, SC	389
St. Louis et al.	Saint Louis, MO	931
Tidewater VA	Norfolk, VA	7
TN Valley	Woodbury, TN	670
Upland VA	Concord, VA	175
WI, MN, etc.	Plum City, WI	1,249
West Virginia	Elizabeth, WV	507

The following table presents the proportion of Norfolk Harbor's TEU volume allocated to each trade cluster based on the 2002 PIERS data. The following table also presents the estimated 2003 TEU volume for each trade cluster. Throughout the Feasibility Study, including the forecast of future cargo movements, the proportional allocation of cargo among trade clusters is based on the proportions exhibited by the 2002 PIERS data.

Table 9. NORFOLK'S HINTERLAND TEU DISTRIBUTION

Trade cluster	Percent total	TEU's (2003)	Trade cluster	Percent total	TEU's (2003)
Balt/DC	24%	392,417	PacNWst	2%	28,383
TdWtr VA	22%	355,884	STLouis et al.	2%	28,062
CHI, N. IL & IA	10%	159,853	WI, MN, etc.	1%	22,124
NCarolina	7%	112,046	GA, AL & FL	1%	16,739
Clmb/Cinc	7%	109,309	WVa	1%	11,878
KY & OH Valley	6%	98,048	Cntrl IN	1%	11,813
Upld VA	4%	64,822	Memphis & AR	1%	9,748
NY/Phl/NE	3%	50,352	SCarolina	>0.5%	6,526
Lower MI	3%	49,063	TN Valley	>0.5%	2,785
Clev/Pitt	3%	48,381	LA & S. MS	>0.5%	1,094
KCity & KS	2%	36,311	Greater TX	>0.5%	1,078
CA & SWst	2%	29,562	Total	100%	1,646,279

Landside transportation between Norfolk Harbor and its hinterland is conducted by truck or by truck/rail combinations known as inter-modal transport. Truck transportation is provided by a variety of different services, including short-haul, independent drayage operators, and larger trucking firms.

Six major railroads serve U.S. ports; however, except for New Orleans, most ports are only served by two. Norfolk Harbor is served by Norfolk Southern and CSX. Inter-modal operations at Norfolk Harbor are somewhat unusual in that the VPA has developed an "Inland Port" at Front Royal, Virginia, which is over 200 miles inland from the marine terminals. Norfolk Southern provides seven-day-per-week rail service connecting the marine terminals at Norfolk Harbor to and from Front Royal, where import and export containers are transferred from trucks to trains (and vice versa).

The following table presents an estimated split between truck and inter-modal (truck and train) landside transport for goods being transported to and from each of the 23 Hinterland Trade Clusters. Typically, the longer the landside transport distance, the

larger the proportion of goods moved by inter-modal transport. However, this relationship depends on the availability of rail services, which are not distributed evenly among the trade clusters due to numerous factors, including track ownership, usage agreements, and operational impediments such as grade crossings. For example, TEU's transiting between Norfolk Harbor and the New York/New England trade cluster are exclusively moved by truck, even though the distance to the centroid (387 miles, to just north of New York City) might suggest otherwise.

Table 10. NORFOLK'S INTERMODAL DISTRIBUTION (2003)

Trade cluster	Percent truck	Percent rail	TEU's by truck	TEU's by rail
Balt/DC	85%	15%	334,763	57,655
TdWtr VA	100%	0%	355,884	0
CHI, N.IL & IA	44%	56%	70,309	89,544
NCarolina	100%	0%	112,046	0
Clmb/Cinc	65%	35%	71,414	37,895
KY & OH Valley	58%	42%	57,107	40,941
Upld VA	89%	11%	58,004	6,818
NY / Phl / NE	100%	0%	50,352	0
Lower MI	56%	44%	27,502	21,561
Clev/Pitt	69%	31%	33,343	15,037
KCity & KS	17%	83%	6,052	30,258
CA & SWst	5%	95%	1,478	28,084
PacNWst	5%	95%	1,419	26,963
STLouis et al.	44%	56%	12,403	15,659
WI, MN, etc.	25%	75%	5,549	16,575
GA, AL & FL	61%	39%	10,212	6,527
WVa	70%	30%	8,267	3,612
Cntrl IN	55%	45%	6,520	5,292
Memphis & AR	45%	55%	4,351	5,397
SCarolina	77%	23%	5,002	1,523
TN Valley	60%	40%	1,666	1,119
LA & S. MS	39%	61%	423	671
Greater TX	15%	85%	160	918

PROBLEMS, NEEDS, AND OPPORTUNITIES

The major water resource problems at Norfolk Harbor include dredged material disposal capacity and container handling capacity, both of which cannot keep pace with demand. These problems confronting Norfolk Harbor result from the rapid growth in international maritime trade that the Nation has experienced over the past decade and which is expected to continue into the future. Containerized cargo has been the most rapidly expanding mode of international maritime trade. Norfolk Harbor alone has seen a 39 percent increase in containerized trade between 2001 and 2004. The rapid expansion of trade in containerized cargo has prompted a nationwide need for navigation improvements exemplified by channel deepening projects at nearly every major container port in the Nation over the past 10 years, with corresponding expansion of landside facilities to handle the growing throughput requirements.

At Norfolk Harbor, recent and expected future growth in containerized trade has been the impetus for channel deepening (50-foot in-bound project), berth deepening, and port expansion (i.e., the new approximately 300-acre APM/Maersk facility and improvements to existing facilities). These projects and their maintenance have substantially increased the burden on the CIDMMA as the depository for Norfolk Harbor's dredged material.

In addition, the existing and expected future origin-to-destination patterns of containerized international trade have increased the container handling burden of the major U.S. East Coast container ports. The VPA is currently engaged in a major infrastructure improvement program that includes streamlined landside operations and installation of the world's most efficient container cranes (the last of 11 newly purchased cranes was installed in January 2005). Nonetheless, container handling capacity is ultimately constrained by available real estate. Norfolk Harbor's container handling capacity is anticipated to fall short of the throughput demands posed by international trade by 2011. As will be discussed in the "Without Project Condition Overview" section, the constraints on container handling capacity at Norfolk Harbor pose a large

economic burden to the Nation as a whole, as cargo will have to travel by less efficient routes between origins and destinations once container handling capacity limits are reached.

Projected shortages in dredged material disposal capacity and container handling capacity at Norfolk Harbor create the need for increased capacity for dredged material disposal and for expanded container handling facilities. In general, this need can be met by 1) increased efficiency, 2) expanding existing facilities, or 3) building new facilities. The preceding discussion of existing conditions identifies the efforts being made at increasing efficiencies. These increases in efficiency are included in the following "Without Project Condition" section.

The opportunity posed by existing and expected future conditions is to meet expected future dredged material disposal and container handling needs in a way that generates the greatest benefit to the Nation. The without project condition discussion presented below more fully identifies the water resource problems and needs outlined above. Opportunities are more fully presented under the "Plan Formulation" section.

WITHOUT PROJECT CONDITION OVERVIEW

The without project condition is the dredging and related conditions likely to occur under existing and planned improvements, laws, and policies. It provides the basis for the evaluation of potential solutions for addressing the dredging and port development problems described below.

Dredging will continue to occur at Norfolk Harbor, whether there is an expansion of the CIDMMA or not. Without a Federal expansion project, however, the CIDMMA will reach its full capacity in 2025 without further capital investment, and future dredging operations will be forced to utilize the USEPA designated Norfolk dredged material ocean disposal site as the primary disposal location for ocean-suitable material.

Container traffic will continue to grow at Norfolk Harbor. At current volumes and forecasted growth rates, Norfolk Harbor will experience a container handling capacity shortfall by 2011. This shortfall will cause cargo that would otherwise be serviced at Norfolk Harbor to be serviced at alternative ports, resulting in significant increases in transportation costs. Future without project use of alternative ports will occur regardless of vessel draft. Without project dredged material disposal capacity and container handling capacity are discussed in more detail below.

WITHOUT PROJECT CONDITION: DREDGED MATERIAL DISPOSAL CAPACITY SHORTFALL

The CIDMMA inflow forecast, shown previously in Table 2, is based on the user survey and historical inflows discussed in the "CIDMMA Existing Conditions" section. The inflow forecast includes only those future inflows that have the highest level of certainty. Sensitivity analyses are used to assess the impact of other potential inflows, such as material that would result from deepening the main channel to its authorized depth of 55 feet, or material that would result from berth deepening beyond existing conditions.

User surveys and other information were forwarded to ERDC for analysis and development of with and without project capacity projections for CIDMMA. ERDC used the Primary Consolidation, Secondary Compression, and Desiccation of Dredged Fill computer model to estimate the lifespan of the CIDMMA. The model was calibrated using past surveys of CIDMMA and past inflows. Based on ERDC simulations, CIDMMA will reach its maximum capacity in 2025 under without project condition.

The CIDMMA capacity forecast is based on continuation of the management practices identified in the "CIDMMA Existing Conditions" section, such as use of drying cells, optimization of layer thickness, dike raising, and implementing alternative beneficial uses of dredged material. CIDMMA capacity is regularly increased to meet short-term inflow projections by raising the height of the dikes. Dike heights currently range from 33 to 36 feet above MLW. Under without project condition, the dikes are

capable of being raised to an interior height of 47 feet, which is projected to accommodate forecasted inflow volumes until 2025. After 2025, with an interior height of 47 feet, the CIDMMA foundation will have reached its bearing capacity, and additional inflows will no longer be accommodated.

WITHOUT PROJECT CONDITION: CONTAINER HANDLING CAPACITY SHORTFALL

Norfolk Harbor is the third largest container port, by volume, on the U.S. East Coast (following the Port of New York and New Jersey and the Port of Charleston) and is a primary port-of-call for many of the major liner services calling on the U.S. East Coast. Norfolk Harbor is rapidly approaching its container handling capacity. Norfolk Harbor's container handling capacity shortfall is identified through a comparison of Norfolk Harbor's without project condition TEU forecast and its container handling forecast. In the without project condition, Norfolk Harbor's anticipated TEU volume will slightly overpass its full container handling capacity in 2005, but planned improvements are expected to provide adequate capacity until 2011. Beyond 2011 (see the following table), the quantity of container handling services that would not be able to be accommodated at Norfolk Harbor continues to grow (this quantity is identified in the table as excess TEU's).

Table 11. NORFOLK HARBOR WITHOUT PROJECT CONDITION EXCESS TEU'S (2005-2060)

	2005	2010	2015	2020
Total TEU's	1,898,397	2,430,603	2,980,763	3,586,882
Port capacity	1,881,000	2,487,000	2,518,045	2,560,260
Excess TEU's	17,397	0	462,718	1,026,621

	2030	2040	2050	2060
Total TEU's	5,142,876	7,260,737	10,060,200	13,819,187
Port capacity	2,657,500	2,774,720	2,916,024	3,086,363
Excess TEU's	2,485,375	4,486,017	7,144,175	10,732,825

A basic assumption of the without project condition is that Norfolk's excess TEU's, identified in the table above, will be serviced by alternative ports in order to maintain the forecasted trade between commodity origins and destinations. An analysis of TEU forecasts and planned improvements at other major U.S. container ports indicates that a number of other ports will also experience insufficient container handling capacity at some time during the study period.

During the course of this analysis, 18 potential alternative ports on the Pacific, Gulf, and Atlantic coasts were initially assessed as potential alternatives to Norfolk Harbor (see the following table). This list of potential alternative ports was reduced through a screening process that assessed the likelihood that each port might be used as an alternative to Norfolk Harbor. Criteria used to identify the most likely alternative ports include future available container handling capacity, existing and planned channel depths, and frequency of calls by the major liner services calling at Norfolk Harbor. Three conditions must be met in order for a port to be selected as a reasonable alternative port for those TEU's that cannot be accommodated at Norfolk Harbor.

- The alternative port must have projected future container handling capacity greater than the forecasted TEU volume for that port (this excess capacity would be available for the TEU's that cannot be accommodated at Norfolk Harbor);
- Authorized channel depths at the alternative port must be sufficient for the vessels currently on the major liner services (minimum of -45 feet MLW); and
- The alternative port must be on the same major liner service port rotations that currently include Norfolk Harbor, so that the carriers would not be required to make an additional port-of-call in order to on- or off-load the TEU's that cannot be accommodated at Norfolk Harbor.

Table 12. POTENTIAL ALTERNATIVE PORT LIST

Boston, MA	Wilmington, NC	Miami, FL
PONYNJ, NY & NJ	Savannah, GA	Houston, TX
Philadelphia, PA	Brunswick, GA	Seattle, WA
Baltimore, MD	Jacksonville, FL	Tacoma, WA
Wilmington, DE	West Palm Beach, FL	Oakland, WA
Charleston, NC	Port Everglades, FL	LA/LB, CA

PONYNJ = Port of New York and New Jersey
LA/LB = Los Angeles/Long Beach

In order to identify the most likely alternative ports and to identify which TEU's would be handled at an alternative port, the port's TEU forecast was disaggregated into three generalized trade routes: Pacific trade, North Atlantic trade, and South Atlantic trade. Pacific trade includes those commodities that are landed or loaded at the port and are linked with Asian countries via the Panama Canal. North Atlantic trade includes all port commodities with origins or destinations in Europe, the Mediterranean, and all trade

that passes through the Suez Canal. South Atlantic trade includes trade from Central and South America, the Caribbean, and western Africa.

Each of these trade routes is served by containership lines that have established port rotations and schedules. Port rotations and schedules are developed by the carriers through extensive negotiations among alliance partners, slot sharing partners, and ports. Once a port rotation and schedule becomes operable, it is difficult and expensive for carriers to make adjustments. This analysis assumes that carriers will maintain their existing services and that the most likely alternative ports are those ports that are currently in existing rotations with Norfolk Harbor. The carriers are expected to adjust to Norfolk Harbor's capacity constraint by loading or off-loading Norfolk Harbor's excess TEU's at other ports that are already on the same service string as Norfolk Harbor. In this way, the carriers are not making additional port calls and, therefore, do not adjust port rotations or incur additional waterborne transportation costs.

An analysis of existing service strings, their port rotations, and an analysis of each potential alternative port's future available capacity was conducted to identify the alternative ports. The analyses indicate that the most likely alternative ports that would be used in the without project transportation cost calculations are:

- LA/LB for commodities on the Pacific Trade route;
- Savannah for commodities on the North Atlantic trade route; and
- Miami for commodities on the south Atlantic trade route.

Each of these three ports meets the criteria identified previously for selection as the most likely alternative ports for Norfolk Harbor's excess TEU's. Future available capacities were developed through a comparison of the most recent port development plan (LA/LB) or USACE Feasibility studies for navigation improvements (Savannah and Miami) with the WTM forecast for each port. Current liner service port rotations were assessed to identify ports having available capacity and that are currently ports-of-call for the major services. Channel depths were verified as either existing conditions or authorized USACE deepening projects. Sources of future port capacities for the selected

alternative ports include: NY/NJ: NY/NJ Harbor Navigation Study Post Authorization Economic Reevaluation (Sept. 2004), New York District; Savannah: Georgia Port Authority, Journal of Commerce Special Report dated 28 February 2005; Miami: Jacksonville District (pers. Communication R. King); and Miami Harbor Navigation Study, General Reevaluation Report, Appendix A: Economics, February 2003.

In addition, information concerning the Ports of LA/LB was taken from the Port of Long Beach Master Plan, 2002, and the Port of Los Angeles Navigation Study, November 2000, Los Angeles District.

Smaller ports, such as Baltimore and Philadelphia, were not selected because of limited capacity and because they are not on the port rotations of most of the relevant liner services. A comparison of transportation costs for goods on the North Atlantic route was conducted for Baltimore and Norfolk. Weighted average (weights based on proportion of goods going to each trade cluster) landside transportation costs, including port costs, for Baltimore are $380 per box and $370 per box for Norfolk. These costs do not include the additional cost of 240 miles of ocean travel to Baltimore. Baltimore was rejected as an alternative port early in the analysis because of the additional ocean travel required, which adds an additional day to the vessel's itinerary. The relatively low volume of containers that go through Baltimore today, even though landside transportation costs are similar to NY and Norfolk, is due to the burden of additional ocean travel.

Adding Baltimore as a port-of-call to a service that also calls at Norfolk and New York would add 240 miles and a full day to the vessel's schedule. Similarly, adding Philadelphia would increase the trip by 201 miles and add a day to the schedule. Charleston was not selected because it also faces anticipated future capacity constraints. Port Everglades is expected to have available capacity but was not selected due to relatively limited inter-modal capabilities, and it is not included in the existing major liner service port rotations, which more typically call at Miami rather than Port Everglades. The PONYNJ was not selected for two reasons. One reason is related to the

anticipation of future congestion and the expectation that the PONYNJ will run out of available capacity in approximately 2018, based on the most recent commodity forecast for the PONYNJ. This forecast was conducted more recently than and independently of the forecast used in the PONYNJ consolidation LRR. The second reason is the expectation that carriers will continue the trend of splitting their services to the U.S. East Coast into northern and southern services. This trend has already developed on the West Coast and has begun recently on the East Coast, which places the PONYNJ on the northern service and Norfolk Harbor on the southern service. Therefore, it is expected that there will be fewer services calling at *both* Norfolk Harbor and the PONYNJ in the future, once capacity constraints at both ports are reached.

The following tables display Norfolk Harbor's excess TEU volumes and how they would be allocated to alternative ports under without project condition. By 2045, the selected East Coast alternative ports run out of available capacity that could handle the Norfolk Harbor's excess TEU's. After 2045, the model allocates all of the excess TEU's to LA/LB as a proxy low cost alternative for a solution to the East Coast's capacity constraint. This is a conservative assumption from the perspective of project benefits, because LA/LB is the next least expensive alternative to Norfolk, once Savannah's capacity constraint is reached. The assumption that the ports of LA/LB would be able to handle Norfolk's excess TEU's is supported by the recent creation of land for port development at both ports and the stated intention to create more land in the future. Land creation for port development is documented in the Port of Los Angeles Channel Deepening Project Feasibility Study (Nov. 2000) and the Port of Long Beach Facilities Master plan 2020 (Feb 2002).

Table 13. ALTERNATIVE PORT TEU DISTRIBUTION (2011-2016) WITHOUT PROJECT

	2011	2012	2013	2014	2015	2016
LA/LB	15,143	47,787	84,797	120,568	157,786	196,970
Savannah	21,688	67,857	119,482	168,660	219,307	272,260
Miami	8,181	25,820	45,851	65,300	85,625	107,158

Table 14. ALTERNATIVE PORT TEU DISTRIBUTION (2020-2060) WITHOUT PROJECT

	2020	2030	2040	2050	2060
LA/LB	352,446	1,528,490	3,669,214	7,144,175	10,732,825
Savannah	479,549	47,845	0 (1)	0	0
Miami	194,626	909,040	816,803	0 (1)	0

(1) Port reaches capacity and cannot accept Norfolk's excess TEU's.

WITHOUT PROJECT CONDITION: TRANSPORTATION COSTS

Under without project condition, the routing of historic Norfolk Harbor cargo through alternative ports results in addition transportation costs per box and places a major transportation cost burden on the Nation. The additional transportation cost of using alternative ports was calculated as the difference between the origin-to-destination transportation costs of transporting goods through Norfolk Harbor versus the origin-to-destination costs of using the selected alternative ports. Most of these costs were calculated as the net difference in landside transportation costs between using Norfolk Harbor and alternative ports. The single exception is the reduced waterborne transportation costs for TEU's arriving from Asia that is assumed to be offloaded at the

ports of LA/LB instead of Norfolk Harbor, in which case the trip through the Panama Canal is avoided for those boxes offloaded at LA/LB. In addition, several sensitivity analyses were conducted on alternative routing assumptions.

The following table presents the total overall additional transportation costs for each of the three trade routes for the sample year 2016. Note that all costs discussed in this analysis are at October 2005 price levels. The overall additional transportation costs are the net result of additional costs (or cost savings) caused by routing Norfolk's excess cargo to an alternative port. Norfolk Harbor is not always the least-cost port in terms of landside transportation costs. This result is consistent with the carriers' system-management approach, as opposed to an individual box-management approach. These landside cost comparisons also indicate that the carriers and other freight forwarding entities are making decisions based on other criteria (i.e., origin to destination shipping times) in addition to minimizing landside costs. Modeling the full logistical decision process is not required for this analysis, because transportation cost calculations are based on observed industry practices, i.e., the trade route-trade cluster distribution observed in 2002.

The following table also shows the weighted average additional cost per box for Norfolk's excess TEU's that are routed through an alternative port. The relatively low additional cost per box of moving excess TEU's through LA/LB is largely due to the efficiencies gained through assumed re-packing of boxes and reliance on rail for long haul transport. The relatively high additional cost per box for goods moving through Miami reflects the relative lack of efficient rail service from that port to Norfolk's 23 Hinterland Trade Clusters. The total discounted (5.125 percent) without project landside transportation cost for TEU's routed through alternative ports starting in 2011 is $13,577,130,353. The average annual equivalent (AAEQ) value (50 years, 5.125 percent, 2010 base year) of this cost is $784,311,327.

Table 15. TOTAL ADDITIONAL TRANSPORTATION COSTS SAMPLE CALCULATION 2016 WITHOUT PROJECT CONDITION

	Pacific route (LA/LB)	North Atlantic route (Savannah)	South Atlantic route (Miami)
Total TEU's	191,651 TEU's	264,909 TEU's	104,265 TEU's
Total additional cost	$46,011,986	$34,736,756	$121,945,717
Average additional cost per TEU	$239.46	$130.79	$1,166.56

PLAN FORMULATION

The purposes of this section of the report are to present the planning objectives and constraints used in the formulation of alternative plans, to present the development of alternative plans, and to provide an overview of the evaluation and preliminary screening of alternative plans. Based on the problems, objectives, and constraints identified in the analysis, the development of alternative plans followed the standard planning model, which includes:

- Establishment of plan formulation rationale;
- Identification and screening of potential solutions; and
- Assessment and evaluation of detailed plans.

The Planning Guidance Notebook (ER 1105-2-100, dated 22 April 2000) states that "water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to study planning objectives and, consequently, to the Federal objective" (page 2-1). Plan formulation has been conducted for this Feasibility Study recognizing that the USACE Civil Works Program cost share for a combined port development-dredged material placement project

is limited by current law and policy to the present worth value of the least-cost long-term dredged material placement alternative. Therefore, plan formulation must identify the costs associated with a least-cost disposal option.

Although current law and policy preclude the USACE from cost sharing in a port development project, the study authorization requires coordination between planning for port development and planning for dredged material placement. Specifically, plan formulation must be responsive to the authorizing Congressional resolution, which directs the USACE to "...give specific attention to rapid filling to accommodate anticipated port expansion and to the operation of the existing facility while extending the useful life of CIDMMA..." The dual purpose of the authorizing resolution directs formulation to consider alternatives that address port expansion needs and also extend the useful life of CIDMMA. Although port development at Norfolk Harbor cannot be financed as a USACE Civil Works project, the USACE and the VPA have conducted extensive analyses in order to identify the NED benefits that will result from port expansion and optimize alternatives that satisfy the terms of the Congressional resolution. The plan formulation process is presented briefly in the "Port Development Plan Formulation" section.

In summary, plan formulation has proceeded along two tracks:

- Assessment of net NED benefits of alternative plans that meet the dual purpose cited in the authorizing resolution (port development and CIDMMA useful life expansion); and
- Identification and evaluation of the least-cost disposal option, so that the Federal cost share, under existing laws and policies, can be identified.

PLANNING OBJECTIVES

Based on the dredged material placement and port expansion, needs, concerns, and opportunities identified in the study area, a number of general and specific planning

objectives have been established to assist in the development and evaluation of alternative plans.

In general, the primary Federal objective is to contribute to NED and National Ecosystem Restoration. The pursuit and attainment of this objective must be consistent with national legal statutes, applicable executive orders, and other Federal planning requirements. The general and specific planning objectives for this study take an integrated systematic approach to the solution of dredged material placement and future port development problems associated with maintenance and construction activities of numerous channels, anchorages, berthing areas, turning basins, and other areas comprising the port complex. Continuing vital dredging, maintaining appropriate depths, and preserving the port's economic health are all important considerations. The following general and specific objectives have been identified.

General

- Meet the specified needs and concerns of the general public;
- Respond to expressed public desires and preferences;
- Be flexible to accommodate changing economic, social, and environmental patterns and changing technologies;
- Integrate with, and be complementary to, other related programs in the study area;
- Be implementable with respect to the financial and institutional capabilities, as well as public support; and
- Support national defense requirements and needs.

Specific

- Develop an environmentally and socially acceptable, technically feasible, and economical long-term disposal plan for dredged material management;
- Ensure that commercial and military navigation requirements will be satisfied;

- Provide for continued port growth and expansion that would enhance the economic well-being of the Norfolk Harbor and the Nation by providing the most efficient movement of waterborne cargo from origin to destination;
- In accordance with the limits of institutional participation, all plan components must meet NED objectives;
- Preserve and maintain the environmental character of the area under study, including such considerations as aesthetic, environmental, and social concerns, as directly related to plans formulated for implementation by the USACE; and
- Consider all practical beneficial uses of dredged material.

PLANNING CONSTRAINTS

Planning constraints are any policy, technical, environmental, economic, local, regional, social, and institutional considerations that act to restrict or otherwise impact the planning process. Typical general constraints include state-of-the-art limitations, time, money, uncertainty of the future, policy, and the inaccuracies inherent in design procedures on which alternative plans are based. A specific and important constraint with disposal of dredged material on a large scale in a highly developed area such as Norfolk Harbor is locating an area acceptable to the general populace. Often the location selection is a sensitive and controversial issue and involves complex environmental, social, and political issues. Further specific constraints are listed below:

- Consideration must be given to eastward expansion of CIDMMA to accommodate anticipated port expansion, as per the Congressional study authorization;
- Project benefits must be greater than project costs; and
- Transportation cost savings resulting from port expansion are legitimate NED benefits; however, they cannot be used as a basis for full Civil Works cost sharing of the CIDMMA eastward expansion based on current policy and law because the eastward expansion is not considered a General Navigation Feature (GNF).

In this section, alternative plan development is presented for plans that meet the dual purpose of port expansion and dredged material placement. Each alternative plan is formulated in consideration of four general criteria, as identified in the Principles and Guidelines: (1) completeness, (2) efficiency, (3) effectiveness, and (4) acceptability.

Completeness is the extent to which the alternative plans provide and account for all investments, or other actions, necessary to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities. Efficiency is the extent to which an alternative plan is the most cost-effective means of achieving the objectives. Effectiveness is the extent to which the alternatives plans contribute to achieving the planning objectives. Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies. Appropriate mitigation of any unavoidable adverse effects shall be an integral component of each alternative plan.

ALTERNATIVE PLAN DEVELOPMENT CRITERIA

The following specific formulation and evaluation criteria have been identified for this study.

Technical Criteria

- The plan selected should be consistent with local, regional, and state goals for water resources development;
- Plans must be realistic and reflect state-of-the-art measures and analysis techniques;
- The optimal scale of project development should be identified by analyzing NED and engineering feasibility;
- The plan should be capable of handling all types of material normally dredged in Hampton Roads, i.e., silt, sand, shell, and mixtures of these, as well as suitable and unsuitable material;

- The plan should accommodate large and small input loads without undue sacrifice of effectiveness. It should be capable of accommodating unanticipated new project dredging work without appreciable disruption.
- With the possible exception of extreme storms, the plan should function regardless of weather conditions;
- The entire plan 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, such as storms, floods, waves, etc.;
- The plan 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;
- Levees must be sized sufficiently to withstand storm tides and wave action; and
- The plan should be capable of accommodating future port development to increase container handling capacity. The container handling capacity is defined as how many containers can pass through the port in a given year.

Economic Criteria

- Each separable unit of improvement should be optimized to provide the maximum net benefits;
- The scope of the proposed development must be scaled to provide maximum net benefits. However, departure from the economically optimum project is possible in cases where the departure is justifiable and substantiated and an exception is granted from the Assistant Secretary of the Army (Civil Works) (ASA[CW]); and
- There must be no more economical means, evaluated on a comparable basis, of accomplishing the same purpose that would be precluded from development if the Federal plan were under taken. This limitation applies

only to those alternative possibilities that would be physically displaced or economically precluded from development if the project were undertaken.

Institutional Criteria

- Plans must be consistent with existing Federal, state, and local laws;
- Plans must be locally supported to the extent that non-Federal partner provides a letter of intent stating that it understands its responsibilities and obligations as set forth in the WRDA of 1986, as amended, and related policy;
- Prior to the Preconstruction Engineering and Design (PED) Phase, the non-Federal partner would enter into a written Design Agreement to cost share 25 percent of the costs of the Design Phase upfront. Ultimate cost sharing of design is the same percentage as for construction. Settlement is made at the time of construction, subsequent to execution of the Project Cooperation Agreement (PCA); and
- Prior to the Construction Phase, the non-Federal partner would enter into a written PCA to provide all items of local cooperation satisfactory to the Secretary of the Army, as mandated by Section 22 of Public Law 91-611, as amended.

Environmental and Social Criteria

- The plan should minimize the commitment of natural resources, whether they are marine bottom-lands, wetlands, other coastal zones, inland environments, or wildlife in these areas;
- The plan should minimize environmental impacts and maximize environmental quality in the project area to the extent practicable considering environmental, economic, and engineering criteria;
- The plan formulation process will include efforts to avoid and minimize adverse environmental consequences;
- A mitigation plan will be developed to fully mitigate any remaining unavoidable adverse consequences of the Recommended Plan.

- The available sources of expertise should be used to identify environmental resources that might be endangered, damaged, or destroyed by plan implementation. These would include the USFWS, USEPA, NMFS, and appropriate state agencies, such as Virginia Institute of Marine Science (VIMS), Virginia Marine Resources Commission (VMRC) and the VDHR;
- Measures should be incorporated into the Recommended Plan to protect, preserve, restore, or enhance environmental quality in the project area;
- The plan should be capable of being integrated into local or regional planning for water and air pollution abatement, transportation, recreation, and land use;
- As much as possible, the plan should minimize noise, dust, odor, unsightliness, and potential health risks;
- The plan should meet existing public health and environmental control standards;
- As nearly as possible, the plan should be aesthetically pleasing to the public, which has to support and live with it;
- The plan should not displace, devalue, or destroy important historical and cultural landmarks or sites; and
- The adverse impacts on area recreation resources should be minimized.
- The plan should be publicly acceptable.

The degree to which any water resources development project meets the foregoing criteria is taken as a measure of its relative merit. Clearly, no plan could meet all these criteria fully. However, the evaluation, selection, and development of alternatives will emphasize optimization in terms of the respective economic (NED) benefits along with the consideration of environmental, social, and regional impacts.

PORT DEVELOPMENT PLAN FORMULATION

Optimizing the size of future port facilities is beyond the scope of this study and is, therefore, not a requirement of this Feasibility Study, because the eastern expansion of CIDMMA cannot be recommended as a GNF. Thus, Federal cost sharing under current laws and policy does not include capital improvements associated with development of a

port facility. The VPA, in order to better direct its own capital investments, conducted a needs analysis based on the Master Plan forecast and planned operational capacity increases of the existing terminals. VPA found that 1,200 additional acres would be required to meet the containerized cargo forecast through 2040. The new APM facility, currently under construction, will provide approximately 300 acres of marine terminal. Therefore, the VPA still requires 900 acres of additional container terminal to meet the long-term forecast. This need for additional container terminal acreage is based on port productivity forecasts that include implementation of both structural and non-structural (i.e., operational) improvements identified by the VPA in the Master Plan.

Based on the findings of the needs analysis, the VPA conducted an extensive investigation of alternative port expansion opportunities within Norfolk Harbor and found that no area other than CIDMMA could support development of a major container handling facility. The following table presents the alternative container-terminal development locations considered by VPA and a brief assessment of each potential development site.

Table 16. EVALUATION OF POTENTIAL TERMINAL SITES

Potential locations	Container terminal requirements		
	Land area (> 400 acres)	Road and rail corridors	Deepwater channel access
CIDMMA Eastward Expansion	Provides 580 acres of container cargo area	Close proximity to major transportation corridors	Provides port access for deep draft vessels. Minor dredging required.
Hampton Sites	Substantial acreages of tidal wetlands	Not readily accessible	Navigation channels at least 5 miles from sites, extensive dredging required.
York County Site	Substantial acreages of tidal wetlands	Not readily accessible	Navigation channel at least 5 miles from site, extensive dredging required.
Other Potential York and Gloucester County Sites	No known undeveloped waterfront sites	Frequent bridge openings to allow vessels upstream of the Coleman Bridge would result in significant traffic impacts; U.S. 17 not suitable to support additional heavy truck traffic; no major roads and rail corridors within rural areas	Substantial dredging would be required to deepen the navigation channel, to create an access channel to a new port facility, and to establish a deep draft anchorage.
James River Sites	No sites downstream of the James River Bridge; one known site just upstream of Fort Eustis	Significant traffic impacts resulting from frequent James River Bridge lifts to accommodate vessels; no major roads and rail corridors within rural areas	Substantial dredging would be required to deepen the navigation channel, to create an access channel to a new port facility, and to establish a deep draft anchorage.
Elizabeth River Sites	Multiple small sites, questionable suitability since non-contiguous	Traffic impacts resulting from Jordan Bridge openings to accommodate vessels; limited major road and rail corridors in areas	Substantial dredging would be required to deepen the navigation channel; a turning basin is physically infeasible.

Constraints at the CIDMMA site, such as the Federal channel to the east, the Rehandling Basin to the south, and the legal constraint on expansion to the west, restrict the largest possible port development project at CIDMMA to an expansion of approximately 580 acres to the east. Although a 580-acre port development project falls short of the identified need, it is the best solution available to VPA. In consideration of the many constraints to port development in Norfolk Harbor, VPA has identified a 580-

acre container terminal on top of the eastward expansion of CIDMMA as the project that would best address future conditions.

The "Without Project Condition: Container Handling Capacity Shortfall" section identifies the container handling capacity shortfall in Norfolk starting in 2011. On a very aggressive schedule, the design and construction process for port development on an eastward expansion of CIDMMA would require at least 12 years to complete. This long lead time is required to design and construct the eastward expansion, fill it with dredge material, perform ground improvements, and then construct the marine terminal. The first phase of the new marine terminal would not be available and operational until 2016 with the remaining phases built in the following years.

ALTERNATIVE PLAN IDENTIFICATION: DREDGED MATERIAL PLACEMENT FOR PORT DEVELOPMENT AND USEFUL LIFE EXTENSION AT CIDMMA

A multi-disciplinary alternatives analysis team was convened, and its work was independently reviewed to ensure that the full range of dredged material placement alternatives was identified and that each alternative was evaluated thoroughly and properly. The alternatives analysis team:

- Reviewed alternatives identified in previous studies;
- Incorporated alternatives identified by the local sponsor and stakeholders;
- Identified all other possible alternatives;
- Developed sufficient design details for each alternative to fairly evaluate its merits and shortcomings;
- Evaluated each alternative relative to consistent screening criteria;
- Eliminated favoritism toward any individual plan so that plans are evaluated objectively;
- Allowed design revisions for alternatives and fairly evaluated the revised alternatives; and
- Maintained an inventory of alternatives considered and rationale for advancing an alternative to additional screening or for rejecting an alternative.

A comprehensive list of all the alternative plan categories identified for initial screening is presented below. Currently, the CIDMMA operates consistent with a dredged material management plan. Part of the plan calls for use of the existing north, center, and south containment cells to be rotated. Rotation allows for optimal drying of the dredged material within the facility. The alternative plans were formulated under the following general assumptions:

- Expansion cells would be incorporated into the existing Dredged Material Management Plan (DMMP) unless otherwise noted. The expansion cells would be added into the cell rotation plan to continue optimal drying of material within the facility; and
- Port/confined disposal facility (CDF) expansion cells will be rapidly filled, such that dredged material would be placed into that cell as rapidly as possible without the expansion cell participating in the DMMP cell rotation for optimal drying.

The alternatives are grouped into the following major categories:

- No Action Alternative: Based on ERDC simulations, CIDMMA will reach its maximum capacity in 2025 under without project conditions. CIDMMA capacity is regularly increased to meet short-term inflow projections by raising the interior height of the dikes. Interior dike heights currently range from 33 to 36 feet above MLW. Under without project conditions, the dikes are capable of being raised to an interior height of 47 feet, which is projected to accommodate forecasted inflow volumes until 2025. After 2025, with the dikes at an interior height of 47 feet, the CIDMMA foundation will have reached its bearing capacity, and additional inflows will no longer be accommodated. At this time ocean disposal will be utilized for suitable material.
- On Site Alternatives: These include potential modifications of the existing site that could extend the life of CIDMMA and provide port development (see Plates 3 and 4). No modifications to the existing site were found potentially feasible for useful life extension and port development.

- East Expansions: These include potential solutions for eastward expansion footprints of the existing site that could extend the life of CIDMMA and provide for future port development (see Plates 5-8). Expansion cell dikes would be constructed from the existing CIDMMA eastern dike into the Elizabeth River, and the cell would be filled with dredged material. Many different dike construction and construction phasing techniques were considered. Utilization of this site as only a CDF, and as a CDF with port terminal development, were both considered. When considering a port terminal, such development would occur on top of the expansion footprint once the cell has been filled with dredged material. A channel and berthing area would be dredged to allow ship access to the port facility.
- North Expansions: These include potential solutions for northward expansion footprints of the existing site that could extend the life of CIDMMA and provide port development (see Plates 9-11). A larger northward expansion and a smaller northward expansion were considered. A northward expansion cell would require dike construction from the existing CIDMMA northern dike northward into Hampton Roads. The cell would be filled with dredged material. Many different dike construction and construction phasing techniques were considered. Utilization of this site as only a CDF and as a CDF with port terminal development were both considered. When considering a port terminal, such development would occur on top of the expansion footprint once the cell has been filled with dredged material. A channel and berthing area would be dredged to allow ship access to the port facility.
- West Expansions: These include potential solutions for westward expansion footprints of the existing site that could extend the life of CIDMMA and provide the potential for port development (see Plates 12-18). Several different westward expansion footprints were considered. The smallest footprint expansion was one that would minimally extend the life of the facility. The largest possible expansion was the maximum footprint that would fit within physical constraints surrounding the site. A westward

expansion cell would require dike construction from the existing CIDMMA western dike westward into the James River. The cell would be filled with dredged material. Many different dike construction and construction phasing techniques were considered. Utilization of this site as only a CDF, and as a CDF with port terminal development, were both considered. When considering a port terminal, such development would occur on top of the expansion footprint once the cell has been filled with dredged material. A channel and berthing area would be dredged to allow ship access to the port facility.

- East and North Expansions: These include potential solutions for eastward and northward expansion footprints of the existing site that could extend the life of CIDMMA and provide the potential for port development. These expansion footprints are combinations of the north and east expansion footprints discussed previously.
- East and West Expansions: These include potential solutions for eastward and westward expansion footprints of the existing site that could extend the life of CIDMMA and provide the potential for port development. These expansion footprints are combinations of the east and west expansion footprints discussed above.
- North and West Expansions: These include potential solutions for northward and westward expansion footprints of the existing site that could extend the life of CIDMMA and provide the potential for port development. These expansion footprints are combinations of the north and west expansion footprints discussed above.
- Upland Placement Sites: These include new confined upland placement site potential solutions involving acquisition of upland real estate and construction of new diked facilities (see Plate 19). Such sites are land locked areas that are considered upland that is not periodically inundated with seawater during tidal fluctuations. Such sites generally require larger tracts of land. The tracts should be of such a shape to facilitate water clarification goals of a dredged material placement site. Upland sites are constructed by building containment

dikes to hold the dredged material. The dimensions of the upland site should be such that appropriate ponding and freeboard are maintained at all times. Weir structures should be installed to allow ponding of the water and decanting of clarified water. Management plans should be developed to optimally operate the site and maximize its lifespan. For the upland sites examined in this study, each lifecycle phase was considered. Conceptual design efforts considered site location, environmental and institutional considerations, real estate, technical parameters, and so forth. Initial construction, operation and maintenance (O&M), and closeout phases are also considered.

- Ocean Placement Sites: These include the two ocean placement sites (see Plate 20). These two sites were designated previously and are considered to be possible alternatives to the CIDMMA.
- Beneficial Use Sites: These include beneficial use of dredged material placement potential solutions (see Plate 21). Beneficial use sites for the purposes of this study are those sites where dredged material could be used to accomplish environmental benefits. Examples of such benefits could include beach nourishment, marsh creation or restoration, oyster ground creation, fish and wildlife habitat, and use of dredged material as construction materials. Design, construction, and placement techniques, as well as O&M procedures are specific to the beneficial use goal.
- Creation of New Island Facilities: These include building new islands in open water similar to the existing CIDMMA that could be operated as new DMMA's (see Plate 22). These sites were identified in prior studies and were revisited during this study. In most cases, such sites would require building dikes up from the existing sub-aqueous bottom to contain a large area of harbor or bay bottom. Dredged material would be deposited into the site until the dredged material elevation exceeded the high water line. Then the site would be operated much as the existing CIDMMA is operated. Management plans would be developed to optimally operate the site and maximize its lifespan. Each lifecycle phase would also be considered. Conceptual design

efforts considered site location, environmental and institutional considerations, real estate, technical parameters, and so forth. Initial construction, O&M, and closeout phases were also considered.

- Deep Hole Sites: These include locations within the Hampton Roads area where deep water exists that may have sufficient capacity to serve as pits for placement of dredged material (see Plate 23). The concept of such a placement site is that dredged material would be deposited into the deep holes such that the deep holes would eventually be filled enough for the bottom contours to rise enough to match the surrounding bathymetry.
- Combined Aquatic Disposal Facilities: These include sites that could be used as borrow sources of sand that could be used for any number of construction projects (see Plate 24). Once the sand is removed, a pit would remain that could provide dredged material storage capacity. Once the removal of borrow material is complete, dredged material could be placed into the pit. The pit would be filled until the rising bottom contours match the surrounding bathymetry.

PRELIMINARY SCREENING OF PLANS FOR DREDGED MATERIAL PLACEMENT FOR PORT DEVELOPMENT AND USEFUL LIFE EXTENSION AT CIDMMA

Dredged material disposal solutions were evaluated individually on the basis of their ability to meet the planning objectives within the constraints identified for the study. The goal of preliminary screening is to discard those solutions that obviously do not fulfill the dredged material disposal and port expansion needs of the study or are inappropriate due to other factors such as prohibitively high costs. Judgments are made about each measure based on knowledge gained from researching past reports, including the Reconnaissance Report, and the professional experience and expertise of the alternatives analysis team.

The alternatives analysis team findings were presented to the public through the periodic stakeholder meetings. The stakeholder meetings provided feedback on the

alternatives screening process. An alternatives matrix was created to facilitate the preliminary screening process, which utilized three preliminary screening criteria:

- Does the alternative provide long-term dredged material storage capacity for Norfolk Harbor (generally the geographic area currently included within the bounds authorized for the existing CIDMMA facility)?
- Does the alternative provide potential for container-port construction? and
- Does the alternative provide potential for military use of the site, either as logistical support, such as through a port facility, or as a potential training facility? Military use of the facility was cited as a potential source of Federal interest in the Section 905(b) Reconnaissance Report.

The alternatives and the screening results are presented in Table 17. The columns are grouped together to provide a concise reference to indicate whether the associated alternative meets the objectives of the study: provision for dredged material capacity, consideration to port development, and military usage. The second column indicates whether the alternative provides dredged material placement capacity. Results of screening analysis are summarized in the third column as:

- "Yes." In this case, the alternative provides long-term dredged material storage capacity for Norfolk Harbor (generally the geographic area currently included within the bounds authorized to the existing CIDMMA facility).
- "No." In this case, the alternative does not provide sufficient long-term dredged material storage capacity.
- "Possibly." The level of design detail to determine whether dredged material storage capacity could be increased cannot be determined. However, with the limited information available increased storage appears to be likely.
- "Minimally." At the current level of design, an increase of dredged material storage capacity appears likely, but the increased capacity does not really increase enough to provide long-term capacity for Norfolk Harbor.

The third column includes information as to whether the alternative would allow development of a port terminal facility in conjunction with the dredged material

placement site. Results of the screening analysis for this study objective are summarized as:

- "Yes." In this case, the alternative has potential for port terminal development following or simultaneous to use of the alternative as a dredged material placement site.
- "No." The alternative does not provide potential for terminal development.

The fourth column includes information as to whether the alternative provides for military use of the site. There were two potential military uses of each alternative. The first use would be use of the alternative as a port facility for military logistics. The facility could be used to provide for transport of troops, supplies, weapons, equipment, and so forth. The second use would be for military training purposes. The existing CIDMMA facility is used regularly for military training purposes. The results of screening analysis for this study objective are summarized as:

- "Yes." In this case, the alternative provides potential for both types of military use, training and logistics.
- "No." The alternative does not provide potential for either military use.
- "Partial." Here, the alternative provides for either logistical or training use. In most cases, "Partial" means only training use is support.
- "Possibly." There could be military use opportunities, but the degree to which the site could be used cannot be determined at the level of design for this study.
- "Conflict." A conflicting use would be an alternative that prevents military activities that are current on-going at an alternative's location from continuing once the alternative is constructed.

The fifth column presents various resource categories that presented significant concerns during the alternatives evaluation process. These environmental considerations were not used as the sole justification for screening but provided an additional weight to the screening process.

The last column in the previous table is a brief synopsis of the major reasons for eliminating or carrying forward an alternative. This column's data indicate whether an alternative survived the initial screening analysis and progressed to the more rigorous analyses of the intermediate screening. In addition, institutional concerns were considered when evaluating an alternative. These could include alternatives that violate a law or are against policy.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
ON SITE ALTERNATIVE: Existing CIDMMA & west berm construction	Yes	No	Partial	No significant effects	Does not meet all three objectives.
ON SITE ALTERNATIVES: Various potential solutions that include port development on existing CIDMMA	No/Possibly	Yes	Yes	No significant effects	Constructability, operability, and storage capacity problems.
EAST EXPANSION: Eastward expansion for CDF cell only	Yes	No	Partial	Aquatic biota	Does not meet all three objectives.
EAST EXPANSION: Eastward expansion for CDF cell & port development	Yes	Yes	Yes	Aquatic biota and air quality	Retain. (First, southern 1/3 of cell is filled, then port is constructed, then remaining 2/3rd's of cell is filled.)
NO ACTION ALTERNATIVE	No	No	Partial	No Significant Effects	Does not meet objectives. Retain for comparison purposes.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
EAST EXPANSION: Eastward expansion for CDF cell & port development & west berm construction	Yes	Yes	Yes	Aquatic biota and air quality	Retain. (First, southern 1/3 of cell is filled, then port is constructed, then remaining 2/3rd's of cell is filled.)
NORTH EXPANSION: Large northward expansion for CDF cell only	Yes	No	Partial	Aquatic biota, hydrodynamics, and water quality	Does not meet all three objectives. Also, hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community. Also, institutional concerns.
NORTH EXPANSION: Large northward expansion for CDF cell & port development	Yes	Yes	Yes	Aquatic biota, hydrodynamics, water quality, and air quality	Hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community. Also, institutional concerns.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
NORTH EXPANSION: Small northward expansion for CDF cell only	Yes	No	Partial	Aquatic biota, hydrodynamics, and water quality	Does not meet all three objectives. Also, hydrodynamic impacts and larval dispersion cause a non-workable solution among stakeholder community. Also, institutional concerns. (Area of expansion too small for efficient port expansion.)
WEST EXPANSION: Large westward expansion for a CDF cell only	Yes	No	Partial	Water quality, aquatic biota, visual/aesthetic, and recreational/commercial water use	Does not meet all three objectives. Also, institutional concerns.
WEST EXPANSION: Medium westward expansion for a CDF cell only	Yes	No	Partial	Water quality, aquatic biota, visual/aesthetic, and recreational/commercial water use	Does not meet all three objectives. Also, institutional concerns.
WEST EXPANSION: Small westward expansion for CDF cell only	Yes	No	Partial	Water quality, aquatic biota, visual/aesthetic, and recreational/commercial water use	Does not meet all three objectives. Also, institutional concerns.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
WEST EXPANSION: Modified (after hydrodynamic modeling) large westward expansion for a CDF cell only	Yes	No	Partial	Water quality, aquatic biota, visual/aesthetic, and recreational/commercial water use	Does not meet all three objectives. Also, institutional concerns.
WEST EXPANSION: Large westward expansion for CDF cell & port development	Yes	Yes	Yes	Water quality, aquatic biota, visual/aesthetic, air quality, and recreational/commercial water use	Incurs extensive costs and institutional problems that can be avoided by alternative plans that accomplish study objectives.
WEST EXPANSION: Medium westward expansion for CDF cell & port development	Yes	Yes	Yes	Water quality, aquatic biota, visual/aesthetic, air quality, and recreational/commercial water use	Incurs extensive costs and institutional problems that can be avoided by alternative plans that accomplish study objectives.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
WEST EXPANSION: Small westward expansion for CDF cell & port development	Yes	Yes	Yes	Water quality, aquatic biota, visual/aesthetic, air quality, and recreational/commercial water use	Incurs extensive costs and institutional problems that can be avoided by alternative plans that accomplish study objectives.
EAST & NORTH EXPANSIONS: Various combinations of various sizes of eastward & northward expansions for CDF cell only	Yes	No	Partial	Water quality, aquatic biota, and hydrodynamics	See previous potential solutions involving east & north expansions for CDF cells only.
EAST & NORTH EXPANSIONS: Various combinations of eastward & northward expansions for CDF cells & port development	Yes	Yes	Yes	Water quality, aquatic biota, hydrodynamics, and air quality	See previous potential solutions involving east & north expansions for CDF cells & port development.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
EAST & WEST EXPANSIONS: Various combinations of various sizes of eastward & westward expansions for CDF cells only	Yes	No	Partial	Water quality, aquatic biota, hydrodynamics, visual/aesthetics, and recreational/commercial water use	See previous potential solutions involving east & west expansions for CDF cells only.
EAST & WEST EXPANSIONS: Various combinations of various sizes of eastward & westward expansions for CDF cells & port development	Yes	Yes	Yes	Water quality, aquatic biota, hydrodynamics, visual/aesthetics, air quality, and recreational/commercial water use	See previous potential solutions involving east & west expansions for CDF cells & port development.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
NORTH & WEST EXPANSIONS: Various combinations of various sizes of northward & westward expansions for CDF cells only	Yes	No	Partial	Water quality, aquatic biota, hydrodynamics, visual/aesthetics, and recreational/commercial water use	See previous potential solutions involving north & west expansions for CDF cells only.
NORTH & WEST EXPANSIONS: Various combinations of various sizes of northward & westward expansions for CDF cells & port development	Yes	Yes	Yes	Water quality, aquatic biota, hydrodynamics, visual/aesthetics, and recreational/commercial water use	See previous potential solutions involving north and west expansions for CDF cells & port development.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
UPLAND PLACEMENT SITE: Southeastern Public Service Authority landfill site in Suffolk	Yes	No	No	Water quality, sanctuaries and refuges, protected species/critical habitat, visual/aesthetics, and wetlands	Does not meet all three objectives. Also, many environmental, real estate, engineering, and institutional concerns.
UPLAND PLACEMENT SITE: Upland site in Portsmouth between power generation plant and State Highway 164	Possibly	Yes	Yes	Transportation, visual/aesthetics, wetlands, land use, and utilities	Does not meet all three objectives. Also, conflict of land use with Maersk port development. Maersk has purchased the property and is currently constructing a port terminal.
OCEAN PLACEMENT: Norfolk ocean placement site	Yes	No	No	No significant effects	Does not meet all three objectives.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
OCEAN PLACEMENT: Damn Neck placement site	Possibly	No	No	No significant effects	Does not meet all three objectives. Also, would require major modifications.
BENEFICIAL USE OF DREDGED MATERIAL SITE: Ragged Island site	Possibly	No	No	Hydrodynamics, water quality, and protected species and critical habitat	Does not meet all three objectives. Also, cannot be rapidly filled.
BENEFICIAL USE OF DREDGED MATERIAL SITE: Hoffler Creek site	No	No	No	Hydrodynamics, water quality, protected species and critical habitat, and aquatic biota	Does not meet all three objectives. Also, cannot be rapidly filled. Also, conflict of use, since it is now a wildlife preserve.
BENEFICIAL USE OF DREDGED MATERIAL SITE: Lily Creek site	No	No	No	Hydrodynamics, water quality, protected species and critical habitat, and aquatic biota	Does not meet all three objectives. Also, cannot be rapidly filled. Also, conflict of use since the land was recently developed as residential housing.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
CREATION OF NEW ISLAND FACILITIES: Buckroe Beach/Horshoe Flats	Yes	Possibly	Possibly	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Conflict of use since area is borrow site for Buckroe Beach Federal project. Also, this is a finfish migratory route and crab nursery.
CREATION OF NEW ISLAND FACILITIES: Willoughby Bay Island	Yes	Possibly	Could conflict	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	May not meet all three objectives. Also, protected area for juvenile fish. Also, drainage of the Mason Creek area could be disrupted. Also, strong recreational and military use of this bay.
CREATION OF NEW ISLAND FACILITIES: Ocean View offshore/Chesapeake Bay	Yes	Possibly	Possibly	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Heavy use of this site for fishing, and recreation would be lost and is, therefore, socially unacceptable. Also, there are possible incompatibilities with Norfolk Redevelopment Plan.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
CREATION OF NEW ISLAND FACILITIES: East of Chesapeake Bay Bridge-Tunnel	Yes	Possibly	Possibly	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Conflicts with Chesapeake Bay multi-agency goals. Also, site would likely need larger capacity than other alternatives considered for this report, since its location would be favorable for projects not traditionally allowed to use CIDMMA. Also, beyond the scope of this study.
CREATION OF NEW ISLAND FACILITIES: Hampton Flats	Yes	Possibly	Possibly	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Would be detrimental to shellfish larvae and other marine organisms. Also, disruptive to hydrodynamics.
DEEP HOLE SITE: Site in James River	Possibly	No	No	Hydrodynamics, water quality, and aquatic biota	Does not meet all three objectives. Also, dredged material nutrient release concerns. Also, scour concerns.
DEEP HOLE SITE: Site near Hampton Roads Bridge-Tunnel	Possibly	No	No	Hydrodynamics, water quality, and aquatic biota	Does not meet all three objectives. Also, dredged material nutrient release concerns. Also, scour concerns.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
DEEP HOLE SITE: Site in southern Chesapeake Bay	Possibly	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Does not meet all three objectives. Also, dredged material nutrient release concerns. Also, scour concerns
COMBINED AQUATIC DISPOSAL FACILITY: Offshore of River Shore neighborhood in Portsmouth	Minimally	No	No	Hydrodynamics, water quality, and aquatic biota	Does not meet all three objectives.
COMBINED AQUATIC DISPOSAL FACILITY: Offshore of old Tidweater Community College campus in Suffolk	Minimally	No	No	Hydrodynamic, water quality, and aquatic biota	Does not meet all three objectives. Also, high commercial fishery value.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
COMBINED AQUATIC DISPOSAL FACILITY: Mouth of Nansemond River	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/ commercial water use	Does not meet all three objectives. Also, impacts to James and Nansemond Rivers.
COMBINED AQUATIC DISPOSAL FACILITY: James River between mouths of Nansemond River and Chuckatuck Creek	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Does not meet all three objectives. Also, disruptive of discharge from Nansemond River and Knotts Creek.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
COMBINED AQUATIC DISPOSAL FACILITY: Middle ground site west of Monitor Merrimac Bridge-Tunnel	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Does not meet all three objectives. Also, high commercial fishery value.
COMBINED AQUATIC DISPOSAL FACILITY: Middle ground site east of Monitor Merrimac Bridge-Tunnel	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Does not meet all three objectives. Also, high commercial fishery value.
COMBINED AQUATIC DISPOSAL FACILITY: Hampton Flats west side	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, recreational/commercial water use, and submerged aquatic vegetation (SAV)	Does not meet all three objectives. Also, high commercial fishery value. Also, disruptive to "plunging front" hydrodynamics that are critical to larval fisheries. Also, possible navigation concerns.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
COMBINED AQUATIC DISPOSAL FACILITY: Channel to Newport News	Minimally	No	No	Water quality, aquatic biota, and recreational/commercial water use	Does not meet all three objectives. Also, full time use as a placement site would disrupt navigation.
COMBINED AQUATIC DISPOSAL FACILITY: Adjacent to Hampton Creek entrance	Minimally	No	No	Hydrodynamics, water quality, aquatic biota, recreational/commercial water use, and SAV	Does not meet all three objectives. Also, high commercial fishery value. Also, proximity to Hampton Flats and associated "plunging front" hydrodynamics that are critical to larval fisheries.
COMBINED AQUATIC DISPOSAL FACILITY: Adjacent to Willoughby Federal navigation channel in Norfolk	Minimally	No	Possible conflicts with other military use	Hydrodynamics, water quality, aquatic biota, and recreational/commercial water use	Does not meet all three objectives. Also, high commercial fisheries value. Also, proximity to navigation channel is undesirable. Also, possible conflicts with Virginia Department of Transportation and/or Navy interests.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
COMBINED AQUATIC DISPOSAL FACILITY: North of Norfolk Naval Base carrier docks	Minimally	No	Conflicts with other military use	Water quality, aquatic biota, and recreational/com-mercial water use	Does not meet all three objectives. Also, placement site option is incompatible with Navy's use of site.
COMBINED AQUATIC DISPOSAL FACILITY: Norfolk Harbor	Minimally	No	No	Water quality, aquatic biota, and recreational/commercial water use	Does not meet all three objectives.
COMBINED AQUATIC DISPOSAL FACILITY: Adjacent to Norfolk International Terminals North	Minimally	No	No	Aquatic biota and recreational/com-mercial water use	Does not meet all three objectives. Also, conflicts with Virginia Port Authority as well as navigation.

Table 17. RESULTS OF SCREENING OF POTENTIAL SOLUTIONS
(Cont'd)

Potential solutions	Meets Objectives			Environmental considerations	Determination
	Extends life of existing CIDMMA facility	Provides for anticipated future port development	Supports national defense needs		
COMBINED AQUATIC DISPOSAL FACILITY: Adjacent to Norfolk International Terminals South	Minimally	No	No	Aquatic biota and recreational/commercial water use	Does not meet all three objectives. Also, borrow material quality is questionable. Also, conflict of use with borrow site for oyster shell. Also, conflicts with Virginia Port Authority as well as navigation.
COMBINED AQUATIC DISPOSAL FACILITY: East side of existing CIDMMA	Minimally	No	No	Aquatic biota and recreational/commercial water use	Does not meet all three objectives.

Out of the scores of plans that were included in the preliminary screening process, only those plans that include eastward expansion of the existing CIDMMA provide for potential port construction. Four plans emerged as candidates for further investigation. Under each of the four alternative plans, a 580-acre area suitable for port development would be constructed at the CIDMMA facility. In preparation for future port development, the 580-acre area would be divided by a dike into two dredged material receiving areas consisting of 220 and 360 acres. The 220-acre area would be filled with dredged material first and would be the area where the VPA would begin port construction. The 360-acre area would begin to receive dredged material after filling of the 220-acre area. Once the 360-acre area is filled it would also be turned over to the VPA for port construction.

The differences between the four alternative plans are based on whether the 360-acre area is utilized in the cell-rotation program and whether the western dikes would be strengthened so that they could be raised to additional heights in the future. The alternative plans that do not include participation in the cell rotation program would have material spread out over a large single deposit in selected areas of the facility (the spreading option). Alternative plans that do not include western dike strengthening provide less dredged material disposal capacity. Alternative plan descriptions are as follows:

1. Eastward expansion of the existing CIDMMA with:
    - One-third of the expanded cell (220 acres) would be rapidly filled first and would be the initial site of port construction.
    - Two-thirds of the cell (360 acres) would be used for large single deposits of dredged material that would not be utilized in the cell rotation program prior to port construction.
2. Eastward expansion of the existing CIDMMA with:
    - One-third of the expanded cell (220 acres) would be rapidly filled first and would be the initial site of port construction.

- Two-thirds of the cell (360 acres) would be utilized in the dredged material placement rotation program along with the existing three cells, prior to port construction.

3. Eastward expansion of the existing CIDMMA with:
   - Strengthening of the western dike (the west berm) so that it can be raised to provide additional capacity.
   - One-third of the expanded cell (220 acres) would be rapidly filled first and would be the initial site of port construction.
   - Two-thirds of the cell (360 acres) would be used for large single deposits of dredged material that would not be utilized in the cell rotation program prior to port construction.
4. Eastward expansion of the existing CIDMMA with:
   - Strengthening of the western dike (the west berm) so that it can be raised to provide additional capacity.
   - One-third of the expanded cell (220 acres) would be rapidly filled first and would be the initial site of port construction.
   - Two-thirds of the cell (360 acres) would be utilized in the dredged material placement rotation program along with the existing three cells, prior to port construction.

PLAN SELECTION: PORT DEVELOPMENT AND CIDMMA EXPANSION

The four alternative plans that survived the initial screening process were advanced to the more rigorous intermediate screening evaluation. During intermediate screening, the alternative plans were assessed based on economic, engineering, and environmental criteria. Additional analyses conducted as a part of the intermediate screening evaluation include a navigation safety analysis, hydrodynamic modeling to predict with project current velocity, salinity, water level, etc., and inflow modeling to predict ultimate dredged material storage capacity volume and lifetime for each of the four alternatives.

DETAILED PLAN EVALUATION

The major differences between the remaining alternative plans were identified as project cost and the amount of additional dredged material capacity provided by the plans. The intermediate screening evaluation revealed that plans that included cell rotation as a plan component provided less dredged material capacity and were more costly than the plans that included the material spreading component. The following table presents the projected useful life of CIDMMA and the preliminary annual average equivalent costs (excluding PED, lands, easements, rights-of-way, and relocation [LERR], mitigation, and construction management) for the four alternatives. These cost items were excluded because they are the same for the two eastward expansion alternatives and the eastward expansion with west berm alternatives and, thus, did not add to the analysis at this time.

Table 18. ALTERNATIVE PLAN EVALUATION: AAEQ COSTS AND CIDMMA USEFUL LIFE

Plan description	Construction cost ($)	Dredging costs ($)	Total costs ($)	Year capacity achieved
Eastward expansion using material spreading	72,028,000	30,648,000	102,676,000	2028
Eastward expansion using cell rotation	72,028,000	31,286,000	103,314,000	2027
Eastward expansion w/west berm using material spreading	73,629,000	24,388,0000	98,017,000	2042
Eastward expansion w/west berm using cell rotation	73,710,000	24,705,000	98,415,000	2041

Based on the information presented in the table above, the two eastward expansion plans utilizing the material spreading option were selected for a more detailed analysis of costs and benefits. The results of this more detailed analysis are presented in the "With Project Condition" section. A full discussion of the benefits and costs of the two eastward expansion plans, including sensitivity analyses, is presented in the Economic Analysis Appendix.

With Project Condition: Transportation Cost Savings

Under with project condition, a new container terminal would be constructed by the VPA on top of the CIDMMA eastward expansion (regardless of western dike strengthening). The container terminal is expected to be operable in 2016 and would reach its full container handling capacity by 2030. After 2030, overall container handling capacity at Norfolk Harbor is expected to increase at a very modest annual rate due to technical and operational innovations until ultimate capacities of approximately 5,000 lifts per acre are achieved. The CIDMMA eastward expansion's addition to container handling capacity at Norfolk Harbor is presented in the following table.

Table 19. CIDMMA EASTWARD EXPANSION ADDITION TO NORFOLK HARBOR CONTAINER HANDLING CAPACITY (ANNUAL TEU VOLUME)

	2016	2020	2030	2040	2050	2060
Without project	2,526,175	2,560,260	2,657,500	2,774,720	2,916,024	3,086,363
With project	3,087,000	3,301,286	4,212,000	4,329,220	4,470,524	4,640,863
CIDMMA addition	560,825	741,025	1,554,500	1,554,500	1,554,500	1,554,500

As discussed previously, under without project condition, TEU's that would otherwise be serviced at Norfolk Harbor would use alternative ports because of capacity constraints at Norfolk. Under with project condition including the associated increase in Norfolk Harbor's container handling capacity, TEU's would not need to be diverted (or rerouted) to alternative ports because transportation costs are lower through Norfolk than they are through the alternative ports.

The additional container handling capacity provided by the CIDMMA terminal reduces, but does not eliminate, the volume of TEU's that would be handled under without project condition at alternative ports in future years. As referenced in previous discussions, the VPA estimated that it would need 900 acres to fully meet the demand for container capacity; however, only 580 acres can be realized from this project. The following table presents Norfolk Harbor's excess TEU volumes for selected years. Because the CIDMMA terminal does not become operable until 2016, the volume of TEU's allocated to alternative ports prior to 2016 is the same under both without and with project conditions.

Table 20. NORFOLK HARBOR WITH PROJECT EXCESS TEU'S (2005-2060)

	2005	2010	2015	2020
Total TEU's	1,898,397	2,430,603	2,980,763	3,586,882
Port capacity	1,881,000	2,487,000	2,518,045	3,301,286
Excess TEU's	17,397	0	462,718	285,596
	2030	2040	2050	2060
Total TEU's	5,142,876	7,260,737	10,060,200	13,819,187
Port capacity	4,212,000	4,329,220	4,470,524	4,640,862
Excess TEU's	930,876	2,931,517	5,589,676	9,178,325

Under with project condition, since a greater volume of TEU's can be handled at the port, fewer TEU's will be allocated to alternative ports. The following tables present the with project volumes of TEU's allocated to alternative ports.

Table 21. ALTERNATIVE PORT TEU DISTRIBUTION (2011-2016) WITH PROJECT

	2011	2012	2013	2014	2015	2016
LA/LB	15,143	47,787	84,797	120,568	157,786	5,318
Savannah	21,688	67,857	119,482	168,660	219,307	7,351
Miami	8,181	25,820	45,851	65,300	85,625	2,893

Table 22. ALTERNATIVE PORT TEU DISTRIBUTION (2020-2060) WITH PROJECT

	2020	2030	2040	2050	2060
LA/LB	98,047	553,718	2,114,715	5,589,676	9,178,325
Savannah	133,406	47,845	0 (1)	0	0
Miami	54,143	329,313	816,803	0 (1)	0

(1) Port reaches capacity, cannot accept Norfolk's excess TEU's.

With project transportation costs are calculated in exactly the same manner as without project costs, with the only difference being the volume of excess TEU's allocated to the same three alternative ports. The following table, presents the same

calculations presented Table 15, except for the reduced volume of TEU's allocated to alternative ports under the with project condition.

Table 23. WITH PROJECT TOTAL ADDITIONAL TRANSPORTATION COSTS SAMPLE CALCULATION 2016

	Pacific route (LA/LB)	North Atlantic route (Savannah)	South Atlantic route (Miami)
Total TEU's	5,318	7,351	2,893
Total additional cost	$1,273,456	$961,265	$3,375,068
Avg. additional cost per TEU	$239.46	$130.79	$1,166.56

Transportation cost savings begin in 2016, the first year of container handling operations at the CIDMMA terminal. The base year of the analysis is 2010, which is the first year of dredged material placement for the project and, therefore, the first year of beneficial impact. There are no transportation cost savings associated with the project between 2010 and 2015. The following table presents transportation cost savings for selected years based on a comparison of landside transportation costs to alternative ports under without and with project conditions.

Table 24. SAMPLE TRANSPORTATION COST SAVINGS CALCULATIONS (1)

	2016	
Item	Without project	With project
TEU's to alternative ports	576,387	15,562
Additional transportation costs	$207,775,598	$5,609,790
Cost savings	$202,165,508	
Discounted cost savings	$142,483,639	

	2030	
Item	Without project	With project
TEU's to alternative ports	2,485,375	930,876
Additional transportation costs	$1,432,718,960	$523,013,397
Cost savings	$909,705,563	
Discounted cost savings	$318,474,501	

	2060	
Item	Without project	With project
TEU's to alternative ports	10,732,825	9,178,325
Additional transportation costs	$2,570,082,169	$2,197,841,672
Cost savings	$372,240,497	
Discounted cost savings	$29,049,920	

(1) Discounted to base year 2010 at 5.125 percent.

Table 25. TOTAL TRANSPORTATION COST SAVINGS (2010-2060) (1)

	Sum of present values	AAEQ
Without project	$13,404,492,000	$748,481,000
With project	$7,473,333,000	$417,297,000
Transportation cost savings	$5,931,158,000	$331,184,000

(1) Discounted to base year 2010 at 5.125 percent.

The transportation cost savings identified in the previous table are identical for both eastward expansion alternative plans, i.e., with and without the western dike strengthening. It is also important to note that the transportation cost savings would include benefits relating to all containership sizes and not just the subset of larger vessels that were identified as benefiting from the 50-foot inbound project currently under construction at Norfolk Harbor.

With Project Condition: Other Project Benefits

In addition to transportation cost savings, the two eastward expansion alternative plans also provide dredged material disposal benefits. The dredged material disposal benefits are based on the difference in dredged material disposal costs between disposal at CIDMMA and disposal at the USEPA-designated Norfolk dredged material ocean disposal site. Without strengthening the western dikes, the eastward expansion of CIDMMA provides 3 years of additional capacity and relatively fewer dredged material disposal benefits than eastward expansion with western dike strengthening, which provides 17 years of additional capacity. The following table presents the dredged material disposal benefits associated with each of the two alternative plans. A more detailed discussion is located in Appendix B.

Table 26. AAEQ ALTERNATIVE PLAN DREDGED MATERIAL DISPOSAL BENEFITS (2010-2060) (1)

Item	Additional years of operation	AAEQ dredged material disposal benefits
Eastward expansion	3	$2,286,000
Eastward expansion with western dike strengthening	17	$8,546,000

(1) Discounted to base year 2010 at 5.125 percent.

Additionally, the construction of the eastward expansion provides for navigation benefits in the form of reduced maintenance costs. The borrow areas for the construction material will be in the Atlantic Ocean and Thimble Shoals Channels. While the Thimble Shoals channel will not garner any benefits due to the amount dredged and sedimentation rates, the Atlantic Ocean channel will receive benefits.

The Atlantic Ocean channel is dredged to a depth of 52 feet for navigation purposes. The construction of the eastward expansion will dredge the Atlantic Ocean channel to a depth of 60 feet. Given that the depth is 52 feet at the time of construction and the maintenance cycle is 5 years, then it would be expected that at least 1 maintenance cycle is skipped. The Atlantic Ocean channel dredging to 52 feet will be complete in 2006; thus, the maintenance cycle skipped will be in 2011. The following table shows the cost of the maintenance cycle and the benefits realized. These benefits are garnered by both alternatives, since the eastward expansion is the catalyst.

Table 27. AAEQ NAVIGATION BENEFITS FROM REDUCED MAINTENANCE (1)

Alternative	Cost of construction	AAEQ navigation benefits
Atlantic Ocean Channel Maintenance Avoided	$1,578,000	$97,000

(1) Discounted to base year 2010 at 5.125 percent.

With Project Condition: Project Costs

The project costs for the two alternatives include all project related costs such as costs related to construction, PED, utility relocations, interest during construction (IDC), real estate, additional CIDMMA O&M, and mitigation. Economic costs (i.e., those include in NED calculations) also include the associated costs related to port infrastructure that are required to ensure the realization of projected transportation cost savings. These associated costs (borne entirely by the non-Federal sponsor) include costs related to port facility construction, landside access (road and rail), access channel deepening, port equipment, and related mitigation. The following paragraphs describe the cost information used in the analysis. Complete discussions are available in the Engineering, Design, and Cost Estimates Appendix.

Expansion Costs. Expansion costs are the initial costs necessary to construct a containment facility or port facility. The cost estimates require a Feasibility-level design of containment cell structures (including dikes, weirs, etc.) and port structures (including alternative construction techniques for bulkheads, foundation treatments, channel design, etc). In addition to the cost of constructing the facility, costs for relocating the Navy fuel line that runs along the eastern side of CIDMMA have been included for each alternative. The Navy fuel line is only affected by construction of an eastern expansion.

Systems Dredging Costs. Systems dredging costs were developed to determine how much dredging in the local area would cost for each placement site alternative

considered. A unit cost per cubic yard for placement of dredged material in each of the alternative placement cells was required.

To determine the unit cost, users of the facility were surveyed to obtain locations of dredging, dredged material quantity estimates, and dredging schedules for placement in future years. Knowing the location of the future years dredging, a "centroid of dredging" was determined in order to determine distance from the dredging area to each dredged material placement site alternative. Once the centroid was located, the USACE Dredge Estimating Program was used to calculate unit costs for each option. For this study, the systems dredging analysis included various cost variables. Among these variables are: consideration of dredging project magnitude, the distance of the user's dredging project site to the placement site alternative, a contractor's dredging plant and equipment required to perform the dredging, type of material dredged, fuel costs to operate the dredge and attendant plant, dredge hired labor costs, dredging plant availability and contractor competition, etc.

Operation and Maintenance. The O&M cost component was forecasted to estimate long-term costs associated with expansion of the CIDMMA. Some considerations captured in the O&M cost component were historical O&M costs to establish a baseline. During the study, the prior years' funding levels were examined to determine how the Norfolk District's O&M funding baselines and capabilities may be changed as the result of CIDMMA expansion alternatives. For instance, the financial records have been detailed regarding how much funding has been used to maintain the CIDMMA containment dikes. Current funding levels and existing funding capability were reviewed. Analyses were performed to determine how future O&M funding needs would increase with expansion alternatives.

Existing Norfolk District policies regarding the operation of CIDMMA will likely change with different expansion alternatives. Current O&M practices have been reviewed and assumptions have been made as to how these practices must be modified with expansion alternatives. Some examples include: modifications to cell-rotation

cycles and dike maintenance schedules, as well as policies with customers regarding timing of dredged material placement into the CIDMMA. For all of the O&M analyses discussed in this section, the USACE ERDC filling and capacity studies were used to help predict future years O&M funding requirements.

Differences in O&M costs for the two alternatives are due to the difference in operational life spans for the alternatives. The expansion alternatives do not have an O&M cost component. The eastward expansion will be built to its final height during initial construction, thus, eliminating any O&M associated with raising the dikes. Additionally, the facility will be rapidly filled in the southern 1/3, and the northern 2/3 will be spread out over the next 5 years and filled in conjunction with the existing facility. It should also be noted that the alternatives examined do not provide the same amount of capacity and do not provide capacity for the entire 50-year period of analysis. Ocean disposal is utilized when an alternative's capacity is reached. Thus, the average annual costs of the alternatives will differ depending on how long they will provide confined disposal capacity.

The access channel for the port facility will have some O&M costs associated with it as well. This cost will be the same for both alternatives and included in the final analysis.

Environmental Mitigation Costs. Construction of the proposed eastward expansion at CIDMMA will result in unavoidable impacts to ecological resources associated with the filling of approximately 580 acres of open water habitat. The impacts have been avoided or minimized to the extent practicable, and remaining unavoidable impacts have been compensated to the extent justified. The mitigation plan includes sediment remediation, wetlands restoration and conservation, oyster restoration, and a bird management plan. The mitigation plan was developed using USACE guidelines and evaluation criteria including Cost Effectiveness/Incremental Cost Analysis (CE/ICA) (see the Mitigation Plan Summary below, as well as the Environmental Impact Statement (EIS) and accompanying appendices for a full discussion of the mitigation plan).

Real Estate. Real estate costs consist of an evaluation of the value of the existing CIDMMA facility. This value is analyzed to determine what the average annual value is for the CIDMMA as an asset of the Government. There is no value examined for any of the expansion area created. Only the existing facility owned by the Federal Government is examined as an asset. This is done to account for changes in the discounted present value for the project alternatives. As the alternatives last longer, the discounted present value will be lower, resulting in a loss of value in the existing project. Real estate acquisition costs for environmental mitigation are included in the mitigation costs.

Interest During Construction. Per ER 1105-2-100, section D-3.d(10), compound interests for all costs are up to the period of analysis which begins in 2010. The period of analysis begins in 2010, which is when benefits begin to be realized. The compounding interests is included beginning with the 2007 construction year through the 2009 construction year for a total of 36 months. Because the west dike strengthening is not constructed until 2028, the initial construction costs are the same. Thus the IDC for both alternatives will be the same. The following table shows the detailed construction costs and initial investment for each alternative.

Table 28. DETAILED CONSTRUCTION COSTS AND INVESTMENT COSTS

Component	Eastward Expansion	Eastward Expansion w/West Dike Strengthening
Initial construction		
Design	$27,824,000	$27,824,000
Construction management	$23,187,000	$23,187,000
Construction	$423,732,000	$423,732,000
Navy Fuel Pipeline	$40,000,000	$40,000,000
West Dike Strengthening (1)		$77,262,000
Environmental mitigation	$50,200,000	$50,200,000
Contingencies	$106,398,000	$106,398,000
Total initial construction costs	$671,340,000	748,602,000
Interest during construction		
Construction	47,590,000	47,590,000
Environmental mitigation	3,846,000	3,846,000
Total investment	722,776,000	800,038,000

(1) Would occur in 2028 and includes Design, Construction Management, Construction, Environmental Mitigation and Contingencies.

The following table presents the AAEQ costs for the two alternative plans receiving detailed evaluation. The first costs and total investment costs are shown in the Economic Analysis Appendix.

Under existing and without project future conditions, CIDMMA dikes are raised to meet the expected immediate demand for dredged material disposal. This periodic dike raising is the source of CIDMMA O&M expenses. The eastward expansion, without the western dike strengthening, would be built to its final height during initial construction, thus, eliminating the need to periodically raise its dikes. However, the eastward expansion would increase the useful life of the entire facility by 3 years. During those 3 years, the dikes surrounding the existing facility will need to be raised, thereby

incurring O&M expenses. The incremental O&M costs for the eastward expansion without the western dike strengthening are only the cost of periodically raising the dikes surrounding the existing facility for the 3 years of additional useful life (2025-2028). The incremental O&M costs for the eastward expansion without the western dike strengthening are identified on Table 29 as $69,000 (AAEQ).

The O&M costs for the eastward expansion with the western dike strengthening include the additional O&M costs associated with periodically raising the western dike during the years following its construction in 2028. The full incremental O&M cost for the eastward expansion with western dike strengthening includes the 3 years of additional O&M for the existing facility and the cost of periodically raising the western dikes during the 14 years of its useful life. Table 29 identifies the incremental O&M cost for this alternative as $1,558,000 (AAEQ).

Table 29. AAEQ ALTERNATIVE PLAN PROJECT COSTS (1)

Item	Eastward expansion	Eastward expansion with western dike strengthening
Cell Construction	37,341,000	37,341,000
Terminal Construction	34,688,000	34,688,000
West Dike Strengthening		1,600,000
Real estate (2)	69,000	284,000
Incremental O&M	65,000	1,558,000
Access Channel O&M	209,000	209,000
Environmental Mitigation(3)	3,018,000	3,086,000
Total	75,389,000	78,766,000

(1) Discounted to base year 2010 at 5.125 percent.
(2) Includes annualized incremental loss of value.
(3) Includes annualized mitigation of 69,000 for the west dike strengthening.

With Project Condition: Net Benefits

The following table presents the net NED benefits of the two alternative plans. Although the plan including western dike strengthening has a higher AAEQ cost, it also provides the most net benefits.

Table 30. AAEQ ALTERNATIVE PLAN NET BENEFITS (1)

Item	Costs	Benefits (2)	Net benefits	Benefit-to-cost ratio
Eastward expansion	$75,389,000	$333,566,000	$258,179,000	4.4
Eastward expansion with western dike strengthening	$78,766,000	$339,828,000	$261,062,000	4.3

(1) Discounted to base year 2010 at 5.125 percent.
(2) Benefits include transportation cost savings, dredged material disposal cost savings, and reduced maintenance of the Atlantic Ocean Channel.

PLAN SELECTION

The previous table identifies the eastward expansion with strengthening of the western dikes in 2028 as the alternative with the greatest net benefits that satisfies all the planning objectives and constraints that guided the planning process. The non-Federal partner, the VPA, has exercised an active role throughout the plan formulation process and has collaborated in the detailed evaluation of the two alternative plans. The VPA, however, prefers the eastward expansion as a stand alone project, which excludes strengthening the western dikes. This preference is based on the uncertainty associated with making a decision today to strengthen the western dikes in 2028.

Eastward Expansion with West Dike Strengthening Alternative Description

The Eastward Expansion with West Dike Strengthening (EEWDS) Alternative, as shown on Plate 8, includes the construction of a 580-acre disposal cell to the east of the existing CIDMMA in conjunction with a strengthening of the western dike in 2028. One-third of the expanded cell would be used for initial port construction, and the remaining two-thirds of the cell would be used for large single deposits of dredged material that would not participate in the cell rotation program. Perimeter dikes will be constructed around the area of the new cell to contain dredged material. The western limit of the proposed cell will tie into the existing east dike of the CIDMMA. After filling, the new cell will be turned over to the local sponsor for the construction of a new marine terminal.

The main dike will be approximately 8,500 feet in length and constructed to elevation +18 feet MLLW, with a 5H:1V side slope below elevation +5 feet and 2H:1V side slope above +5 feet. The remaining dikes, which run east-west, will be constructed with a 10H:1V side slope from the mudline to elevation +5 feet MLLW and an 8H:1V side slope from +5 feet to +18 feet.

Under the EEWDS Alternative, strengthening of the western dike would be conducted just prior to 2028, so that the western dike can be raised to meet the capacity needs of that year's inflow. The strengthening of the western dike will be accomplished with the construction of a berm along the outside of the dike. It would consist of a 150-foot berm extending from the outside edge of the existing dike that would have to be constructed of suitable sandy material to elevation +8 feet MLLW. With the construction of the stability berm and building the dike exterior slopes on a 10H:1V side slopes, the west dike could be built to elevation +60 feet MLLW with adequate factors of safety. The EEWDS Alternative is shown on Plate 8.

Engineering Challenges. The dual purpose study authorization for this project requires consideration of the rapid filling of an eastward expansion with dredge material as well as the consideration of the expansion being used to accommodate port expansion.

Based on the large cargo volumes forecast for Hampton Roads, the need for the port expansion drives the construction schedule. In addition, the dike construction for the expansion must be able to support itself structurally with adjacent channels dredged to -55 feet MLLW (the authorized project depth for the Norfolk Harbor main channel). In addition, the eastward expansion is proposed to be constructed on 100 feet of very soft clay, and major settling is expected. Details of the geotechnical considerations can be found in the Engineering, Design, and Cost Estimates Appendix.

It should be noted that the method of construction proposed below has been thoroughly evaluated and determined to be a feasible method of construction for the eastward expansion. Alternative methods of construction were considered early in the study but were eliminated from further consideration due to either high initial cost or unacceptable construction periods. Additional value engineering and refinement of the construction will occur during the PED Phase of this project.

Construction of the Eastward Expansion. To expedite construction and minimize problems associated with settlement of the dikes, the dikes would generally be constructed in the following way:

- Pre-dredge to a depth of -60 feet MLLW on the dike alignment;
- Dredge suitable sand from the Atlantic and Thimble Shoal channels for construction of the dike. Based on existing USACE records and other on-going projects, adequate sand volumes are available to construct the dikes from these borrow sources;
- Place the dike material in the pre-dredged hole to elevation +18 MLLW;
- Install a cross dike to subdivide the interior into a southern cell of approximately 220 acres and a northern cell of approximately 360 acres;
- Install wick drains to expedite the remaining settlement of the dikes; and
- Install spill boxes in the newly created eastward cell.

Plate 25 shows the dike layout. Additional details regarding the geotechnical considerations for the construction can be found in the Engineering, Design, and Cost Estimates Appendix.

Rapid Filling of the Expansion. Once the eastward expansion is constructed it will be filled first in the southern 220-acre parcel. All of the maintenance and new work dredge material removed from Norfolk Harbor that would normally be placed in CIDMMA would be placed in the expanded area. This placement would continue until the southern portion of the new cell is filled. Upon filling the southern portion of the expansion, the northern parcel of the expansion would be filled on a "material spreading" basis with the existing three cells of CIDMMA.

Material Spreading. The remaining portion of the expansion (the northern parcel) would be filled with large single deposits of dredge material while preserving the existing three cells for routine smaller deposits. By placing large deposits in the northern cell, the existing CIDMMA cells will receive less material and will be allowed to consolidate and settle more than would be possible if the northern expansion cell was not available for large deposits. Once filled, the northern piece of the expansion would be turned over to the Local Sponsor to accommodate additional port expansion.

Mining CIDMMA. In the event that additional dredge material is required to expedite filling the expansion cells to meet the port construction schedule and cargo demand, material may be mined from the existing CIDMMA. Mining material from the existing CIDMMA would provide additional life to the existing facility and also provide better fill material for the expansion fill. The mined material from CIDMMA would be material that has already been dried and, if removed from the eastern side, would be of larger grain size due to the settling characteristics. The use of already dried dredge material would significantly reduce the amount of consolidation required of the dredge material inside of the expansion cell. This option may be considered during the PED Phase in an effort to further improve the schedule and soil conditions upon completion of filling of the expansion area. Additional investigations for potential construction material

will be conducted, thus possibly improving the capacity of those sites as well. These investigations may include exploring the possibility of mining other placement sites, such as the site for the James River channel to Richmond.

Water Quality. Dredge material is currently pumped into the existing CIDMMA on the eastern side of the site and the water-dredge slurry flows westerly across the site. As the slurry flows across the site, dredge material settles out of the slurry. The resulting water that reaches the western side of the site is cleaned of dredged material particles by a settling process. Spill boxes are used to control the flow of the effluent from the CIDMMA to the adjacent James River. Testing and monitoring by the USACE has demonstrated that the combination of settling time and the use of the spill boxes allows sediment retention from the dredge slurry which results in an effluent that meets USEPA Clean Water requirements. This same process will be used for the expansion cell in the following manner.

- As described above, the southern portion of the expansion cell will be rapidly filled first so as to accommodate the port expansion schedule;
- After the southern cell is rapidly filled, material will be placed in the northern cell on a material spreading basis with the existing CIDMMA;
- The spreading basis will allow the northern cell detention times to be increased and the effluent can be slowly released. Similar to how the detention times are controlled for the existing CIDMMA; and
- The spill boxes will be similar to the existing spill boxes used to control the detention time and effluent of the existing CIDMMA.
- Dredged material will be placed overboard within the confines of the constructed cell.

Water Quality Modeling. Detailed hydrodynamic modeling (available in the Engineering, Design, and Cost Estimates Appendix) was conducted during this study to evaluate global effects from the proposed expansion. The hydrodynamic modeling indicated very little change in key water column physical parameters due to the proposed filling. During this effort it was determined that additional modeling should be

conducted during PED that would further evaluate water quality on a local scale (i.e., the areas immediately adjacent to the proposed expansion area). Detailed modeling and analysis will be completed during the PED Phase of the project to determine and verify:

- Water quality of the effluent and local area around the new cell;
- Detention times and range of available inflows for the new cell, both the southern section and the northern section; and
- The number of weirs required.

Port Construction. As the expansion cells are filled they will be turned over to the VPA. The VPA will be responsible for additional ground improvements on the dredge material placed within the cell as necessary to allow the future port construction.

The Locally Preferred Plan

The Locally Preferred Plan (LPP) is a component of the EEWDS Alternative. The physical description of the LPP is identical to the description of the EEWDS Alternative, with the exception that the LPP does not include the western dike strengthening in 2028 as described above. The LPP is shown on Plate 6.

Differences between the EEWDS Alternative and the Locally Preferred Plan

The main differences between the EEWDS Alternative and the LPP are the differences in project cost and in the forecasted useful life of the CIDMMA. The first costs of construction for the EEWDS Alternative and the LPP are the same; however, long-term costs would be less for the LPP without the expense of the western dike strengthening in 2028. In contrast, the LPP provides for less storage of dredged material than does the EEWDS Alternative. The EEWDS Alternative provides storage until 2042 or 67 mcy more than the LPP. Both plans provide the same transportation cost savings.

The following table presents the average annual benefits and net benefits associated with the EEWDS Alternative and LPP and shows the value of benefits foregone by the LPP. The LPP provides more than 99 percent of the net benefits of the EEWDS Alternative. In comparing these two plans, it is important to note that the LPP

does not preclude strengthening the western dikes in the future when additional dredged material capacity would be required. The LPP provides dredged material disposal capacity up to 2028, at which time western dike strengthening could be reevaluated. As a component of the EEWDS Alternative, western dike strengthening would also likely require reevaluation under a General Reevaluation Report prior to construction in 2028.

Table 31. AAEQ NET BENEFIT COMPARISON OF ALTERNATIVE PLANS (1)

Alternative	Average annual benefits	Net benefits
Eastward Expansion with West Dike Strengthening Alternative	$339,828,000	$261,062,000
LPP (Eastward Expansion)	$333,568,000	$258,179,000
Differential	$6,260,000	$2,883,000

(1) Discounted to base year 2010 at 5.125 percent.

The EEWDS Alternative, however, cannot be identified as the NED Plan, even though it generates the greatest net benefits and fully addresses the study authority. The reason that the EEWDS Alternative is not the NED Plan is that the eastward expansion is not the least-cost disposal method. Formulation of the least-cost disposal method is presented later in this section.

THE RECOMMENDED PLAN

The EEWDS Alternative meets the planning objectives and maximizes beneficial contributions to the Nation, however, it is not supported by the local sponsor, as previously discussed. Only the eastern expansion component of the EEWDS Alternative has local sponsor support.

Although the LPP does not maximize net benefits, it does provide a significant net benefit to the Nation. Average annual equivalent net benefits of $258 million or 99 percent of the benefits, would result from implementation of the LPP. Average annual costs of the LPP are less than the EEWDS Alternative annual costs; therefore, the LPP is a "buy down" of the EEWDS Alternative. The LPP extends the useful life of CIDMMA with potential further extension available in the future. It provides for anticipated future port development and ensures that related national defense needs would be met. For these reasons, it is believed that implementation of the LPP is warranted and in the best interest of the study area, the region, and the Nation. Therefore, the eastern expansion without western dike strengthening, the LPP, is designated as the Recommended Plan. The following table contains the detailed cost estimate for the Recommended Plan.

PLAN ACCOMPLISHMENTS

The LPP would make a major contribution in addressing the problems and needs, as well as realizing the opportunities identified. The plan provides for a significant reduction in transportation cost savings and extending the life of CIDMMA. Average annual dredging costs would be reduced in Hampton Roads and CIDMMA's life would be extended an additional 3 years. The transportation cost for diverted cargo would be reduced 44 percent. The plan would also allow for continued use of the eastern side of Craney Island as a training site for national defense as well as allowing for the potential use as a loading and off-loading site for military cargo.

The Recommended Plan: Summary of Environmental and Other Social Impacts

This section includes summaries of the key environmental and other social impacts related to the following actions:

- Navigation improvements in the vicinity of the eastward expansion of the CIDMMA;
- The east expansion cell construction and operation; and
- The proposed marine terminal construction and operation (to be located on the expansion cell).

ENVIRONMENTAL IMPACT STATEMENT AND MITIGATION PLAN DEVELOPMENT

NOTICE OF INTENT

On 2 March 2001, the USACE published a Notice of Intent (NOI) in the Federal Register. The NOI announced the USACE intent to prepare a DEIS for an expansion of the existing CIDMMA in the Hampton Roads area near Norfolk, Virginia. Reference was also made to providing port facilities in a collaborative effort with the VPA. At this time, this provision would be accomplished by building terminal facilities on about 580 to 600 acres of an eastward expansion of the CIDMMA. The NOI reads as follows:

> *SUMMARY: An Environmental Impact Statement will be prepared to evaluate environmental impacts, project alternatives, and other public interest review factors for proposed expansion of the Craney Island Dredged Material Management Area.*
>
> *1. Proposed Action: The Corps of Engineers, along with the Commonwealth of Virginia through the Virginia Port Authority, is preparing a comprehensive feasibility investigation report and Environmental Impact Statement to evaluate project impacts, and the need for and interest in an expansion of the Craney Island Dredged Material Management Area (CIDMMA) located in Hampton Roads, Virginia. The proposed expansion would provide dredged material placement capacity and port facilities to support port commerce in Hampton Roads. This activity will require a State permit pursuant to Section 401 of the Clean Water Act (Public Law 95-217). A Section 404(b)(1) analysis will be completed and presented in the NEPA document.*
>
> *2. Alternatives: Alternatives to be investigated include, but will not be limited to various expansion configurations of the existing CIDMMA facility, ocean disposal of dredged material, island construction, overboard placement in Chesapeake Bay, other alternative upland sites, and the "No Action" alternative. Alternative construction and access methods which avoid or minimize wetland impacts will be investigated.*
>
> *3. Scoping Process: A NEPA Technical Review Committee has been formed and one meeting has been conducted with Federal, state, local agency and private interest group representatives. Alternatives have been discussed and continue to be developed by this group. The public*

scoping process may add to or subtract from the list of alternatives that have been discussed.

SCOPING PROCESS

The scoping process, as delineated in the NEPA regulations (40 CFR 1501.7), specifies an early and open process for determining the scope of issues to be addressed in the EIS. The process is initiated with the publication of the NOI and can include, but is not limited to, participation of affected Federal, state, and local agencies, as well as public meetings involving persons with various interests and technical/scientific expertise.

This Feasibility Study has included at least 25 public meetings involving persons and groups with various interests and expertise. The total includes five stakeholder meetings, six meetings of a NEPA Technical Committee, and 15 meetings of a Mitigation Subcommittee. These meetings included extensive discussions that are associated with the scoping process. The following highlight several of the more prominent issues derived from the scoping process:

- A comprehensive EIS should be prepared to address connected actions, cumulative actions, and cumulative effects. A piecemeal approach wherein multiple EIS's are prepared without referring to other nearby actions would not provide the best approach from an environmental management perspective.
- The environmental effects of multiple current and future projects in the vicinity of the eastward expansion of the CIDMMA should be considered together. Examples of these other projects include dredging of the inbound portion of the Norfolk Harbor Channel to a depth of 50 feet (by the USACE), construction and operation of a major marine terminal on the completed expansion cell (by the VPA), construction and operation of a second marine terminal about 1.5 to 2.0 miles south of the CIDMMA (by APM Terminals, Inc.), construction and use of a Third Crossing bridge-tunnel project (by the VDOT), and implementation of sediment cleanup and wetland restoration

projects in the Elizabeth River Basin (by the Elizabeth River Ecological Restoration Program).

- The EIS of the eastward expansion of the CIDMMA should encompass the direct, indirect, and cumulative effects on specific resources such as, but not limited to, water quality, benthos, fisheries, protected species, birds, and wetlands.
- Hydrodynamic modeling should be used as a tool to explore the effects of single and multiple projects on various important hydrodynamic parameters in the Hampton Roads area.
- Mitigation measures for the direct effects of the eastward expansion of the CIDMMA should be considered and developed.

NEPA TECHNICAL COMMITTEE

The NEPA Technical Committee has been assembled to assist the USACE in developing the scope and breadth of the NEPA document to identify significant resource concerns and to provide review of work products supporting NEPA. The Mitigation Subcommittee also has assisted in the development of a consensus mitigation plan. Individuals from the Norfolk District, USEPA, NOAA, USFWS, Virginia Department of Environmental Quality (VDEQ), VMRC, and Virginia Department of Conservation and Recreation (VDCR); academia (VIMS, Old Dominion University [ODU], College of William & Mary, University of North Carolina [UNC]); the sponsor (VPA); and qualified interested parties (Elizabeth River Project [ERP], Wetlands Watch, and James River Association [JRA]) are participants on both the NEPA Committee and the Mitigation Subcommittee.

The wealth of technical experience represented on these committees and shared in independent meetings has been extremely successful in the continued review and development of the NEPA document and its companion mitigation plan and will ultimately produce a useful, thoroughly reviewed, and quality product. These committees and the participant's experience brought to the EIS scoping process are considered to

have more than adequately met the intent of the NEPA regulations and USACE guidance on NEPA.

The anticipated impacts and mitigation measures (including avoidance, minimization, and compensation) related to these proposed actions were delineated by the NEPA Technical Committee and a Mitigation Subcommittee, working in collaboration with the USACE and the VPA. The anticipated impacts and mitigation measures are very similar for each of the two plans receiving detailed evaluation given the similarity of the two plans.

Brief statements related to these anticipated impacts and associated mitigation measures are presented below. A more thorough discussion of the impacts and mitigation analysis is presented in the EIS and the accompanying appendices.

Water Quality. Short-term and localized increases in turbidity will occur during the dredging operations and cell construction, along with the possibility of localized depressed dissolved oxygen levels due to releases of organic materials into the water column. Pre-dredging testing of the sediments will be used to ascertain sediment quality and develop appropriate mitigation measures. Effluent from the cell associated with the dredge material slurry will be treated in the same way as the existing effluent at CIDMMA. The dredge slurry will be pumped into the new expansion cell and will flow across the site from south to north. Spill boxes on the north side of the expansion will control the flow of the effluent and will be monitored and adjusted to provide appropriate settling time to remove suspended solids from the dredge slurry.

Terminal operations could possibly create adverse water quality impacts as a result of storm water runoff from the terminal land area. Compliance with the Virginia Stormwater Management Regulations would be achieved by the implementation of any of several different types of Best Management Practices (BMP's) that the existing VPA container terminals use to treat storm water. Regulatory requirements will be met and environmental impacts avoided by a comprehensive storm water management plan that

provides appropriate BMP technology and is designed to achieve a high level of treatment for the facility.

Biological Resources. There will be a loss of benthic infauna from dredging. Some natural recovery of benthic infauna is expected to occur; however, periodic maintenance dredging will not allow for complete recovery. In addition, there will be a permanent loss of approximately 580 acres of estuarine bottom habitat used by fish, shellfish, crabs, and bottom dwelling organisms. In addition, a loss of open water above the estuarine bottom habitat will also occur. Regarding fish impacts, the area currently serves as a migratory pathway and a limited feeding area. The area also serves as a migratory pathway for crabs; however, it does not function as a nursery area or feeding area. Based on the Benthic Index of Biotic Integrity and other field studies, the fill area is generally poor quality and exhibits degraded conditions. Studies indicate that very few commercially valuable species, such as clams and oysters, are located in the fill area.

A Habitat Equivalency Analysis (HEA) was conducted that identified a loss of biological productivity for secondary producers in benthic habitat and water column habitat. The estimated total annual loss of biological productivity was equivalent to 124,423 kilograms (kg). Off-site and out-of-kind mitigation has been developed to mitigate the effects of bottom habitat loss and open water effects to plankton, finfish, crabs, and bottom-dwelling organisms. The mitigation measures outlined in the mitigation plan will compensate for lost productivity and lost functional values and include oyster habitat restoration, wetland restoration and conservation, sediment cleanup and restoration, and bird management. The mitigation plan is described in more detail below.

Essential Fish Habitat (EFH). Based on the scarcity of EFH species in the site area, it is likely that, due to degraded habitat and anthropogenic impacts, there is little or no EFH in the proposed site area. Adverse effects on EFH species, if any, due to construction, will largely be temporary and minimal, with some permanent effects related to loss of bottom area and open water in the cell footprint. It is highly unlikely that any

adverse effects will be caused from dredging activities due to the nektonic mobility of the EFH designated species. As much as 18 acres (840,000 square feet) of rip-rap placed on the dikes surrounding the expansion areas is likely to attract species that are normally associated with reef structures, species that are commonly found around estuarine inlets, and species that seasonally migrate along the coast (Van Dolah et al., 1987). The EIS assessment of the impacts of the project based on the rarity of EFH species in the site area and proposed mitigation lead the USACE to a determination that the recommended project will not have a substantial adverse effect on EFH. No significant adverse impacts on fish species are anticipated. However, proposed project mitigation includes over $50 million in tidal marsh creation, oyster reef creation, and sediment remediation as part of a mitigation package that will provide significant fishery benefits to mitigate effects on EFH.

Hydrodynamics. Three-dimensional hydrodynamic modeling was conducted for various expansion options in the areas near the CIDMMA. The base condition for the modeling included deepening the local navigation channel to 50 feet and the provision of terminal access/egress. The modeling results indicated that there would be no significant effects to water circulation, sedimentation, salinity, currents, and tidal flushing from the Elizabeth River with an eastward expansion of the CIDMMA. As part of the modeling study, several directional expansion scenarios were evaluated, and the eastward expansion demonstrated the least effects in the areas of evaluation, the lower James River and the Elizabeth River systems (USACE, undated). In addition, three-dimensional hydrodynamic modeling was conducted on the eastward expansion in conjunction with planned improvements at the new APM terminal, including simulated ship operations. This modeling effort confirmed the results that there would be no significant hydrodynamic effects from constructing the eastward expansion. Plan formulation included avoidance of expansion alternatives that resulted in hydrodynamic impacts.

Air Quality. The cell construction and terminal project constitutes a non-transportation Federal action within the Hampton Roads ozone non-attainment area. Provisions of the general conformity regulation are potentially applicable to Federal

projects locating within non-attainment and maintenance areas. To determine if a conformity determination is required, an emissions inventory of Volatile Organic Carbon (VOC) and Nitrous Oxides (NO_x) emissions has been completed. Air pollutant emissions from diesel-powered dredges, earth-moving equipment, and related construction equipment, could cause localized exceedance of the Federal and State of Virginia ambient air quality standards for Nitrogen Dioxide (NO_2), the 8-hour carbon monoxide (CO) standard, and the particulate matter 10 microns (PM_{10}) standards. The state's 24-hour Sulfur Dioxide (SO_2) standard may also be exceeded. For the 2017 Phase I Condition, estimated NO_x emissions from the planned terminal facility exceed the 100 tons per year threshold level prescribed by the general conformity regulation. For the 2050 Build Out condition, both VOC and NO_x emission estimates exceed the 100 tons per year threshold. Further, some emissions will occur during construction activities associated with terminal facilities. In addition, substantial pollutant emissions can be associated with the large container ships. Consequently, general conformity issues must be addressed in order to obtain approval to develop the facility. Compliance with general conformity requirements can be accomplished by the following approaches:

- Estimated terminal facility emissions can be "offset" by obtaining emissions reductions within the Hampton Roads ozone nonattainment area; and
- Emissions associated with the terminal can be incorporated into an approved State Implementation Plan for the nonattainment area.

Mitigation for the ship-related emissions will involve reducing operational emissions by the use of one or a combination of measures, which may include the use of distillate oil in maneuvering vessels, the use of clean fuels for on-dock equipment, and/or other measures as applicable. Mitigation measures for construction practices will include the use of watering to reduce construction dusts, and the use of low sulfur fuels for diesel-powered equipment.

Protected Species and Critical Habitat. Section 7 consultation with the NMFS and the USFWS, under the auspices of the ESA, is being accomplished. As documented in Part IV of the FEIS, the USACE transmitted a letter to NMFS dated 5 January 2006

indicating that the USACE had made a "not likely to affect" determination as regards effects to sea turtles and marine mammals and requested NMFS concurrence with this conclusion. The USFWS has indicated that "...Piping plover (*Charadrius melodus*), which is Federally-listed as a threatened species, nested at Craney Island from 1989 to 1997. The habitat conditions currently appear marginal for this species, and an active management program would probably be needed to attract these birds to the site in the future" (USFWS Planning Aid Report, EIS, Appendix A). The mitigation plan (EIS, Appendix B) includes the development of a bird management plan at CIDMMA in consult with USFWS, the College of William and Mary, and the Virginia Department of Game & Inland Fisheries (VDGIF).

Environmental Justice. No adverse impacts are anticipated because the eastward expansion of the CIDMMA is within a portion of Portsmouth, VA, with a smaller minority and low-income population than the overall minority and low-income population in the city.

Cultural Resources. No historical/cultural resources have been identified in the approximately 580 acres to be filled, nor in the adjacent berthing area for the terminal; thus, no impacts to such resources are anticipated in these areas. No mitigation measures are required for these areas. However, no efforts to identify cultural resources have been carried out for the areas that would be affected by the overall mitigation plan (still being developed). In the next phase of this study, additional studies will be necessary to determine if there are any such cultural resources at the mitigation sites, what the effects on such resources will be, and what mitigation, if any, will be necessary.

Ground Transportation. Because of its proximity to existing or planned major interstate transportation routes, the construction and operation of the CIDMMA terminal will have minimal impacts on local streets and major highways as a result of increased truck traffic. Specifically, local streets will not be significantly affected, as trucks traveling to and from the CIDMMA terminal in the short-term during construction and in the long-term during operation will access the site from a new connector highway to

Virginia Route 164 and from there to I-664 and I-64. Although the existing and planned highway improvements will improve conditions on major highways, some congestion will remain in the future with or without the proposed action.

An average of six to seven additional trains per day would be needed to transport containers in and out of the CIDMMA terminal under Build Out conditions; however, significant impacts on existing railroads are not anticipated. It is anticipated that this projected rail capacity need will be fully addressed when developing the new rail corridor to connect the CIDMMA terminal with existing rail lines.

Socioeconomics. The loss of benthic habitat due to project construction would have a negligible effect on commercial fishing in Chesapeake Bay. Benthic species of commercial importance, such as hard clams, *Mercenaria mercenaria,* were almost totally non-existent in recent surveys. Biomass per unit area of open bottom in the proposed project impact area is low. The limited commercial crabbing and fishing that occurs in the project impact area is expected to relocate to adjacent areas within the Bay.

In the short-term, construction of the CIDMMA terminal will result in the creation of almost 1,200 jobs during all four phases of construction. Earnings from employment during all four phases of construction are estimated at approximately $734 million. Expenditures for materials, equipment, and labor will generate approximately $1.4 billion in total output to the local and regional economy.

In the long-term, annual operation of the CIDMMA terminal would have a positive impact on the Hampton Roads region and the Commonwealth of Virginia by generating over 13,000 direct jobs, 14,000 indirect jobs, and another 25,000 jobs from distribution center activity. It is anticipated that direct and indirect employment generated by CIDMMA operations will provide average annual earnings of $870 million and $2.5 billion in total output and that distribution center operations will add another $788 million in wages and $2.7 billion in total output.

The local economy, the Commonwealth of Virginia, and the Nation will also benefit from increased generation of local sales taxes from purchases made by the new terminal as well as workers directly employed by the terminal and indirectly employed by businesses in the region. Payroll taxes are estimated at approximately $84 million per year from port operations and inland transportation and another $71 million from the distribution centers.

Secondary Growth. Development and operation of the terminal has the potential to cause population growth in the Hampton Roads area, probably in Portsmouth, as well as new residential development. Increases in local and regional traffic would be expected. While not a direct effect, population growth will probably be minimized because jobs at the terminal will likely be filled by people already living in the area. New or expanded businesses will be located at existing facilities or on redeveloped sites. Development would benefit the region in the short-term with construction jobs and in the long-term with increased employment, purchases of goods and services, and tax revenues. Regarding local and regional traffic increases, project-related vehicles will use existing or planned major interstate transportation routes. Trucks will be able to access major highways without going through residential areas.

Summary of Cumulative Effects. Cumulative impacts from the potential expansion action and other nearby past, present, and reasonably foreseeable future actions have been identified and evaluated as part of the NEPA evaluation. An 11-step methodology promulgated in 1997 by the Council on Environmental Quality was utilized as the framework for the cumulative effects assessment study.

The following table depicts the multiple actions that have contributed to, and are expected to continue to contribute to, cumulative effects on specific resources, ecosystems, and human communities in the Hampton Roads area. Regarding the significance of the cumulative effects, particular attention is directed toward adverse effects on water quality, biological resources (including benthic habitat), protected species and critical habitat, and beneficial effects on socioeconomic conditions.

Table 32. PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS CONTRIBUTING TO CUMULATIVE EFFECTS

Action	Past	Present	Future
CIDMMA			
• Continuing use of existing 3 cells (1)	X	X	X
• Eastward expansion (2)			X (M)
Post-authorization Norfolk District projects			
• Navigation channel deepening and anchorages - constructed (3)	X		
• Navigation channel deepening and anchorages - not yet constructed (4)		X	X
• Maintenance dredging (5)	X	X	X
Navigation planning - channel deepening and maintenance dredging (6)			X (H)
Water-related laws, regulations, and programs (7)	X	X	X
Other existing and continuing projects in the area (8)	X	X	X
APM/Maersk Terminal (new marine terminal) (9)		X	X
Elizabeth River Ecological Restoration Program			
• Sediment cleanup (10)		X	X
• Wetland restoration (11)		X	X
Pinner's Point flyover (highway bridge and connector) (12)		X	X
CIDMMA Terminal (VPA) (13)			X (M)
Third crossing of Hampton Roads area (VDOT) (14)			X (M)
Pre-authorization Norfolk District studies (five on beneficial uses of beach-quality dredged material, and one on a city dredging and water management plan) (15)			X (L)
Midtown Tunnel Project (VDOT) (16)			X (L)

Table 32. PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS CONTRIBUTING TO CUMULATIVE EFFECTS
(Cont'd)

Action	Past	Present	Future
Virginia Intermodal Transportation Center (17)			X (L)

Notes: The actions are numbered (1) through (17). Past denotes actions from mid-1950's to 1999; present denotes actions in general time period from 2000 to 2005; and future denotes actions from 2006 to 2050. In the future column, H denotes high likelihood of occurrence, M denotes medium, and L denotes low. No "occurrence code" indicates the continuation of a past and/or present action.

Mitigation Plan Summary

The compensatory mitigation plan was developed with input from a Mitigation Subcommittee consisting of representatives from 12 Federal and State agencies and 3 local interest groups. The committee convened on 15 occasions between June 2002 and May 2005. The CE/ICA resulted in a total of 22 plans that were determined to be cost effective, including three "Best Buy" plans. The selected mitigation plan is one of the "Best Buy" plans.

Using data from existing studies, and those performed specifically for this feasibility investigation, the Mitigation sub-committee was tasked with assessing the degree of habitat impact associated with the 580-acre fill, formulating mitigation ratios to replace or to increase the ecological function and productivity of the area lost, and developing a conceptual mitigation plan comprised of various tidal and sub-tidal habitats. A "landscape approach" was used to establish physical connectivity between various mitigation sites and to establish ecological synergy. Application of this approach also maximizes productivity and ensures long term viability of each of the sites. Habitat Equivalency Analysis (HEA) methodology was used to quantify the loss in habitat productivity from the proposed CIDMMA expansion and to provide a scale for a mitigation project that would compensate for the estimated loss in ecosystem services and

production at the appropriate trophic levels. This information was used to conduct the CE/ICA.

The USACE and VPA used this information and the committee's input to develop and present a "Draft Conceptual Mitigation Plan" at subcommittee meetings in February 2005. The plan considered in-kind relatedness, proximity to impact site, publicly recognized value of the habitat type, risk /long term viability, ability to restore lost ecological functions, and the habitat productivity lost and productivity supplied by each mitigation option to replace the loss. Subsequent meetings in May 2005 resulted in modifications to the conceptual plan and the development of a "Draft Consensus Mitigation Plan." This consensus plan, also known as the LPP, consists of approximately 20 acres of oyster reef restoration, 56 acres of wetland restoration, and 67 acres of sediment clean-up, which results in 411 acres of river bottom restoration. This mitigation plan generates a slightly greater amount of production than is estimated to be lost from project construction, and is distributed among the three major mitigation measures, which include including oyster reefs restoration, wetlands restoration, and sediment clean-up.

As one of the three "Best Buy" plans identified in the CE/ICA, the LPP was selected as the recommended and fully justified mitigation plan. The recommended mitigation plan is acceptable, efficient (cost-effective), complete, and supported by the non-Federal local sponsor (VPA), and also by other State and Federal agencies, such as the USEPA, USFWS, NOAA, and VIMS, and non-profit organizations such as the Elizabeth River Project, which also provided input into the development of the LPP.

The (proposed) mitigation sites for sediment remediation are not within the boundaries of a site designated by USEPA or a state for a response action under CERCLA (Superfund), and they are not part of an NPL site under CERCLA. The non-Federal sponsor will assume full responsibility and liability for any work implicating CERCLA-regulated substances. Furthermore, the non-Federal sponsor will indemnify

USACE from any future CERCLA litigation and/or associated cleanup costs related to this project.

In conclusion, the Mitigation Subcommittee, along with the USACE and VPA, has identified specific feasible mitigation options. The USACE has used CE/ICA to evaluate the options and has identified a "Best Buy" plan that fully compensates for the unavoidable environmental impacts of the project. During plan development, every effort was made to accommodate the diverse input of the stakeholders involved in this process. The recommended "Draft Consensus Mitigation Plan," which is based on three years of stakeholder involvement, scientific study, and thorough analysis of all data and information collected, proposes 487 acres of compensatory mitigation in the form of large scale ecosystem restoration at a total cost of approximately $50 million. Upon successful completion, the mitigation plan will replace important ecological functions in the lower James and Elizabeth River estuaries and will provide compensation for the water column and benthic productivity lost from the proposed expansion of CIDMMA.

Relationship of Mitigation Plan to the USACE Environmental Operating Principles

The USACE has reaffirmed its commitment to the environment by formalizing a set of Environmental Operating Principles (EOP's) applicable to all its decision-making and programs. These principles foster unity of purpose on environmental issues, reflect a tone and direction for dialogue on environmental matters, and ensure that employees consider conservation, environmental preservation, and restoration in all USACE activities. Environmental sustainability can only be achieved by the combined efforts of Federal agencies; tribal, state and local governments; and the private sector, each doing their part, backed by the citizens of the world. These principles help the USACE define its role in that endeavor. By implementing these principles, the USACE is continuing its efforts to develop the scientific, economic, and sociological measures to judge the effects of its projects on the environment and to seek better ways of achieving environmentally sustainable solutions. The principles are consistent with the NEPA; the Army's Environmental Strategy with its four pillars of prevention, compliance, restoration and conservation; and other environmental statutes and WRDA's, which govern USACE

activities. The following table provides information on how these principles were integrated throughout the process of developing the mitigation plan.

Table 33. MITIGATION PLAN CONSISTENCY WITH ENVIRONMENTAL OPERATING PRINCIPLES

EOP's	Mitigation Plan Consistency with EOP's
1. Strive to achieve environmental sustainability. An environment maintained in a healthy, diverse, and sustainable condition is necessary to support life.	A "landscape approach" was used that considers sustainability of the plan by focusing on the spatial relationship and interdependence of different ecological communities.
2. Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of USACE programs and act accordingly in all appropriate circumstances.	Plan recognizes interdependence of life and physical environment and is a proactive proposal to compensate for environmental consequences related to loss of 580 acres of estuarine open water in Elizabeth River.
3. Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.	Expansion and Port development produces large economic returns at significant environmental costs. Mitigation plan is solution which balances these losses with significant environmental gains.
4. Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.	Expansion and Port development impact natural systems and the human environment. Corporate responsibility and accountability under the law is satisfied with mitigation plan that maintains viability of natural systems.
5. Seeks ways and means to assess and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.	Plan mitigates cumulative impacts and is a systems (or watershed) approach. Provides ecosystem mitigation holistically across the landscape (sediments, wetlands, and oysters).
6. Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.	Plan was developed via knowledge sharing and consensus building with a Mitigation Subcommittee consisting of 12 Federal and state agencies and 3 local interest groups. The committee convened on 15 occasions between June 2002 and May 2005.
7. Respect the views of individuals and groups interested in USACE activities, listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the Nation's problems that also protect and enhance the environment.	Elizabeth River Project (2,000 members) letter dated 7 November 2005: "The degree of diverse stakeholder participation in the mitigation planning process was important and unprecedented." "…the current plan offers the potential to achieve the win-win for the river and the economy that has been our long-held goal, offsetting the huge impacts with at least equally large environmental gains." USEPA letter dated 7 November 2005: "The U.S Army Corps of Engineers (USACE) has done a commendable job in developing a consensus among the resource agencies on the appropriate mitigation."

DRAFT EIS COORDINATION AND FINAL EIS PREPARATION

A notice of availability of the Draft EIS was published in the *Federal Register* on 23 September 2005. The 45-day comment period for the Draft EIS ended on 7 November 2005. Seventy letters and over 200 comments were received. These comments were analyzed and considered in preparing this Final EIS, and responses to comments appear in the document. The Final EIS addresses the direct, indirect, and cumulative impacts of the proposed development on human and environmental issues identified during the public interest review, including onsite and offsite alternatives. All factors that may be relevant to the proposed development were considered. Among those factors are air quality, dredged material management, surface transportation, economics, aesthetics and light, wetlands, cultural resources, fish and wildlife resources, land use and coastal zone management, navigation, hydrodynamics, recreation, water quality, public safety, hazardous materials, social characteristics, environmental justice, noise, and, in general, the needs and welfare of the people. The Final EIS provides relevant information to Federal, state, and local agencies and the public, on the potential impacts of the proposed project.

COST SHARING

CIDMMA is a unique dredged material disposal facility in that it was created and continues to operate as a self-liquidating (through toll collection) disposal facility, which is 100 percent Federally-funded. The Section 101 of the WRDA of 1986 as amended by the WRDA of 1996, Section 201(b), changed the status of most new confined dredged material disposal facilities from an item to be funded solely by a non-Federal sponsor (i.e., one of the LERRD's) to a feature to be cost shared the same as any other Federal general navigation feature (GNF) of a project. However, Section 101 of the WRDA of 1986 , as amended, further maintained the unique status of such facilities as CIDMMA's by stating that the cost sharing for O&M and any new expansion of CIDMMA will continue to be in accordance with the (original) authorizing legislation. This is also presented in Section 201(g)(1) of WRDA of 1996, which presents the savings clause to the general cost-sharing rules that prohibits any increase in the non-Federal share of expansion projects for toll-based facilities such as the CIDMMA. Current policy does

not allow the USACE to cost share the eastward expansion of CIDMMA as a GNF because it is not the least-cost dredged material disposal method. Under existing law and policy, the USACE cost-sharing responsibility is limited to the present value of the least-cost long-term dredged material method.

Therefore, in consideration of CIDMMA's unique status and current USACE policy, the Federal cost share of an eastern expansion for port development would be based on the discounted present value of the additional costs necessary to construct the least-cost dredged material disposal method:

- Federal costs would be partially recovered through the collection of tolls for disposal of non-USACE materials and usage.

Even though the Recommended Plan meets all engineering, economic, and environmental criteria for recommendation, it is not the least-cost disposal method because of construction activities required to support port construction. Therefore, Federal cost sharing will be limited to that amount which would ordinarily be applied to an expansion of CIDMMA for dredge material purposes only (strengthening of the CIDMMA west berm.).

Least-Cost Disposal Method Formulation

The transportation cost savings identified previously, although NED benefits, cannot be used as a basis for full Civil Works cost-sharing of the CIDMMA eastward expansion based on current policy and law. The USACE ability to cost share in such a plan would be limited to the Federal interest in a least-cost disposal option that does not consider port development.

In order to evaluate the full Federal interest in a plan that includes eastward expansion for port development, the costs associated with a least-cost method of dredged material disposal must be identified for the entire project life. The Federal cost-sharing for the eastward expansion of CIDMMA will be based on the least-cost method of dredged material disposal, in accordance with current laws and policy. Formulation of

the least-cost disposal method follows the same formulation process as formulation of alternative plans for the dual purposes of the authorizing resolution, with two notable differences. The requirements that the plan support port development and national defense needs have been removed as criteria in the initial screening process. The following discussion summarizes the alternatives that were considered in the preliminary screening least-cost evaluation.

Preliminary Screening of Alternative Least-Cost Disposal Methods

Overall, 50 potential disposal options were considered in the preliminary screening process. These options include structural and non-structural alternatives, such as:

- No-action (the without project condition);
- On-site structural modifications;
- Ocean disposal;
- Beneficial use opportunities;
- Island creation and filling of deep ocean holes; and
- Various CIDMMA expansion alternatives.

Alternative disposal options were screened for their potential future capacity and for potential conflicts with existing uses and users. The preliminary screening also identified obvious potential environmental impacts and excessive costs, such as strip drains. The strip drains were eliminated very early on due to costs. Installing strip drains throughout the interior of CIDMMA was evaluated as an alternative and was not found to be cost-effective. In 2002 price levels, strip drains through out the interior of CIDMMA on a 6-foot off-center placing would cost approximately $900 million. Using a 12-foot off-center placing would cost approximately $230 million. These prices do not include PED or construction management, nor do they include contingencies. For these reasons, it was not considered prudent to continue evaluating these alternatives that could not be part of a cost-effective plan. All of the preliminary alternatives and their assessments are presented in Appendix B, Part 3.

Detailed Evaluation of Alternative Least-Cost Disposal Methods

The initial screening resulted in four alternatives: (1) eastward expansion for CDF cell, (2) eastward expansion for CDF cell and port development, (3) western dike strengthening, and (4) the without project condition. The eastward expansion for CDF cell and port development was included for the purpose of cost comparison with the least-cost disposal method.

For each of the four remaining alternatives, the costs of disposing of dredged material will be evaluated for the entire period of analysis. This will be based on the lifecycle costs for Federal and non-Federal dredging. Two eastward expansion alternatives call for a 580-acre area to be used for dredged material disposal. One of these alternatives would be suitable for port development while the other would only be for dredged material disposal. The remaining two alternatives would not involve an expansion of CIDMMA. One plan is the without project condition, which utilizes ocean disposal in 2025 once the existing CDF has reached its maximum capacity. The last alternative is to strengthen the western dike with construction of a west berm in 2025. Alternative plan descriptions include:

1. Eastward expansion of the existing CIDMMA with:
    - One-third of the expanded cell (220 acres) would be rapidly filled first and would be the initial site of port construction; and
    - Two-thirds of the cell (360 acres) would be used for large single deposits of dredged material that would not be utilized in the cell-rotation program prior to port construction.
2. Existing facility with a:
    - Strengthening of the western dike (the west berm) so that it can be raised to provide additional capacity; and
    - Not needed until 2025.
3. Eastward expansion of the existing CIDMMA with:
    - 580 acres would be utilized in the dredged material placement rotation program along with the existing three cells.

4. Without project condition:
    - CIDMMA will continue to be operated as it is today until it reaches capacity in 2025 and then ocean disposal must be utilized.. There will be no new capital investment.

The four plans developed from the initial screening were advanced to the least-cost analysis. In this step, the alternative plans were compared, based on the existing economic and physical conditions. This comparison takes into account the complete lifecycle costs of systems dredging, real estate, O&M, construction, and mitigation.

Differences in costs between the East Port option and East CDF option are due to the additional dike construction that would be required for the East Port alternative. Pre-dredging and sand dike construction would be required prior to the construction of a conventional dike for the East Port alternative. This additional construction is required because of access channel and berth dredging that would occur adjacent to the dike. The East CDF alternative would require only a conventional dike. In addition, a cross dike, which segregates the initial port construction area from the rest of the facility, would only be required for the East Port alternative.

The alternatives were evaluated over a 50-year period of analysis. Each alternative had its Systems Dredging costs, Real Estate costs, Construction costs, O&M costs, and Mitigation costs considered in the analysis. The following table shows the results of the lifecycle analysis for each costs component. Tables showing the detailed lifecycle analysis can be found in Appendix B, Part 1.The western dike strengthening alternative is the least-cost dredged material disposal method.

It is important to note that Life Cycle Costs are calculated and presented in two different ways. In Table 34, the life cycle costs are calculated and presented as "economic costs" for the purpose of identifying the least-cost method of disposal. For this reason, systems dredging costs are included in the analysis in order to identify the full economic cost of each alternative. For example, the without project condition has a

higher systems dredging cost than the west berm alternative because a larger volume of material would be shipped to the ocean disposal site under without project conditions. The underlying calculations conducted for Table 35 are based on "financial costs" for the purpose of identifying the Federal cost share of the recommended plan. Therefore, systems dredging costs are not included in the financial cost calculations (systems dredging costs are not a financial cost of building the least cost dredged material disposal method). Table 34 shows the Life Cycle costs as average annual costs, which are used to select among alternatives. Table 35 shows the Life Cycle Costs as a present value, which are used to identify the Federal cost share.

Table 34. LEAST-COST DREDGED MATERIAL DISPOSAL ANALYSIS – AAEQ ALTERNATIVES LIFE CYCLE COSTS

Alternative	Cost component					
	Systems dredging	Real estate salvage value	O&M	Construction	Mitigation	Total cost
Without project condition	$32,935,000	($497,000)	$3,106,000	$0	$0	$35,544,000
East port alternative	$30,648,000	($428,000)	$3,171,000	$37,341,000	$3,018,000	$73,750,000
West dike strengthening	$25,358,000	($247,000)	$4,696,000	$1,846,000	$80,000	$31,733,000
East CDF	$26,984,000	($273,000)	$3,896,000	$20,807,000	$3,018,000	$54,432,000

The western dike strengthening alternative is the least-cost dredged material disposal method. The discounted present value of the costs necessary to construct, operate, and maintain the west dike strengthening over its useful life are presented in the following table. Federal cost-sharing, in accordance with current laws and policy, for an eastward expansion of CIDMMA that accommodates port development (the Recommended Plan) is limited to the present worth value of the west dike strengthening alternative, as it is the least-cost dredged material disposal method. The present worth of the least-cost dredged material disposal method is $67,435,000. The least-cost alternative provides CIDMMA with an additional 67.2 million cubic yards of capacity at a cost of $1.003 per cubic yard ($67,435,000/67.2 million cubic yards = $1.003/cubic yard).

Table 35. PRESENT VALUE OF THE LEAST-COST METHOD OF DISPOSAL (DISCOUNTED TO PRESENT VALUE 2010)

Alternative	Construction	O&M	Mitigation	Real estate	Total
West dike strengthening	$33,056,000	$28,472,000	$1,428,000	$4,478,000	$67,435,000

(1) Discounted at 5.125 percent.

Sensitivity Analysis

In the selection of any plan for construction and Federal cost-sharing participation, various degrees of risk and uncertainty are going to be present that could affect the outcome. In any navigation evaluation, risks and uncertainties resulting primarily from the nature and inherent uncertainty of processes that drive the need for dredging and international trade must be evaluated. Various sensitivity analyses evaluating changes in the transportation structure and expectations as well as basic sensitivities on the discount rate are included in the Economic Analysis Appendix. In

addition, a sensitivity analysis was conducted on the effects of deepening the channel to the authorized depth of 55-feet in Norfolk Harbor. The likelihood of this authorized element being completed before CIDMMA reaches its capacity is not known. However, due to the increase in ship sizes on the order book and the growth in trade, it is thought that the probability of this happening is better than absolute uncertainty or greater than 50 percent.

The expected cubic yardage associated with a 55-foot deepening would be approximately 24.4 mcy, that is 5.7 mcy per year for 4 years, plus an additional 1.6 mcy for the dredging of berthing and access. On average CIDMMA can be expected to lose 1-year of life for every additional 5 mcy disposed of there. Therefore, CIDMMA could be expected to reach its capacity in 2020 if the authorized 55-foot deepening is completed before then. The following table shows the results of the sensitivity comparison between the without project condition and the western dike strengthening if the 55-foot element was completed in 2020.

Table 36. LEAST-COST DREDGED MATERIAL DISPOSAL ANALYSIS – AAEQ ALTERNATIVES LIFE CYCLE COSTS

Alternative	Cost component					
	Systems dredging	Real estate salvage value	O&M	Construction	Mitigation	Total cost
Without project condition	$40,402,000	($638,000)	$2,286,000	$0	$0	$42,150,000
West dike strengthening	$31,387,000	($317,000)	$4,173,000	$2,387,000	$102,404	$37,733,000

From the table, it is apparent that while the strengthening the west dike is still the least-cost method of disposal, the overall costs are greater. The following table shows the discounted present value of the strengthening the west dike in the sensitivity analysis.

Table 37. PRESENT VALUE OF THE LEAST-COST METHOD OF DISPOSAL 55-FOOT SENSITIVITY (DISCOUNTED TO PRESENT VALUE 2010) (1)

Alternative	Construction	O&M	Mitigation	Real estate	Total
West dike strengthening	$42,752,000	$32,006,000	$1,834,000	$5,750,000	$82,342,000

(1) Discounted at 5.125 percent.

The discounted present value of the least-cost method results in a unit cost of $1.23 ($82,342,000/67.2 mcy) and potentially $14,704,000 in Federal cost-sharing. In the overall comparison, with a construction cost at $671 million, this may seem insignificant. However, in comparison with a previous discounted present value of $67,435,000 and the present value of the sensitivity analysis, the difference is approximately a 22 percent increase in potential cost sharing.

ACCESS CHANNELS

The access channels to the Craney Island terminal present a unique opportunity for Federal participation. Considering that the facility will be publicly-owned and kept in the public domain and will service multiple carriers, the access channels can be cost-shared as a General Navigation Feature. It is important to note that the with and without project conditions concerning cargo volumes transiting the access channels are the same as those for the east port expansion. Thus, the benefits from an access channel with the

same depth as the main channel are equal to the transportation cost savings previously identified, totaling $331 million. However, in order to identify the appropriate access channel depth, those benefits must be disaggregated by depth. This dissagregation of benefits requires some key assumptions to be made. Additionally, there is a small amount of navigation benefits to be garnered.

PERIOD OF ANALYSIS

The current base year for the study is 2010. However, the terminal would not be online, and, thus, the access channels could not garner benefits until 2017. Therefore, the construction of the access channels would be done in 2016. The construction costs for the access channel will be discounted back to the base year from 2016. While the benefits are discounted from when they begin occurring in 2017, a 50-year period of analysis is used.

DESIGN VESSEL

An analysis of future large vessels contained in the order book showed that there are over 100 vessels that range in size from 6,000 TEU's up to 7,800 TEU's currently under contract to be built, and many vessels of this size are in service now. Many different operators are building these vessels. The design drafts for these vessels also range from 46 feet to 48 feet. Contracts also exist for vessels of 8,000 TEU's, 9,000 TEU's, and 10,000 TEU's. However, the possibility of these vessels calling at Norfolk Harbor is still currently uncertain. As the vessels are expected to grow larger, the design drafts are expected to remain close to a maximum of 48 feet. Vessels should be increasing their capacity by getting wider or longer rather than deeper. Picking a particular TEU size vessel for each of the with project channel conditions is difficult because of the lack of hard data regarding what will actually be built and deployed over the life of this deepening project. Therefore, the selection of the representative large container vessel for each depth of channel deepening is based on the estimated capacity of each vessel, given the expected design draft of the vessel, as displayed in the existing fleet and order book.

The following table identifies the vessels that are most likely to make a first call at Norfolk Harbor with channel deepening. Operators of these larger containerships are not expected to deploy them to Norfolk Harbor at channel depths less than 48 feet; therefore, the 48-foot channel deepening was selected as the beginning threshold for having larger containerships begin to make first calls. Based on information contained in the following table, the 6,000-TEU vessel will be used as the benefiting design vessel for the 48-foot channel deepening, the 7,000-TEU vessel for the 49-foot channel deepening, and the 7,500-TEU vessel for the 50-foot channel deepening. The 6,000-TEU vessel will be used as the benefiting design vessel will also be used for the without project condition.

Table 38. LARGE CONTAINERSHIP DEPTH REQUIREMENTS

	With project		
Vessel class	6,000 TEU	7,000 TEU	7,500 TEU
Design draft	46	47	48
Underkeel clearance	5	5	5
Required depth	51	52	53
Estimated light loading	3	3	3
Actual required depth	48	49	50

Underkeel clearance requirements were determined based upon the 50-Foot Inbound LRR. Adding the underkeel clearance to the design draft of the vessel provides the perceived required channel depth operators desire to have. Since containerships tend to fill volumetrically before they maximize by weight, particularly with regard to import carriages, an allowance of 3 feet for light-loading was subtracted from the perceived required depth to derive the actual channel depth needed for each vessel.

Depth increments are derived for benefit comparison purposes. The analysis will be conducted on a 48-foot, a 49-foot, and a 50-foot channel since the channels have never been dredged. The current 45-foot main channel is currently in the process of being deepened to 50-feet.

WITHOUT PROJECT CONDITION

As previously mentioned, the commodity trade forecast used in the transportation cost analysis for the container cargo will be the same that is used in this analysis. The alternative port used in this analysis for the access channels is the Port of Savannah. The basic premise is that if the eastward expansion is not built, then the cargo must go to one of the ports used in the without project condition of the previous analysis. Another reason for selecting the Port of Savannah is that it has a lower landside cost differential than the Port of Miami, as shown previously in the report. Additionally, vessels that would stop at the Port of LA/LB would travel through the Panama Canal and would not need a 50-foot channel.

Trade Route

The 50-Inbound LRR for Norfolk Harbor and Channels (2002) is used to provide the trade route analyzed for waterborne transportation costs. The trade route starts in Kaohsiung, Taiwan, then stops in Yantian, China; Hong Kong, China; Singapore; Tanjung Pelepas, Malaysia; Salalah, Oman; Colombo, Sri-Lanka; through the Suez Canal; then on to Gioia Tauro, Italy; Algeciras, Spain; and finally, the Port of Savannah. The trade route then goes on to PONYNJ and Halifax.

This route was selected because it was assumed in the 50-Inbound LRR that Norfolk would only be the first port of call until 2016 when traffic would revert to calling first on Halifax and New York. Thus, vessels traveling from Europe across the north Atlantic to Halifax and New York first would likely not need a 50-foot access channel when arriving in Norfolk. However, the case was made in the LRR that there would likely be enough traffic to support a service calling on Norfolk as its first port-of-call due to the increase in cargo. The observed growth in cargo in recent years has far outpaced

the growth forecasted in the LRR, thus making this scenario more likely in the future. The key difference is that rather than Halifax's or PONYNJ's being the first-port-of-call in the without project condition, it is the Port of Savannah for reasons explained earlier.

Waterborne Transportation Costs

This analysis focuses on a very narrow stream of cargo, and the amount of cargo considered in this analysis is the same for both the without project condition and the with project condition. This 50-Inbound LRR determined that the total projected volume of imports expected to benefit from channel deepening is a small percentage of the projected import trade along this route. It was projected that the volume of imports that would benefit from a channel deepening was approximately 16.8 percent in 2005 and would be approximately 17.1 percent in 2015. For this analysis, 17.1 percent of the cargo that would be diverted to the Port of Savannah is counted in the without project condition transportation costs as well as the with project condition. That is approximately 48,900 TEU's in 2017 that would be diverted from Norfolk to Savannah.

In the without project condition, the vessels will be going to the Port of Savannah rather than a port on the eastward expansion and then traveling on to PONYNJ and Halifax. The Port of Savannah is currently maintained at a depth of 42-feet with an authorized depth of 48-feet. The 48-foot channel will be constructed pending the completion and approval of an ongoing analysis. Since the channel is authorized, and the study is currently being conducted, it is assumed that the 48-foot channel will be available for vessel traffic by 2017. The following table shows the total one-way cost per trip cost to PONYNJ using the Port of Savannah as the first port-of-call.

Table 39. PER TRIP WATERBORNE TRANSPORTATION COSTS USING THE PORT OF SAVANNAH(1)

Port	Costs per trip
Savannah	$1,533,000

(1) Discounted to base year 2010 at 5.125 percent.

The cost shown in the table above represents the one-way costs for a 82,000-deadweight-ton container ship to travel along the trade route. This is a 6,000-TEU vessel that requires a depth of 48-feet. The costs per TEU are calculated based on an initial full load. This cargo is distributed based on the amount of imported TEU's each east coast port received in 2003 as a portion of the whole. The following table shows the cost per TEU for the leg to the Port of Savannah and the leg to PONYNJ.

Table 40. WITHOUT PROJECT WATERBORNE TRANSPORTATION COSTS PER TEU BY TRIP LEG

Leg	Cost per TEU
To the Port of Savannah	$244
To PONYNJ from the Port of Savannah	$16

Using the table above, the without project waterborne transportation costs can be calculated. These costs are displayed in the following table.

Table 41. AAEQ WITHOUT PROJECT CONDITION WATERBORNE TRANSPORTATION COSTS (1)

Leg	AAEQ Cost
To the Port of Savannah	$22,736,000
To PONYNJ from the Port of Savannah	$1,075,000
Total	$23,811,000

(1) Discounted to base year 2010 at 5.125 percent.

WITH PROJECT CONDITION

The with project condition considered in this analysis consists of deepening the access channels for the future Craney Island Terminal and considering depths of 48 feet, 49 feet and 50 feet. The 1-foot increments allows for proper scaling of the proposed deepening project and identifies the plan that maximizes the constrained NED navigation benefits as well as realizing the landside NED benefits. The constraint placed upon analysis of the NED Plan is that the non-Federal partner is interested in navigation improvements that include a 50-foot channel, but not deeper. Completion of the construction is assumed to occur when the terminal on the eastward expansion becomes operational in 2017.

The cargo that was being diverted to the Port of Savannah is now going back to Norfolk through the terminal on the eastward expansion at Craney Island. Again, the cargo that is being considered is only 17.1 percent of the cargo that had been diverted. This equates to approximately 48,900 TEU's. The cargo on the ship that is intended for other ports is considered as well and distributed using the same pattern in the without project condition.

Waterborne Transportation Costs

The waterborne transportation costs for the with project condition account for the costs of the different vessels sizes along the trade route. The costs are now calculated using Norfolk as the first port-of-call rather than the Port of Savannah. The costs are presented below by vessel size for the two legs of the trade route.

Table 42. WITHOUT PROJECT WATERBORNE TRANSPORTATION COSTS PER TEU BY TRIP LEG(1)

	With project		
Vessel class	6,000 TEU	7,000 TEU	7,500 TEU
To Norfolk	$238	$231	$230
To PONYNJ from Norfolk	$6.59	$6.39	$6.35

Using the table above, the with project waterborne transportation costs can be calculated. These costs are displayed in the following table.

Table 43. AAEQ WITHOUT PROJECT CONDITION WATERBORNE TRANSPORTATION COSTS (1)

	With project		
Vessel class	6,000 TEU	7,000 TEU	7,500 TEU
To Norfolk	$22,236,000	$21,571,000	$21,419,000
To PONYNJ from Norfolk	$438,000	$425,000	$422,000
Total	$22,674,000	$21,996,000	$21,841,000

BENEFIT ALLOCATION

As previously noted, the landside transportation cost savings must be disaggregated by depth for access channel optimization. These costs savings will only apply to 17.1 percent of the cargo that is diverted through the Port of Savannah. The landside benefits are based solely on the cost saving per TEU through the Port of Savannah. The table below shows the total benefits for each depth.

Table 44. AVERAGE ANNUAL WITH PROJECT BENEFITS

TEU vessel class	Depth	Waterborne benefits	Landside benefits	Total benefits
6,000	48	$1,137,000	$4,863,685	$6,000,000
7,000	49	$1,815,000	$4,863,685	$6,679,000
7,500	50	$1,971,000	$4,863,685	$6,834,000

CONSTRUCTION COSTS

The construction costs for the access channels are included in the Micro-Computer Aided Cost Estimating System (MCACES) cost estimate. The costs are presented below showing the 48-foot depth, the 49-foot depth, and the 50-foot depth. These costs included PED as well as construction management.

Table 45. ACCESS CHANNEL CONSTRUCTION COSTS

Increment	First cost of construction	Average annual costs
48-foot Depth	$19,556,000	$978,294
49-foot Depth	$22,311,000	$1,086,677
50-foot Depth	$25,453,000	$1,210,324

The average annual costs above also include the O&M for the access channel in the amount of 209,000. This is calculated over a 50-year period. The O&M costs are largely dependent on the weather patterns observed in the area. The more rain there is the more frequent the channel must be maintained. The less rain, the less the channel must be maintained. In this regard, the O&M was calculated based on randomly generated numbers that placed the O&M in a 2-5 year cycle. The detailed calculations can be found in Appendix B, part 1.

The following table presents the benefit-cost ratios, and the net remaining benefits.

Table 46. BENEFIT COST RATIOS AND NET REMAINING BENEFITS

Depth	AAEQ Benefits	Total average annual costs(1)	Benefit cost ratio	Net remaining benefits
48	$6,000,000	$978,000	6.1	$5,023,000
49	$6,679,000	$1,087,000	6.1	$5,592,000
50	$6,834,000	$1,210,000	5.6	$5,624,000

(1) Includes the costs for the lower depths.

The table above shows that, when considering the assumptions made, the NED Plan for the access channels is a 50-foot channel with the highest net remaining benefits of $5.62 million. However, it must be noted that this only considers the benefits from 17.1 percent of the cargo diverted through 1 port. This equates to approximately 24 vessel trips at a 50-foot draft in 2017. This is not an unreasonable expectation for the year 2017 when the cargo that will be coming to the East Coast of the U.S. will be much more than it is now. Additionally, the total benefit for the access channels is equal to the transportation cost savings of $331 million plus the waterborne benefits gained from more efficient use of the channel.

PLAN IMPLEMENTATION

This section defines implementation responsibilities necessary to insure that the Recommended Plan's goals and objectives are achieved. Included are discussions of the division of plan responsibilities between Federal and non-Federal interests, institutional requirements, cost sharing, analysis of non-Federal financial capability, a discussion of the PCA, and views of the non-Federal sponsor.

DIVISION OF PLAN RESPONSIBILITIES

The USACE Civil Works program provides for Federal interest in general navigation features associated with navigation improvements. Excluded are interests in the development of port lands, facilities, and infrastructure. The initial construction and O&M of the berthing and ship service facilities are also a non-Federal responsibility. Accordingly, the incremental costs of port development including terminal facility construction and O&M would be the responsibility of the non-Federal sponsor.

Current policy does not allow the USACE to cost-share the eastward expansion of CIDMMA as a general navigation feature because it is not the least-cost dredged material disposal method. Under existing law and policy the USACE cost sharing responsibility is limited to the present value of the least-cost long-term dredged material method as identified previously as $67,435,000.

In accordance with CIDMMA's original authorizing Congressional resolution, Federal cost-sharing in the Recommended Plan will be recovered through the application of tolls. Because the Recommended Plan provides less additional dredged material disposal capacity than the least-cost disposal method it is necessary to evaluate the discounted present value of the least-cost disposal method on a cost per unit basis. This will allow the proper distribution of the tolls. The least-cost disposal method would create a capacity of 67.2 mcy, providing of unit cost of $1.003 per cubic yard ($67,435,000/67.2 mcy). The Recommended Plan creates a capacity of 12 mcy. This provides for a Federal cost-sharing interest of $12,042,000.

Cost sharing for the access channels will be done in accordance with Section 101 of the WRDA 1986 and cost shared as a GNF. This requires a blended cost sharing structure as there are three cost sharing depth increments involved. From 0-feet to 20 feet is cost shared 10 percent non-Federal and 90 percent Federal. From 21-feet to 45 feet is cost shared 25 percent non-Federal and 75 percent Federal. Any depth greater than 45 feet is cost shared 50 percent non-Federal and 50 percent Federal. In addition, 10 percent of the total construction cost will be paid by the non-Federal sponsor over a

period of 30-years. For the purposes of allocating the cost by depth, the mobilization costs are included in the cost for the 20-foot increment. The demobilization costs are included in the greater than 45-foot increment. The cost sharing for the access channel is presented in the following tables by increment.

Table 47. COST SHARING REQUIREMENTS FOR THE ACCESS CHANNEL NED PLAN GREATER THAN 45-FOOT INCREMENT

		Federal		Non-Federal	
Items	Total	Percent	Amount	Percent	Amount
Initial construction					
Access Channel					
Design	$638,900	50%	$319,000	50%	$319,400
Construction management	$532,000	50%	$266,000	50%	$266,000
Construction	$11,110,000	50%	$5,555,000	50%	$5,555,000
LERR	$0	0%	$0	100%	$0
Environmental mitigation	$0	50%	$0	50%	$0
10% non-Federal share	$1,228,000		($1,228,000)	100%	$1,228,000
Subtotal	$13,510,000		$4,913,000		$7,369,000
Total	$13,510,000		$4,913,000		$7,369,000

Table 48. COST SHARING REQUIREMENTS FOR THE ACCESS CHANNEL NED PLAN 21-FOOT TO 45-FOOT INCREMENT

Items	Total	Federal		Non-Federal	
		Percent	Amount	Percent	Amount
Initial construction					
Access Channel					
Design	$568,000	75%	$426,000	25%	$142,000
Construction management	$474,000	75%	$355,000	25%	$118,000
Construction	$9,887,000	75%	$7,415,000	25%	$2,472,000
LERR	$0	0%	$0	100%	$0
Environmental mitigation	$0	75%	$0	25%	$0
10% non-Federal share (1)	$1,093,000		($1,093,000)	100%	$1,093,000
Subtotal	$12,022,000		$7,104,000		$3,825,000
Total	$12,022,000		$7,104,000		$3,825,000

Table 49. COST SHARING REQUIREMENTS FOR THE ACCESS CHANNEL NED PLAN 0-FOOT TO 20-FOOT INCREMENT

Items	Total	Federal		Non-Federal	
		Percent	Amount	Percent	Amount
Initial construction					
Access Channel					
Design	$117,000	90%	$105,000	10%	$12,000
Construction management	$97,000	90%	$87,000	10%	$10,000
Construction	$2,029,000	90%	$1,826,000	10%	$203,000
LERR	$0	0%	$0	100%	$0
Environmental mitigation	$0	90%	$0	10%	$0
10% non-Federal share (1)	$224,000		($224,000)	100%	$224,000
Subtotal	$2,467,000		$1,794,000		$449,000
Total	$2,371,000		$1,794,000		$449,000

The following table shows the cost sharing for each increment as well as the total.

Table 50. ACCESS CHANNEL COST SHARING

Depth	Federal	Non-Federal
0-20 feet	$1,794,000	$449,000
21-feet to 45-feet	$7,104,000	$3,825,060
45-feet to 50-feet	$4,913,000	$7,369,000
Total	$13,810,000	$11,642,000

The costs for the access channels shown in the previous tables are based on 90-percent ocean disposal and 10-percent disposal at CIDMMA. This is the same allocation for the pre-dredging for the Recommended Plan. The reason for this allocation is that some of the access channel construction will be necessary during the initial construction of the Recommended Plan. If this dredging is not done, the constructed disposal cell may cause a reduction in the cross-sectional area of the Elizabeth River, reducing the flushing of the river. During the PED Phase, hydrodynamic modeling will be done to determine how much of the access channel will need to be dredged to avoid this impact to the Elizabeth River. This portion of the access channel will not be cost shared as a GNF. It will be included as part of the construction cost of the Recommended Plan and cost shared the same as the disposal cell that is based on the least-cost disposal plan. The remaining depth of the access channel will be dredged and cost shared as a GNF in 2016. The cost-sharing will be adjusted at the time to reflect what is actually going to be dredged. Therefore, the cost-sharing shown in Table 50 is the upper limit of cost-sharing for the access channels based on October 2005 price levels.

The Federal and non-Federal cost shares were calculated exclusive of associated costs relating to berthing areas and the port facility that would be constructed on top of the eastward expansion. The following table presents the ultimate construction cost share apportionment in 2006 dollars.

Table 51. CONSTRUCTION COST SHARE APPORTIONMENT ($2006)

	Federal	Non-Federal	Total
Eastward Expansion	$12,042,000	$633,846,000	$645,888,000
Access Channel	$13,810,000	$11,642,000	$25,452,000
Total	$25,852,000	$645,488,000	$671,340,000
Percentages	3.85%	96.15%	100%

CERCLA-related Responsibilities

In order to address HQUSACE concerns, the Feasibility Report, EIS, items of local cooperation, and the PCA will reflect a recent agreement between USACE and the non-Federal sponsor that the non-Federal sponsor will assume full responsibility and liability for any work implicating CERCLA-regulated substances. Furthermore, the non-Federal sponsor will indemnify USACE from any future CERCLA litigation and/or associated cleanup costs related to this project.

FINANCIAL ANALYSIS

A financial analysis is required for any plan being considered for USACE implementation that involves non-Federal cost sharing. The purpose of the financial analysis is to ensure that the non-Federal sponsor understands the financial commitment involved and has reasonable plans for meeting that commitment. The financial analysis includes the non-Federal sponsor's statement of financial capability, the non-Federal sponsor's financing plan, and an assessment of the sponsor's financial capability.

The Commonwealth of Virginia, acting through the Secretary of Transportation and represented by the VPA, has expressed support for a potential project. Their cooperation indicates a strong willingness to proceed with a potential solution to the dredged material management and port expansion problems identified for the Port of Hampton Roads. The Commonwealth of Virginia has the capability to fund the design and construction of this project. The VPA, representing the non-Federal sponsor, would issue bonds supported by the Commonwealth Port Fund and terminal revenues as well as receive state appropriations to fund its portion of the work. The VPA has maintained a stable credit rating of A1 or better, demonstrating its ability to issue bonds. The Commonwealth of Virginia's budget for the 2004 - 2006 biennium was $63.6 billion, for the 2006 - 2008 biennium budget is $73.0 billion, demonstrating its capability to provide appropriations.

A fully-coordinated PCA package, including the sponsor's financing plan and reflecting the recommendations of this Feasibility Study, would be prepared during the

preconstruction, engineering and design phase.. The study sponsor, the Commonwealth of Virginia, has provided funds to the District to cost share studies and projects in the past. The non-Federal sponsor is committed to providing dredged material placement and container handling capacity, as demonstrated by the amount of renovation and efficiency expenditures at both NIT North and South. The non-Federal sponsor has indicated its support for the proposed project most recently in a letter of intent dated

27 July 2006 in which the Commonwealth of Virginia endorsed moving forward with design and construction of the Recommended Plan.

PROJECT COOPERATION AGREEMENT

The PCA will be developed and based on the Recommended Plan. The non-Federal sponsor has a clear understanding of the type of agreement that it would be expected to sign prior to the start of construction. The terms of local cooperation to be required in the PCA are described in the "Recommendations" section of this report. The Commonwealth of Virginia's letter of intent dated 27 July 2006 is contained in the "Pertinent Correspondence" section of Appendix D.

Federal commitments relating to a construction schedule or specific provisions of the PCA cannot be made to the non-Federal sponsor on any aspect of this project or separable element until:

- The Recommended Plan is authorized by Congress;
- Construction funds are appropriated by Congress, apportioned by the Office of Management and Budget, and their allocation is approved by the ASA(CW); and
- The draft PCA has been reviewed and approved by the ASA(CW).

The PCA would not be executed nor would construction be initiated on this project or any separable element until the NEPA, the Clean Water Act, the Coastal Zone Management Act, the ESA, the Fish and Wildlife Coordination Act, and the National Historic Preservation Act Planning Phase requirements are met. In the case of the Craney Island Eastward Expansion, these requirements are met once the Draft EIS has been coordinated, comments addressed, and the EIS finalized.

Final PCA negotiations with the non-Federal sponsor may be conducted and a draft PCA package submitted to higher authorities for review and approval by the ASA(CW) once this report is approved and the project is budgeted for construction. The PCA for this project would be executed only after this report is approved and an

Appropriations Bill containing funds for the project is enacted into law. The Chief of Engineers would not allocate Federal construction funds for a project until ASA(CW) approves the non-Federal sponsor's financing plan and the PCA is executed.

VIEWS OF THE NON-FEDERAL SPONSOR

The Commonwealth of Virginia, acting through the Secretary of Transportation and represented by the VPA, agrees with the recommendation to construct the eastward expansion of CIDMMA for dredged material disposal and future port development. The NED benefits of the project, including transportation cost savings and dredged material disposal cost savings, far outweigh the project costs, with a benefit/cost ratio of 4.4 to 1. The Recommended Plan will generate an AAEQ of $258 million in net NED benefits. The non-Federal partner believes that this high yield investment more than meets the Administration's economic criteria as a high priority navigation improvement project.

The VPA, however, is not satisfied with the Federal cost share calculated in this report, which under existing law and policy, is only $9.9 million for a project that returns $258 million in net NED benefits annually. The discounted present value of NED benefits generated by the Recommended Plan is $5.93 billion. These NED benefits, which are largely transportation cost savings, cannot be captured by the Port, but rather accrue to the Nation, in the same manner as the NED benefits of other Federal navigation projects. Under existing law and policy, the USACE will cost share only 1.8 percent of the eastward expansion construction costs (exclusive of the $1.02 billion the Commonwealth of Virginia is committed to investing in terminal facilities and other associated costs). Other navigation projects of this magnitude are typically cost shared 50 percent/50 percent between the non-Federal partner and the USACE. The overall total investment required to implement the Recommended Plan is $1.67 billion.

This Feasibility Report demonstrates the huge and obvious need for this project. It also demonstrates the substantial benefit to the Nation that would be realized through greatly reduced transportation costs. However, USACE policy severely limits Federal cost-sharing at this time, and as such the non-Federal partner is pursuing alternative cost-

sharing scenarios. The non-Federal partner is developing potential legislative language that would allow the eastward expansion of CIDMMA to be cost shared by the USACE Civil Works Program on a 50/50 basis.

The Commonwealth of Virginia supports construction of the eastward expansion of CIDMMA in a manner that will allow it to implement port development. The VPA sees this as a unique and extremely beneficial opportunity to enhance the Nation's ability to advantageously pursue international trade, which is a cornerstone of the Nation's economy. The non-Federal sponsor indicates that the existing cost-share, although in accordance with current policy, presents a disproportionate cost burden on the Commonwealth of Virginia for a project that generates such substantial national economic development benefits. It is the VPA's hope that alternative cost sharing arrangements can be achieved.

SUMMARY OF COORDINATION

This section discusses the manner in which coordination was conducted with the many and varied stakeholders involved in the development of the CIDMMA Eastward Expansion Study. In order to execute an integrated and comprehensive study, it is important to obtain the input and perspective of a wide variety of interests. Fifty-three stakeholders were involved in the study coordination, including Federal, state, regional, and local government agencies; large and small businesses; professional groups; environmental organizations; civic groups; and local universities.

MEETINGS

Seven public stakeholder meetings were held at key points during the study to facilitate effective input and reviews. The dates of the meetings were:

- 12 August 1999
- 12 April 2000
- 23 May 2001
- 15 January 2002

- 9 September 2004
- 14 December 2004
- 25 April 2005
- 6 September 2005

The objectives of the stakeholder meetings were to obtain public input from stakeholders regarding problems, needs, concerns, and opportunities relative to the study and to provide an interactive forum to publicly communicate with the stakeholders study assumptions, progress, data, results, and conclusions, and receive feedback and comments from the stakeholders regarding various phases of the study. Notes from each stakeholders meeting were mailed to each stakeholder, and the notes were also posted on a public web site maintained by the USACE.

In addition to the stakeholder meetings, formal coordination of the draft report and draft Environmental Impact Statement with Headquarters USACE, other Federal agencies, and the public comment period will be done in accordance with laws and regulations prior to submission of the final feasibility report and final EIS.

RECOGNITION

All 57 stakeholders were periodically advised of the study's status over the full study period. Most were active participants in the stakeholder meeting process. The following is a listing of stakeholders who provided pertinent information during the study:

- Baker Environmental
- Chesapeake Bay Foundation Office
- City of Chesapeake
- City of Hampton
- City of Newport News
- City of Norfolk
- City of Portsmouth

- City of Suffolk
- City of Virginia Beach
- College of William & Mary
- Diesel Tech, Inc.
- The ERP
- Federal Highway Administration
- Hampton Roads Chamber of Commerce
- Hampton Roads Maritime Association
- Hampton Roads Partnership
- Hampton Roads Planning District Commission
- Hampton Road's Waterman's Association
- Hampton University
- Hampton Yacht Club
- Hoffler Creek Wildlife Refuge
- Isle of Wight County
- JRA
- Larchmont-Edgewater Civic League
- Lower Chesapeake Bay Waterman's Association
- Mofatt & Nichol
- NMFS
- National Oceanic & Atmospheric Administration
- Naval Station Norfolk
- Norfolk Airport Authority
- Norfolk Southern Corporation
- Norfolk State University
- Norfolk Yacht and Country Club
- ODU
- Parson, Brinckerhoff, Quade & Douglas, Inc.
- River Shore Civic League
- United Waterman's Association

- U.S. Coast Guard
- USEPA
- USFWS
- U.S. Navy Region Mid-Atlantic Regional Environmental Group
- Virginia Department of Environmental Quality
- VDGIF
- Virginia Department of Rail & Public Transportation
- VDOT
- Virginia Institute of Marine Science
- Virginia Marine Resources Commission
- Virginia Pilots Association
- VPA
- Virginia Seafood Council
- Virginia Secretary of Commerce & Trade
- Virginia Secretary of Natural Resources
- Working Waterman's Association

NEPA COORDINATION

Five meetings of a NEPA Technical Committee and 15 meetings of a Mitigation Subcommittee were convened during the study period. These meetings involved a diverse group of stakeholders engaged in the scoping process consistent with NEPA regulations.

Table 52. CRANEY ISLAND EXPANSION FEASIBILITY STUDY – NEPA SCOPING MEETINGS

Review Group/Meeting	Meeting Date(s)	Members/Participants
NEPA Technical Committee	27 November 2000	USACE, USFWS (Chesapeake Bay Field Office), USEPA, (VIMS), VDCR, VDEQ Tidewater Regional Office, VDGIF, William & Mary, USDOT Maritime Administration, VPA, ERP, JRA, Malcolm Pirnie, City of Portsmouth, Wetlands Watch
	15 May 2001	
	24 October 2001	
	3 April 2002	
	21 September 2004	
	7 December 2005	
Mitigation Subcommittee	21 June 2002	USACE, USEPA, USFWS, NOAA, VPA, VIMS, VDEQ, ODU, VMRC, VDGIF, William & Mary, ERP, JRA, VDCR, UNC, Wetlands Watch
	24 July 2002	
	26 August 2002	
	23 September 2002	
	24 October 2002	
	16 January 2003	
	19 March 2003	
	20 June 2003	
	29 July 2004	
	18 November 2004	
	16 December 2004	
	10 February 2005	
	24 February 2005	
	3 May 2005	
	26 May 2005	
VIMS Meeting	18 July 2001	USACE, VIMS
VIMS Workshop - Chesapeake Bay Scientists	21 August 2001	ODU, VIMS, ENSR, ERP, Moffatt & Nichol, HRPDC, USEPA
NMFS Meeting	25 September 2002	USACE, and Tim Goodger, NMFS Oxford Lab
USEPA/NOAA Meeting	16 September 16, 2002	Bill Hoffman (USEPA, Reg. III), Regina Poeske (USEPA, Reg. III), Kathryn Gallagher (USEPA, Chesa. Bay Program), Simeon Hahn (NOAA), Craig Seltzer (USACE), Doug Martin (USACE)
Scientists (13) Review – Habitat Equivalency Analysis (HEA)	1 May 2003	USACE,USFWS,VIMS, NOAA, UNC, ODU, ERP
USEPA Meeting(s)	1 July 2004; 24 March 2005	USEPA, Reg. III, VPA, USACE (Philadelphia, PA)

CONCLUSIONS

The dredged material and container capacity problems and needs of the study area have been reviewed and evaluated with regard to the overall public interest and with consideration to engineering, economic, environmental, social, and cultural concerns. The conclusions drawn by this study are as follows:

a. The CIDMMA will reach its full capacity in 2025.

b. The Port of Hampton Roads will begin to experience capacity short falls in its container handling capabilities in 2011.

c. The Recommended Plan, the LPP, consisting of a 580-acre eastward expansion to an elevation of +18 (MLLW) would provide additional dredged material capacity and a suitable platform to construct a container handling terminal.

d. The deviation from the EEWDS Alternative would result in no additional costs for the non-Federal sponsor, since the LPP is clearly of less scope and cost.

e. The Recommended Plan is economically, engineeringly, culturally, environmentally, and socially feasible.

f. The Recommended Plan is supported by the non-Federal sponsor, the Commonwealth of Virginia, which has the capability to provide the necessary non-Federal requirements presented in the "Division of Plan Responsibilities" section of this report.

RECOMMENDATIONS

In view of the conclusions just presented, I recommend the implementation of the LPP at CIDMMA, Virginia, with such modifications thereof as in the discretion of the

Commander, HQUSACE, may be advisable, at initial construction costs currently estimated at $671 million. This recommendation is subject to the cost-sharing policies as outlined in this report and is endorsed, provided that, prior to construction, the non-Federal sponsor enters into a written PCA, as required by Section 221 of Public Law 91-161, as amended, to provide local cooperation satisfactory to the Secretary of the Army. All cost-sharing requirements as stated in law and regulation will be satisfied prior to initiating project construction. Such local cooperation would include the following non-Federal responsibilities in addition to the responsibility for fulfilling the requirements of law for the selected project:

a. Provide, during construction, initial project costs of the Recommended Plan (LPP) for the eastward expansion of CIDMMA in excess of the Federal responsibility, whose contribution is limited to the present value of the least-cost long-term dredged material alternative, estimated at $12,042,000. The remaining costs for the eastward expansion, which is the responsibility of the non-Federal sponsor, is estimated at $633,846,000. In addition, the non-Federal sponsor will provide a portion of initial construction of the access channel, as a GNF in accordance with the WRDA of 1986, as amended, currently estimated at $11,642,000. Therefore, the total non-Federal share of the construction cost of the recommended LPP is $645,888,000 (96.1 percent).

(1) Provide, during construction, any additional funds needed to cover the non-Federal share of design costs;

(2) Provide all LERR's and perform, or ensure the performance of, any relocations determined by the Federal Government to be necessary for the initial construction and O&M of the project; and

(3) Provide, during construction, any additional amounts as are necessary to make its total contribution required by item "a" currently estimated at $645,888,000 (96.1 percent).

b. For so long as the eastward expansion project elements remain authorized; operate, maintain, repair, replace, and rehabilitate the completed project elements, or functional portion of project elements, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes an in accordance with applicable Federal and state laws and regulations and any specific directions prescribed by the Federal Government.

c. With regard to the access channel, provide 50 percent of the annual incremental cost to maintain the access channel at a depth greater than 45-feet, currently estimated at a total annual cost of $209,000, in accordance with the WRDA of 1986, as amended.

d. Allow the USACE to collect additional tolls in accordance with the existing authorization for CIDMMA contained in the Rivers and Harbors Act of 1946 and computed on the basis of the least-cost dredged material disposal plan identified in this Feasibility Report.

e. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor, now or hereafter, owns or controls for access to the project elements for the purpose of inspection, and, if necessary after failure to perform by the non-Federal sponsor, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project elements. No completion, O&M, repair, replacement, or rehabilitation by the Federal Government shall operate to relieve the non-Federal sponsor of responsibility to meet the non-Federal sponsor's obligations, or to preclude the Federal Government from pursuing any remedy at law or equity to ensure faithful performance.

f. Hold and save the United States free from all damage arising from initial construction, O&M, repair, replacement, and rehabilitation of the project elements and any project-related betterments, except for damages due the fault or negligence of the United States or its contractors.

g. Keep and maintain book, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project elements in accordance with the standards of financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to state and Local Governments at 32 CFR Section 33.20.

h. Perform, or cause to be performed, any investigations determined to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, amended, 422 U.S.C. 9601-9875, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for initial construction and O&M of the project elements. However, for lands that the Federal Government determines to be subject to the navigation servitude, the non-Federal sponsor must obtain prior written instruction from the District Engineer regarding the method of testing and must perform such investigations only in accordance with those instructions. The Government shall have no obligation under the PCA for the costs of any investigations performed under this paragraph.

i. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response cost of any CERCLA-regulated materials located in, on, or under lands, easements, or rights-of-ways that the Federal Government determines to be necessary for the initial construction or operation and maintenance of the project elements, inclusive of mitigation.

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

k. Agree to hold the Federal Government harmless from any associated CERCLA liability or cleanup costs related to this project, inclusive of mitigation.

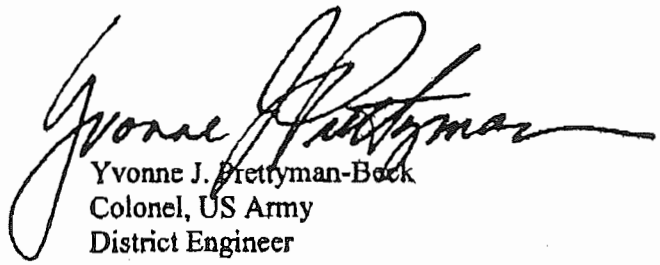
l. Comply with all applicable Federal and state laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army." Non-Federal Sponsor is also required to comply with all applicable Federal labor standards requirements including, but not limited to, the Davis-Bacon Act (40 USC 276a et seq), the Contract Work Hours and Safety Standards Act (40 USC 327 et seq), and the Copeland Anti-Kickback Act (40 USC 265c).

m. For so long as the project elements remain authorized, the non-Federal sponsor shall ensure continued conditions of public ownership and use of the facility upon which Federal participation s based.

n. All LRR's necessary for the project must be provided by the non-Federal sponsor free and clear of all environmental hazards.

NOTE ON THE INFORMATION PRESENTED IN THIS DOCUMENT

The information contained herein reflects the policies governing formulation of individual projects and the information available at this time. It does not necessarily reflect program and budgeting priorities inherent in the local and state program or the formulation of a National Civil Works Construction Program. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the non-Federal sponsor, the Commonwealth of Virginia; interested Federal agencies; and other parties would be advised of any modifications and would be afforded an opportunity to comment further.



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ABBREVIATIONS

AAEQ -- average annual equivalent
ASA(CW) -- Assistant Secretary of the Army for Civil Works
BMP's -- Best Management Practices
CDF – confined disposal facility
CE/ICA -- cost effectiveness and incremental cost analysis
CERCLA -- Comprehensive Environmental Response, Compensation, and Liability Act
CIDMMA -- Craney Island Dredged Material Management Area
CO – carbon monoxide
DEIS – Draft Environmental Impact Statement
DMMP -- Dredged Material Management Plan
EA – Environmental Assessment
EFH – Essential Fish Habitat
EIS -- Environmental Impact Statement
EOP's -- Environmental Operating Principles
ERDC -- Engineer Research and Development Center
ERP – Elizabeth River Project
ESA -- Endangered Species Act
°F -- degrees Fahrenheit
FEIS – Final Environmental Impact Statement
GNF -- General Navigation Feature
HAPC – Habitat Area of Particular Concern
HEA -- Habitat Equivalency Analysis
IDC -- interest during construction
JRA – James River Association
kg -- kilograms
LA/LB -- Los Angeles/Long Beach
LERR -- lands, easements, rights-of-way, and relocation
LF – linear feet
LPP – Locally Preferred Plan
LRR – Limited Reevaluation Report
mcy – million of cubic yards
mg/l -- milligrams per liter
MLW – mean low water
MLLW – mean lower low water
MMPA -- Marine Mammal Protection Act
MSA -- Metropolitan Statistical Area
MSFCMA -- Magnuson-Stevens Fishery Conservation and Management Act
NED -- National Economic Development
NEIT -- Northeast Implementation Team
NEPA -- National Environmental Policy Act
NIT – Norfolk International Terminals
NMFS – National Marine Fisheries Service
NOAA -- National Oceanic and Atmospheric Administration
NO_2 – Nitrogen Dioxide

ABBREVIATIONS
(Cont'd)

NOI – Notice of Intent
NO_x – Nitrous Oxides
ODU -- Old Dominion University
O&M – operation and maintenance
PCA -- Project Cooperation Agreement
PED -- Preconstruction Engineering and Design
PM_{10} –particulate matter 10 microns
PONYNJ -- Port of New York and New Jersey
SO_2 – Sulfur Dioxide
TEU's -- twenty-foot-equivalent units
UNC – University of North Carolina
USEPA -- U.S. Environmental Protection Agency
USACE – U.S. Army Corps of Engineers
USFWS – U.S. Fish & Wildlife Service
VOC -- Volatile Organic Carbon
VDCR -- Virginia Department of Conservation and Recreation
VDGIF – Virginia Department of Game & Inland Fisheries
VDHR -- Virginia Department of Historic Resources
VDEQ – Virginia Department of Environmental Quality
VDOT -- Virginia Department of Transportation
VIMS -- Virginia Institute of Marine Science
VMRC -- Virginia Marine Resources Commission
VSMS – Virginia Marine Science Museum
VPA – Virginia Port Authority
WRDA -- Water Resources Development Act
WTM -- World Trade Model

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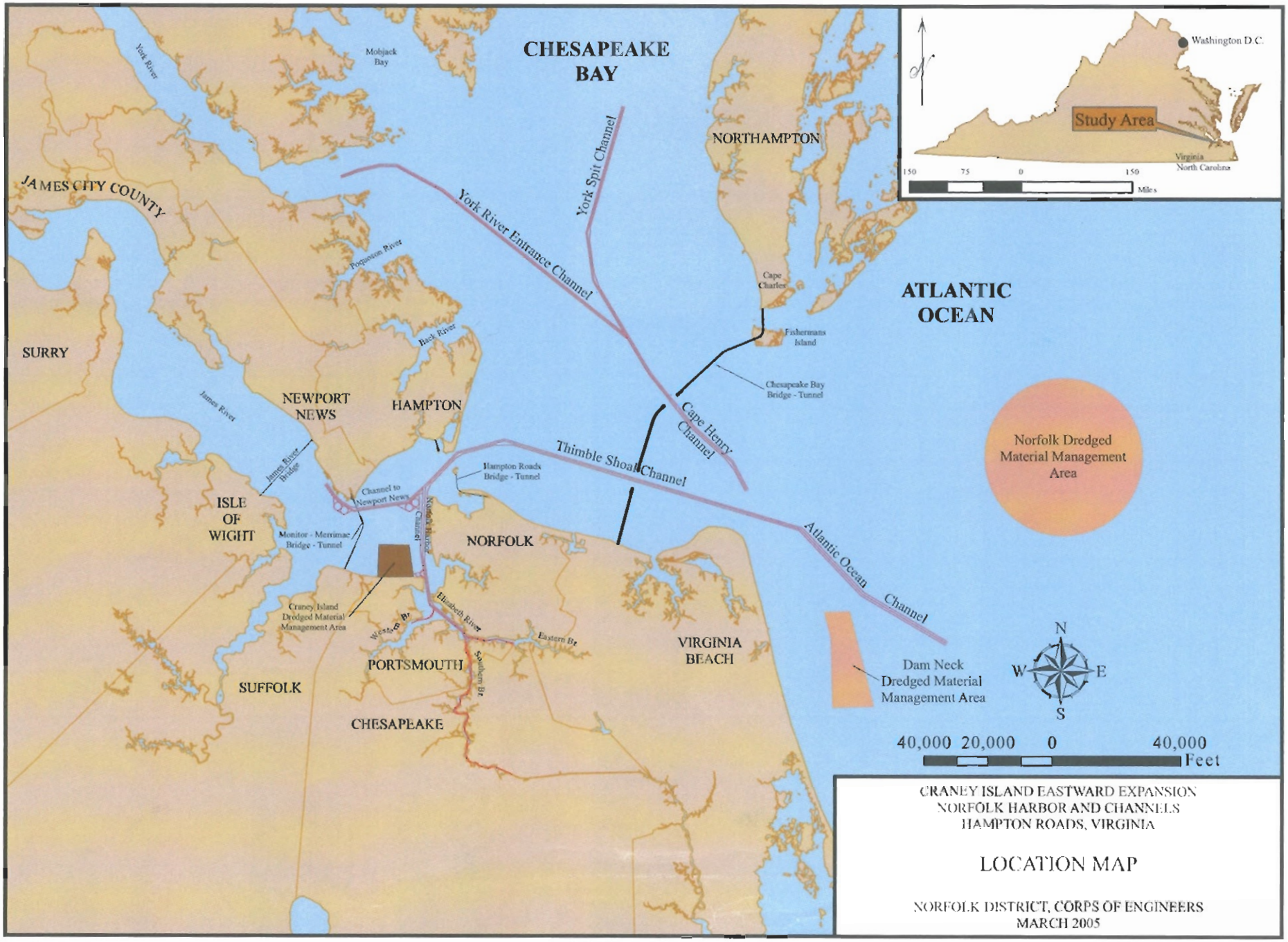
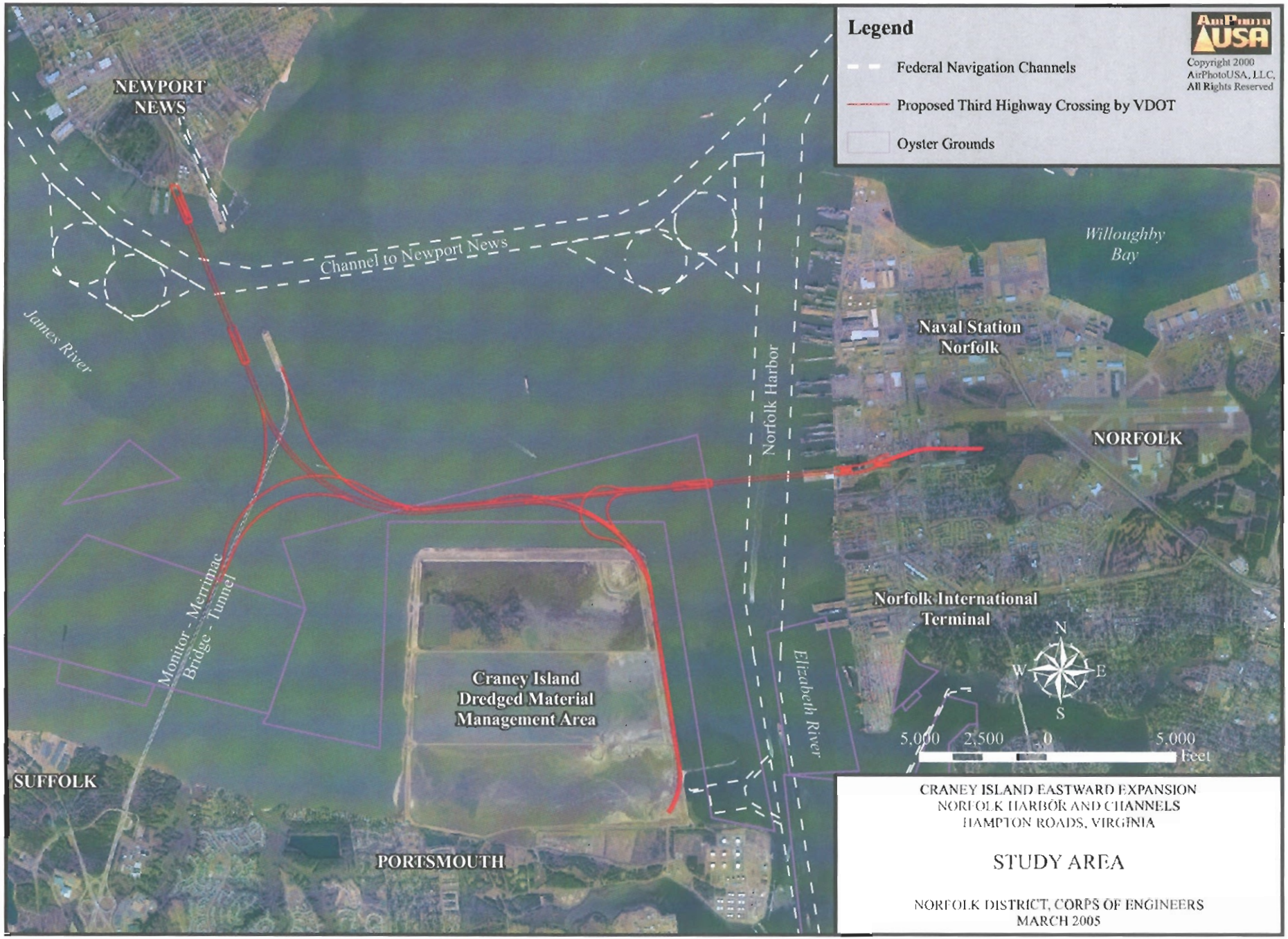


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

LOCATION MAP

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 1



CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

STUDY AREA

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 2

CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

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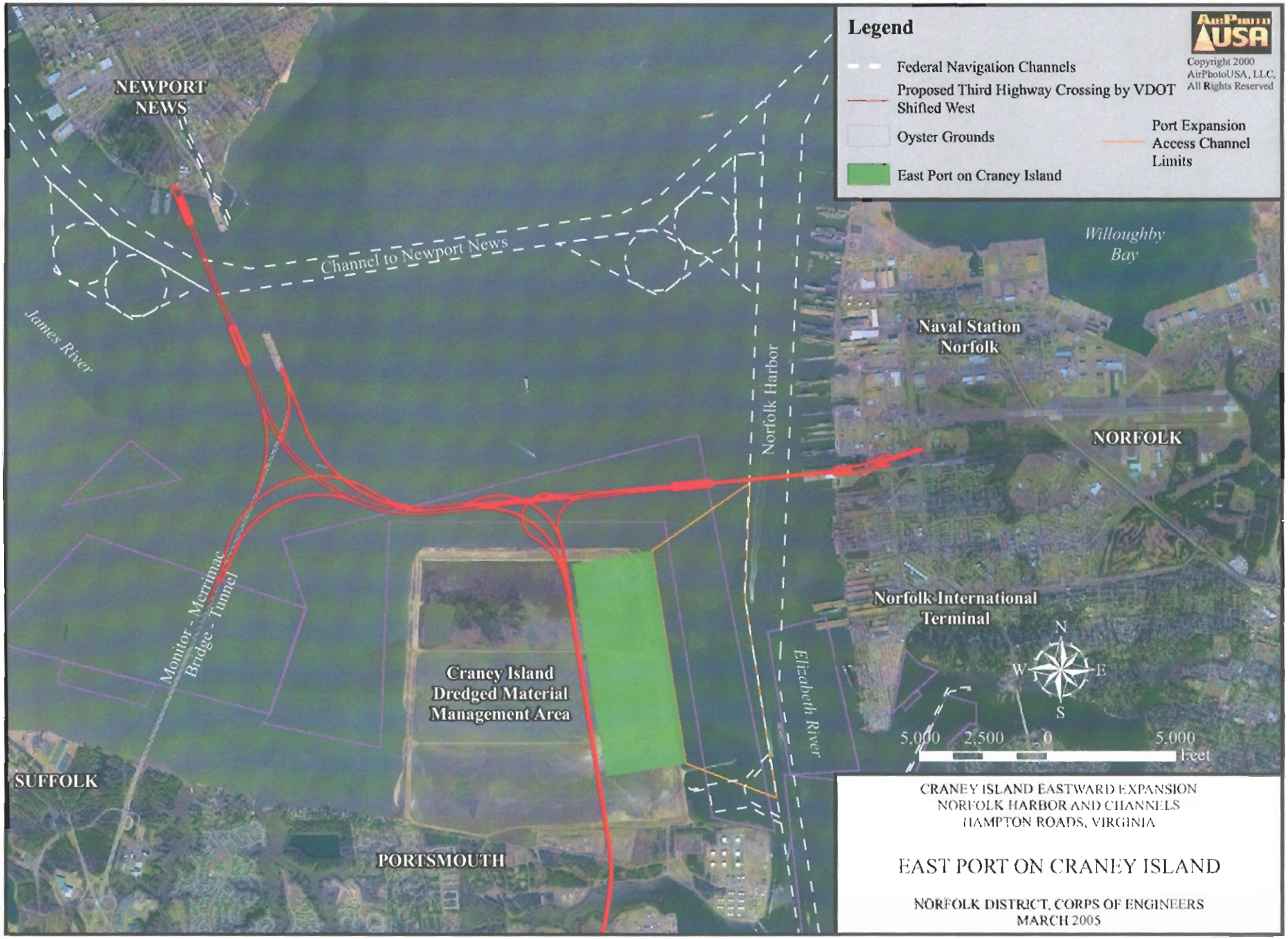
NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 3



CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

EAST PORT ON CRANEY ISLAND

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 4

CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

EAST CDF EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

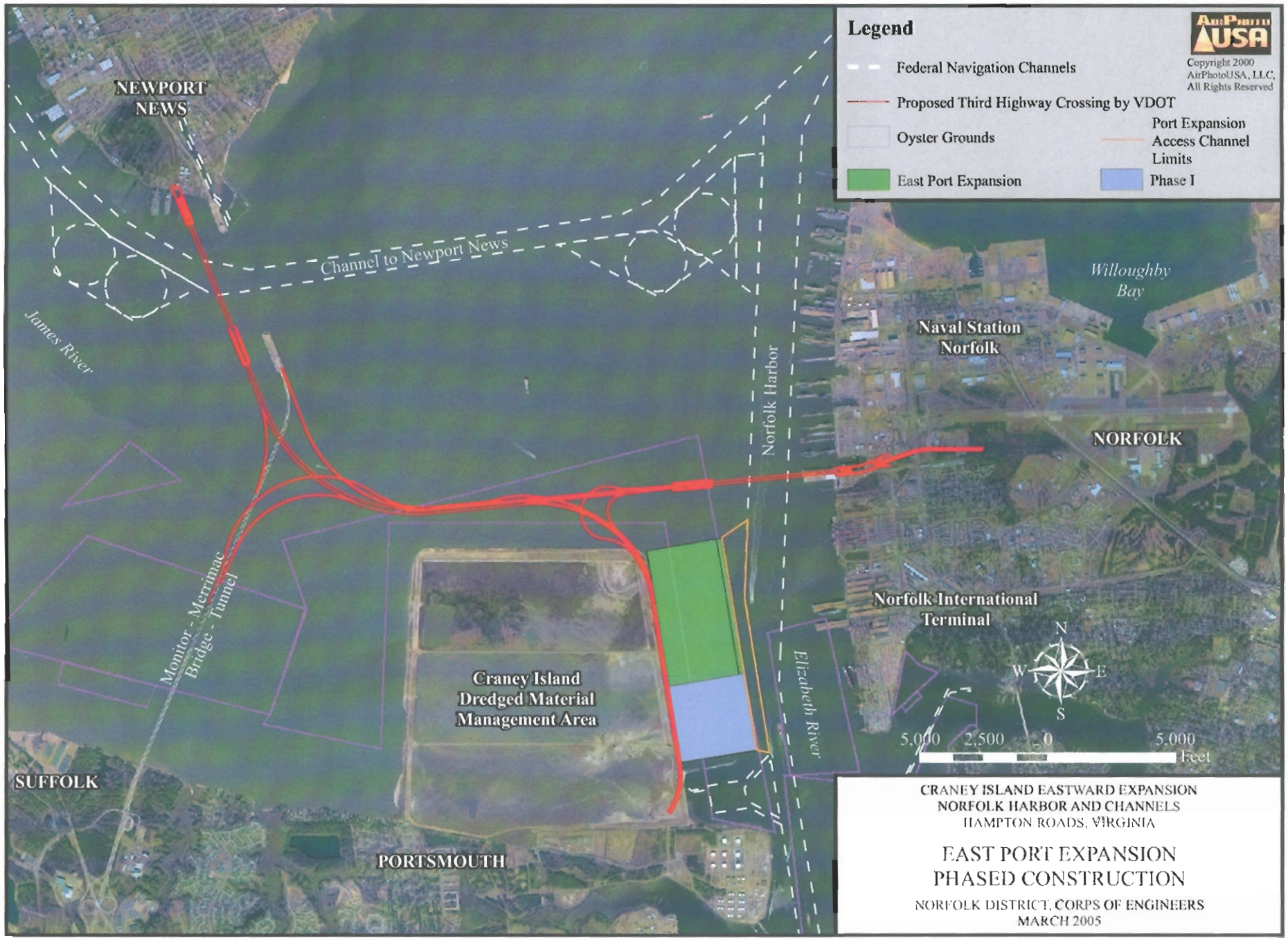
PLATE 5

CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

EAST PORT EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 6

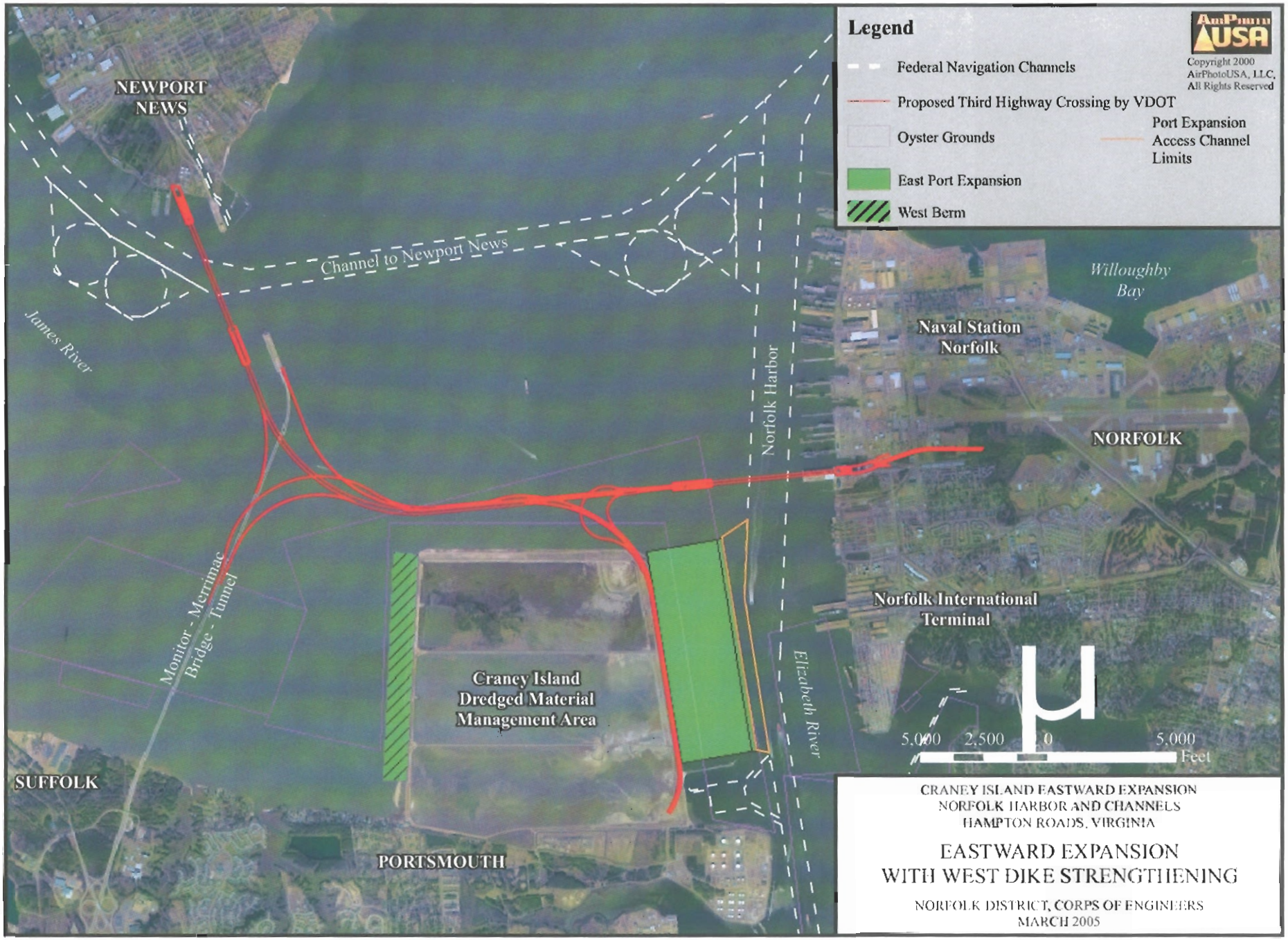


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

EAST PORT EXPANSION PHASED CONSTRUCTION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 7

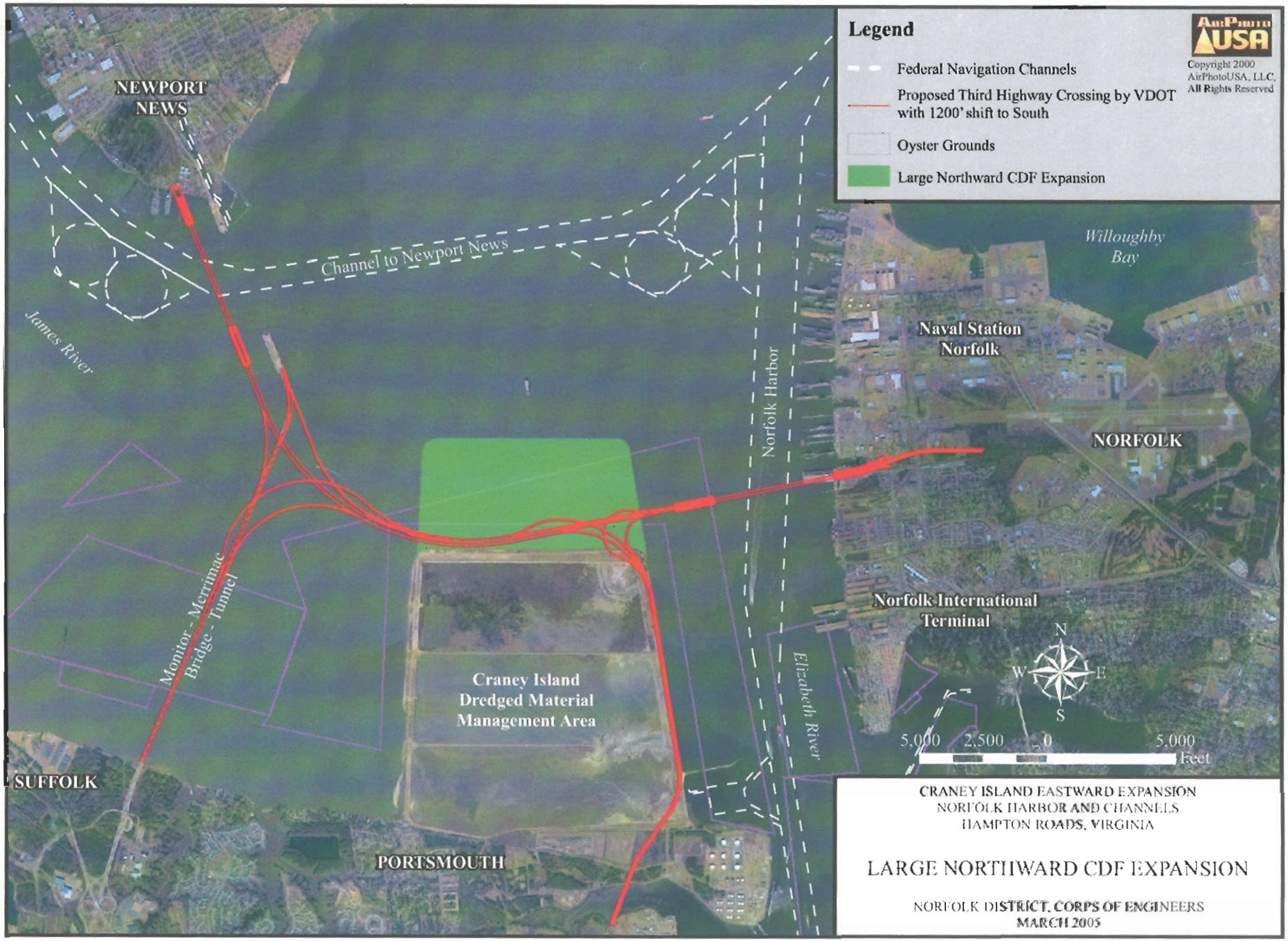


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

EASTWARD EXPANSION WITH WEST DIKE STRENGTHENING

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 8

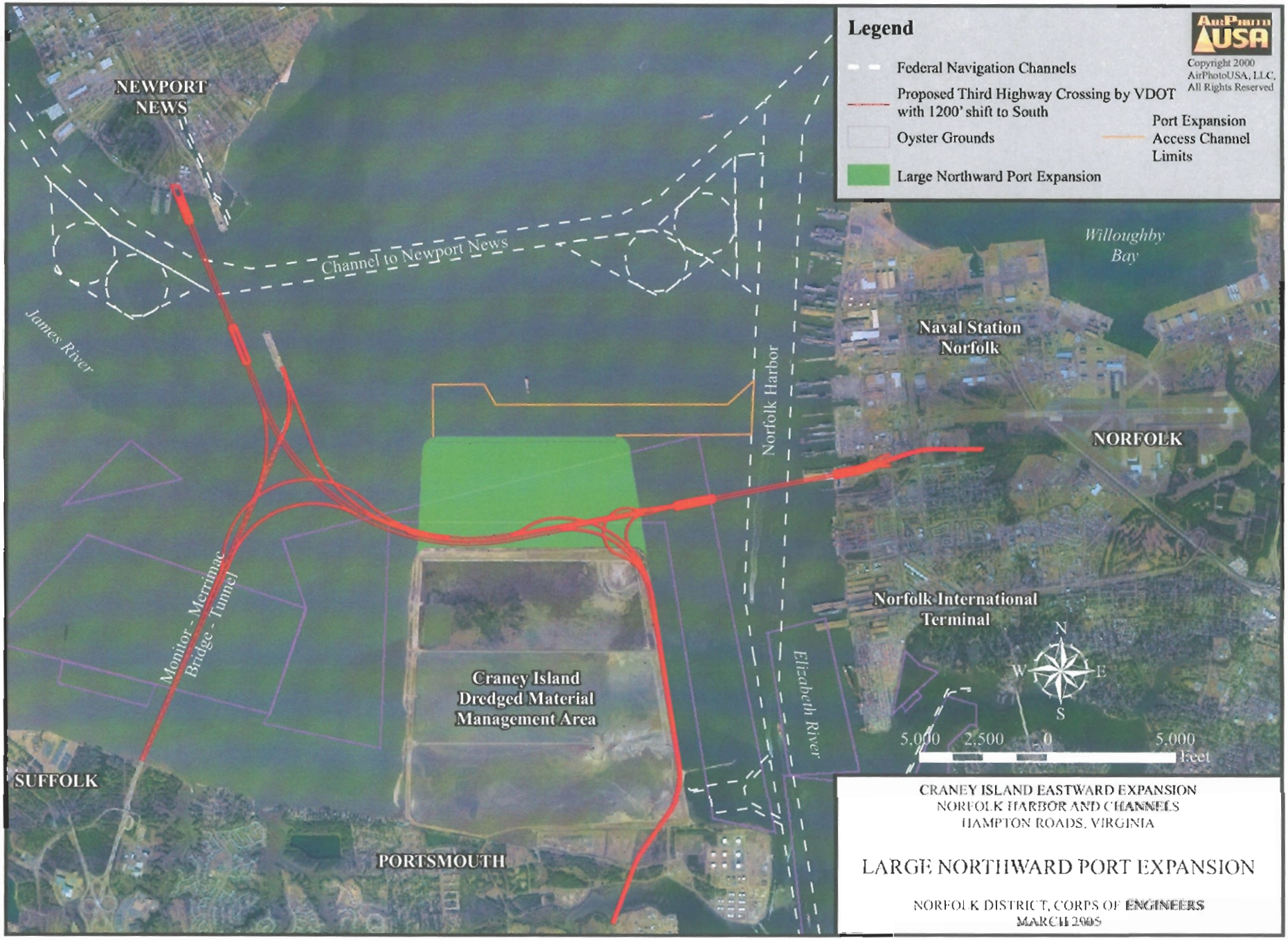


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

LARGE NORTHWARD CDF EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 9

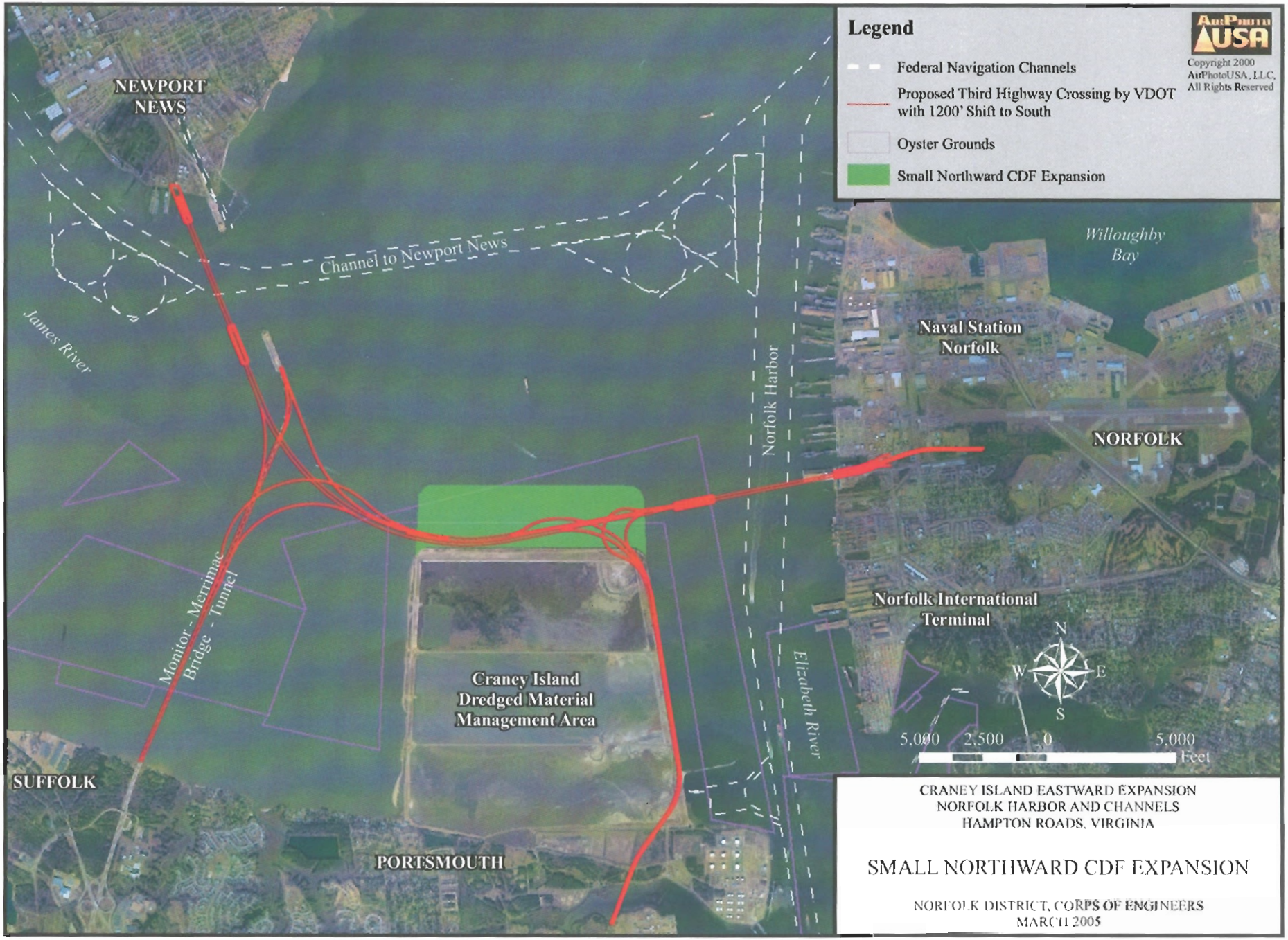


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

LARGE NORTHWARD PORT EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 10



CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

SMALL NORTHWARD CDF EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 11

CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

LARGE WESTWARD CDF EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2003

PLATE 12

CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

MEDIUM WESTWARD CDF EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

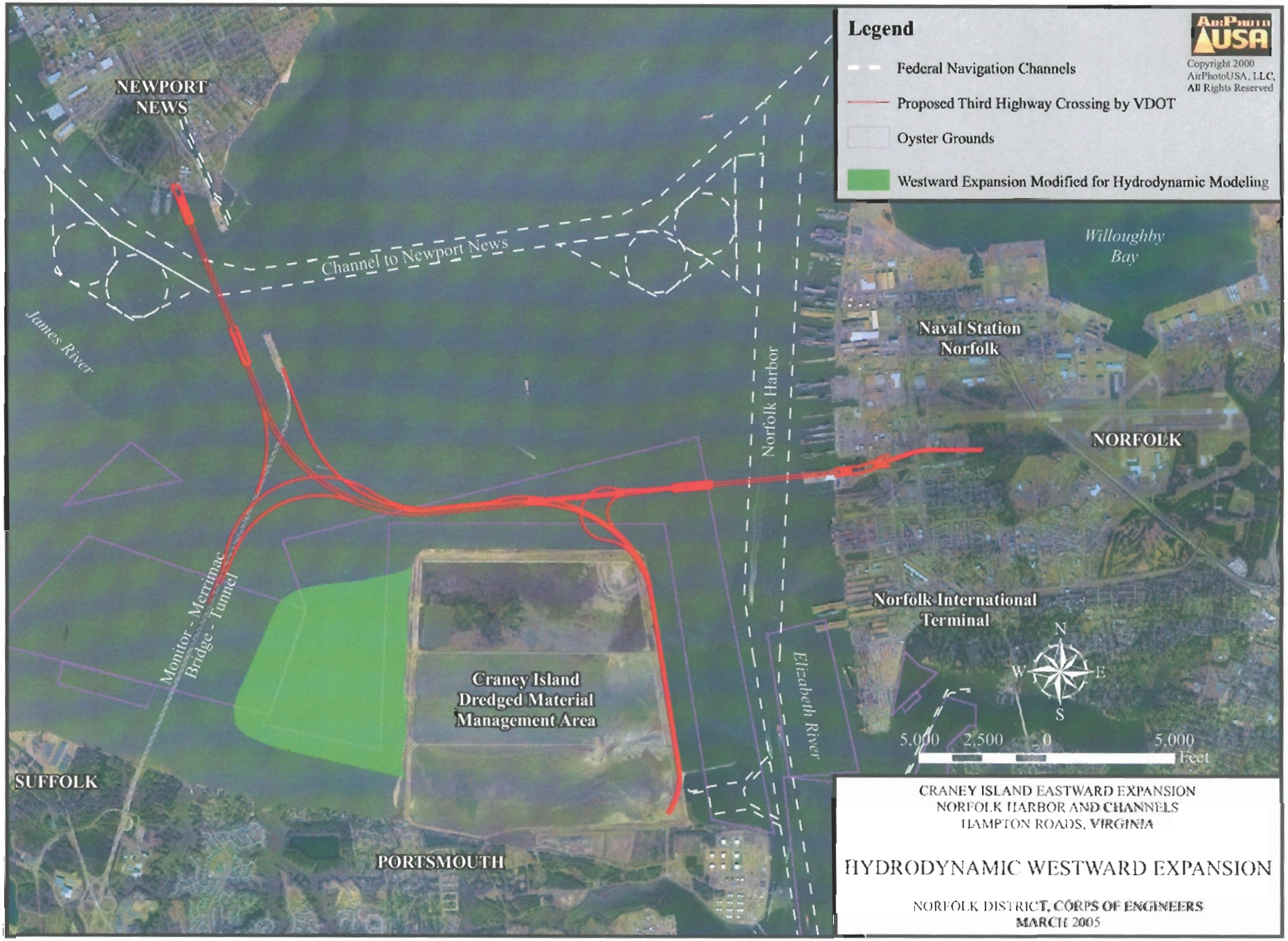
PLATE 13

CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

SMALL WESTWARD CDF EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 14

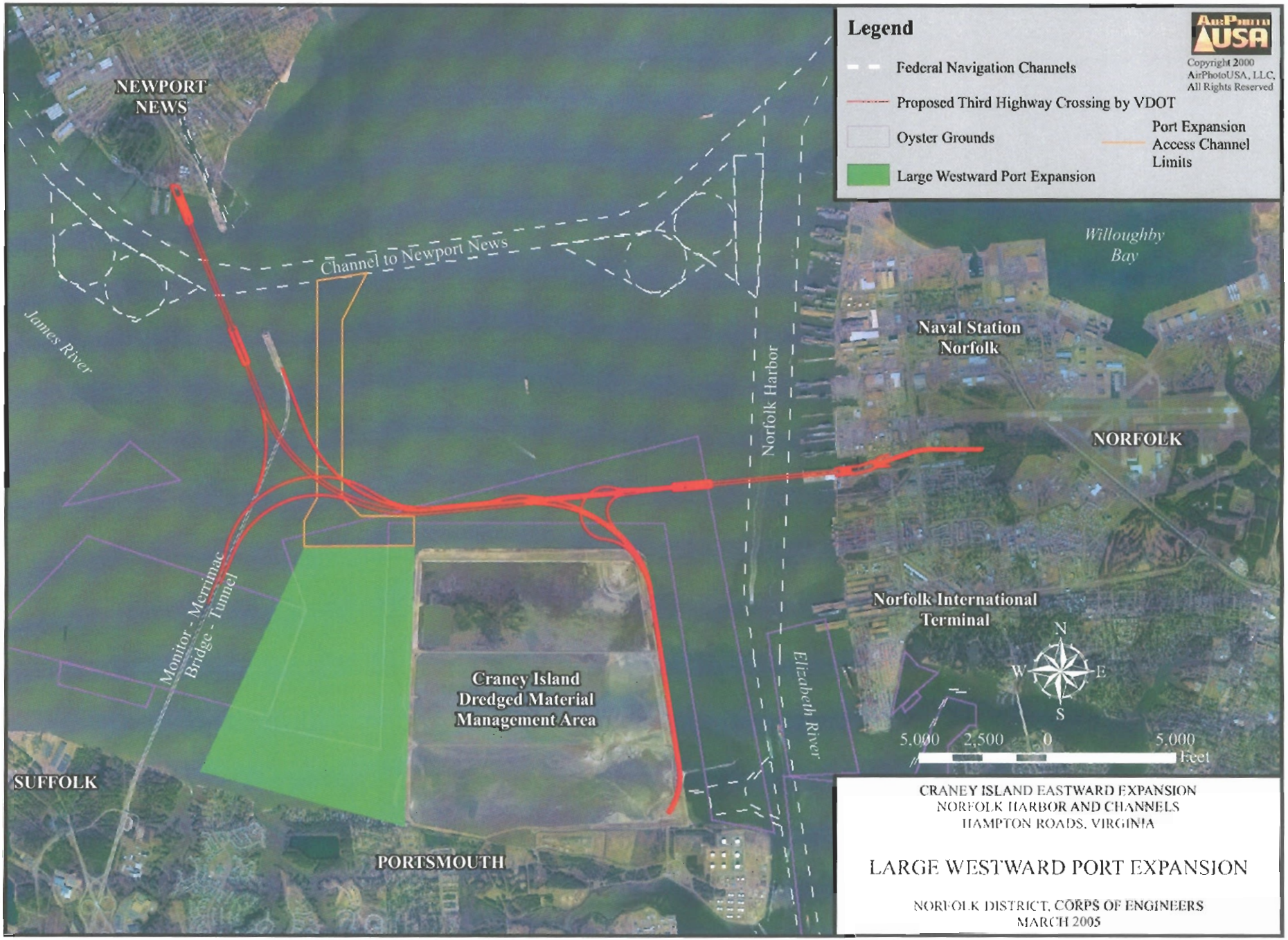


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

HYDRODYNAMIC WESTWARD EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 15

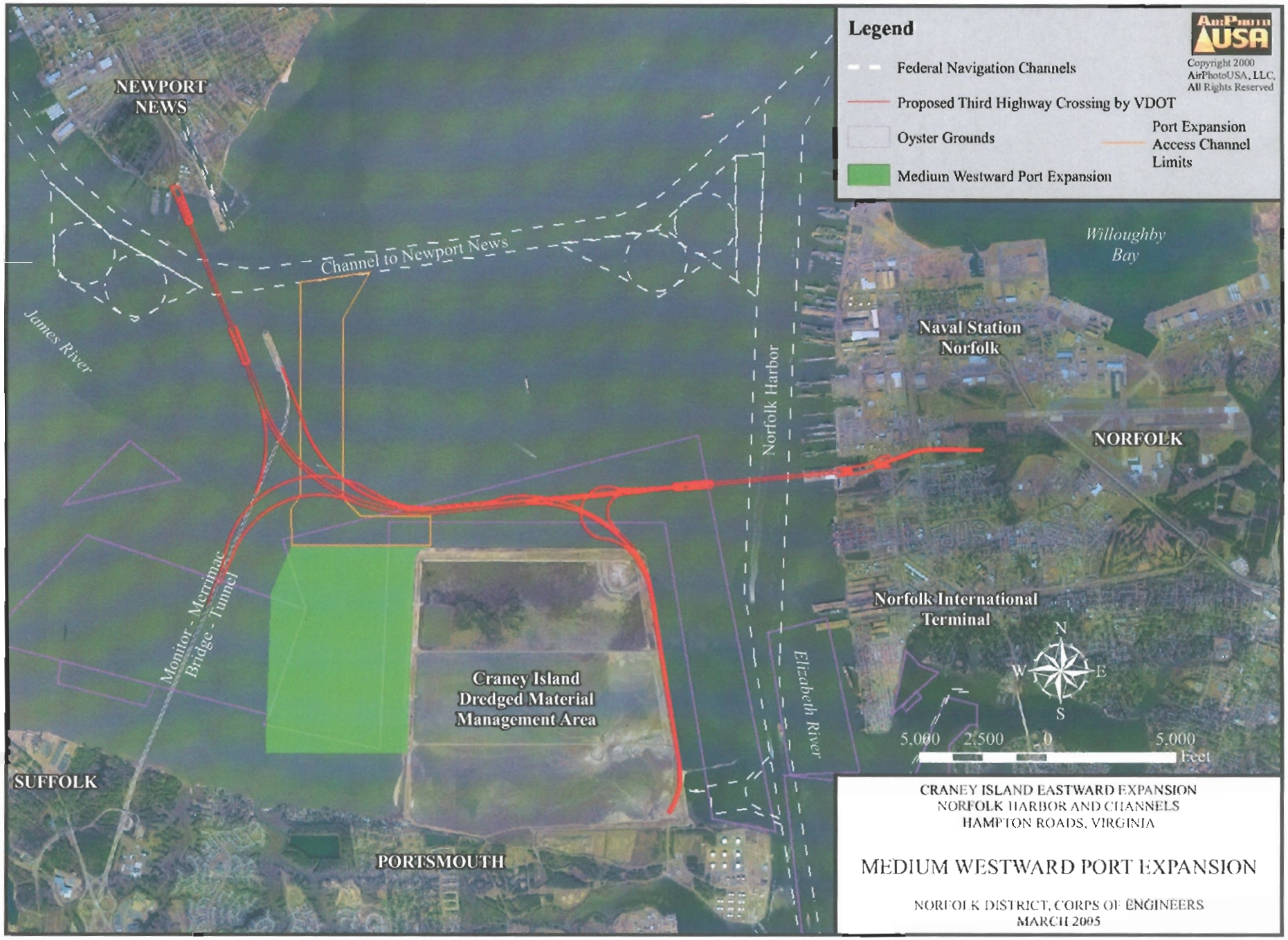


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

LARGE WESTWARD PORT EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 16

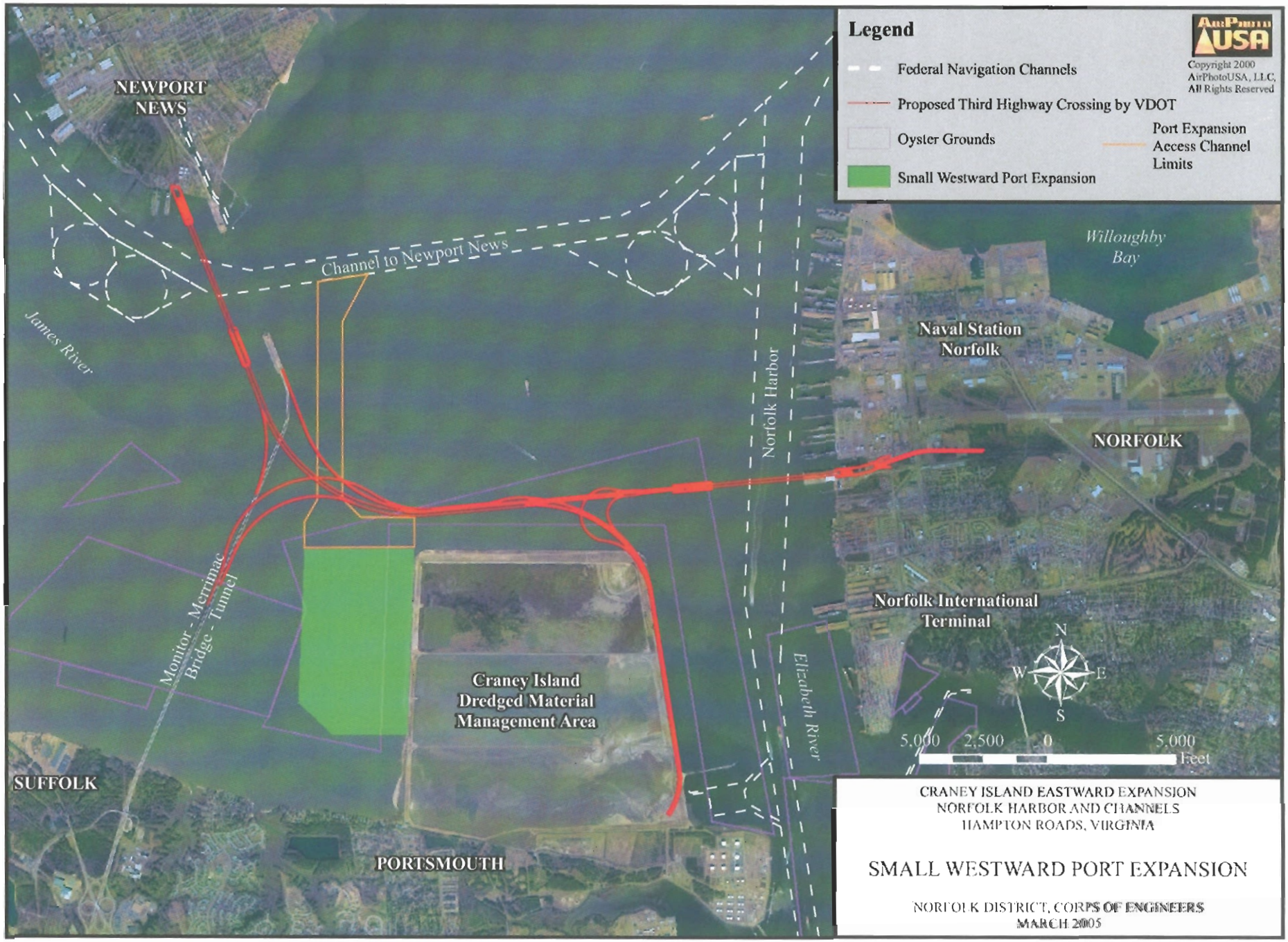


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

MEDIUM WESTWARD PORT EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 17

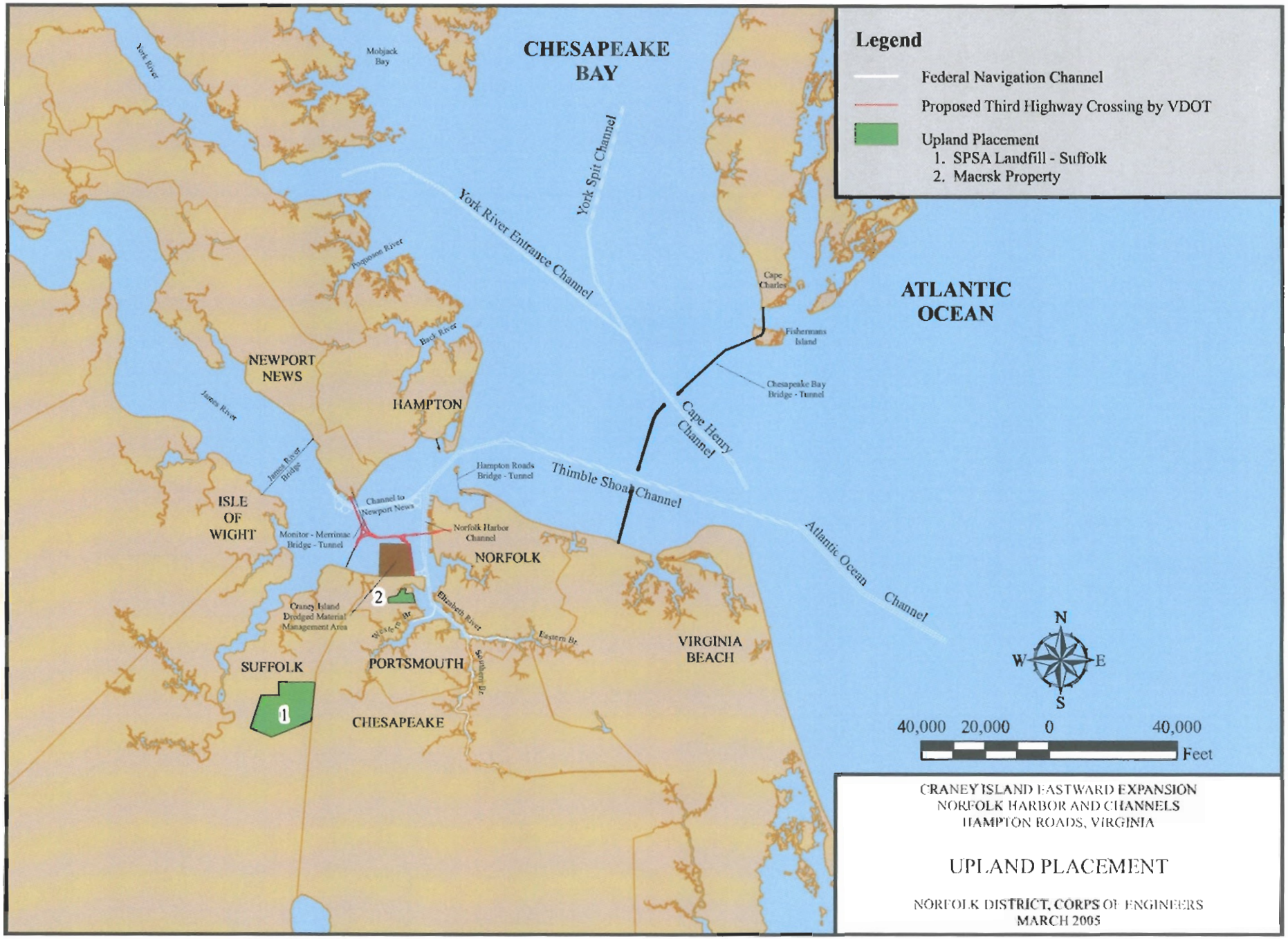


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

SMALL WESTWARD PORT EXPANSION

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 18

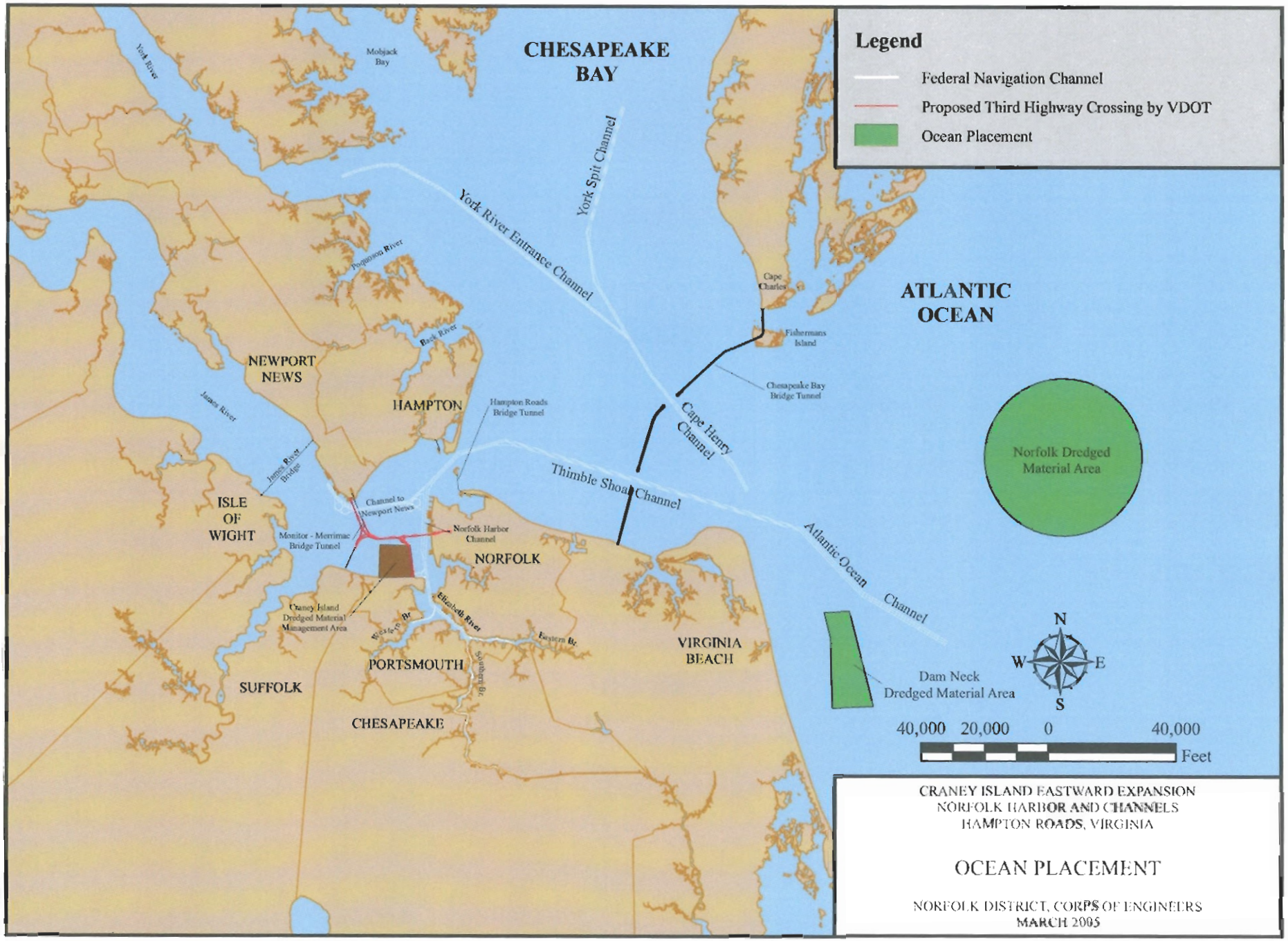


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

UPLAND PLACEMENT

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 19


Legend
Federal Navigation Channel
Proposed Third Highway Crossing by VDOT
Ocean Placement
CHESAPEAKE BAY
ATLANTIC OCEAN
York River
Mobjack Bay
York Spit Channel
York River Entrance Channel
Poquoson River
Back River
NEWPORT NEWS
HAMPTON
James River
Hampton Roads Bridge Tunnel
James River Bridge
ISLE OF WIGHT
Channel to Newport News
Monitor - Merrimac Bridge Tunnel
Norfolk Harbor Channel
NORFOLK
Thimble Shoal Channel
Cape Henry Channel
Cape Charles
Fishermans Island
Chesapeake Bay Bridge Tunnel
Norfolk Dredged Material Area
Atlantic Ocean Channel
Craney Island Dredged Material Management Area
Elizabeth River
Western Br.
Eastern Br.
Southern Br.
PORTSMOUTH
SUFFOLK
CHESAPEAKE
VIRGINIA BEACH
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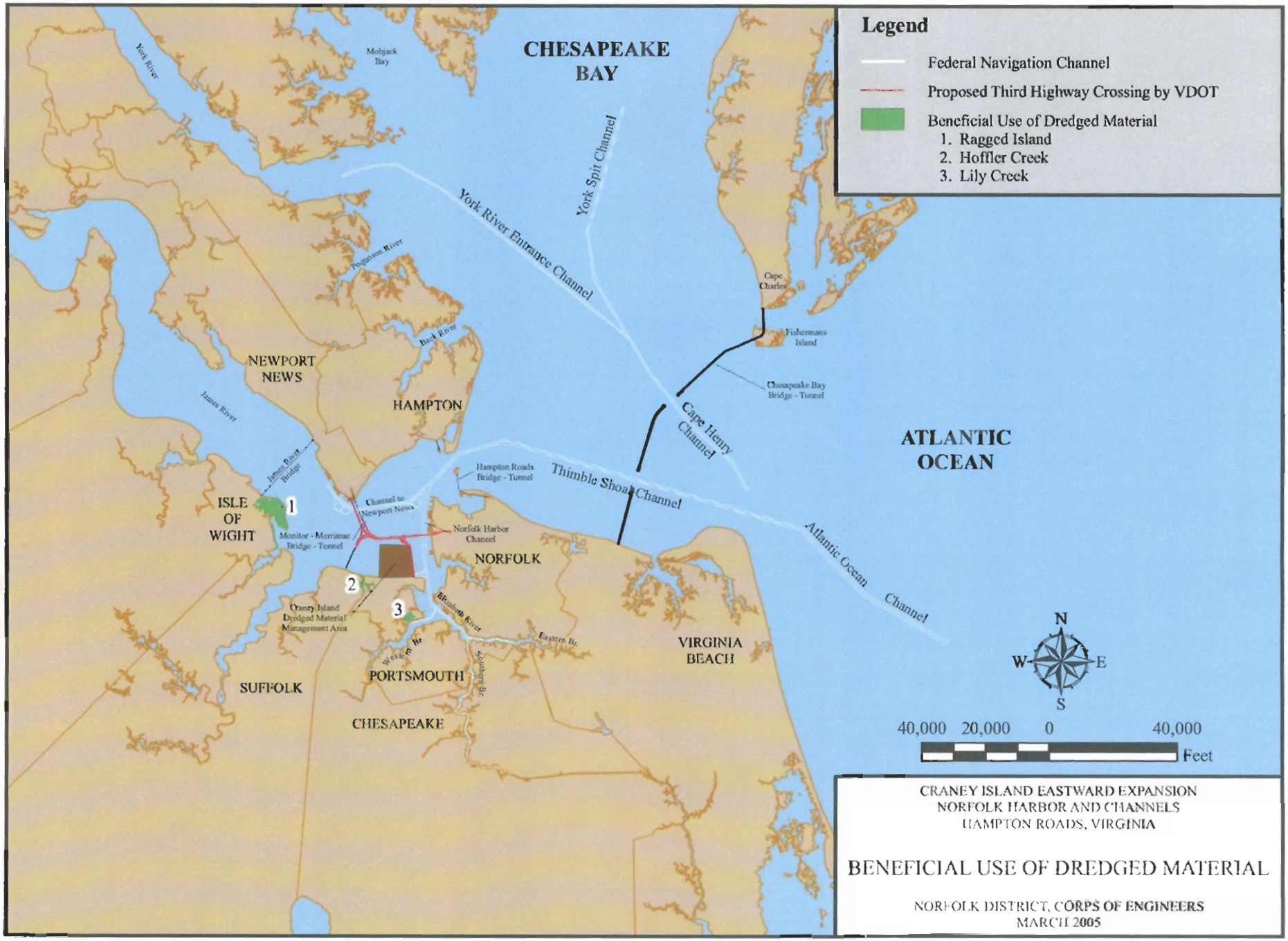
CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA
OCEAN PLACEMENT
NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 20


Legend
Federal Navigation Channel
Proposed Third Highway Crossing by VDOT
Beneficial Use of Dredged Material
1. Ragged Island
2. Hoffler Creek
3. Lily Creek
CHESAPEAKE BAY
ATLANTIC OCEAN
York River
Mobjack Bay
York Spit Channel
York River Entrance Channel
Poquoson River
Back River
NEWPORT NEWS
HAMPTON
James River
James River Bridge
ISLE OF WIGHT
Monitor - Merrimac Bridge - Tunnel
Channel to Newport News
Hampton Roads Bridge - Tunnel
Thimble Shoal Channel
Cape Henry Channel
Norfolk Harbor Channel
NORFOLK
Craney Island Dredged Material Management Area
Elizabeth River
Eastern Br.
Western Br.
Southern Br.
PORTSMOUTH
SUFFOLK
CHESAPEAKE
VIRGINIA BEACH
Atlantic Ocean Channel
Cape Charles
Fishermans Island
Chesapeake Bay Bridge - Tunnel
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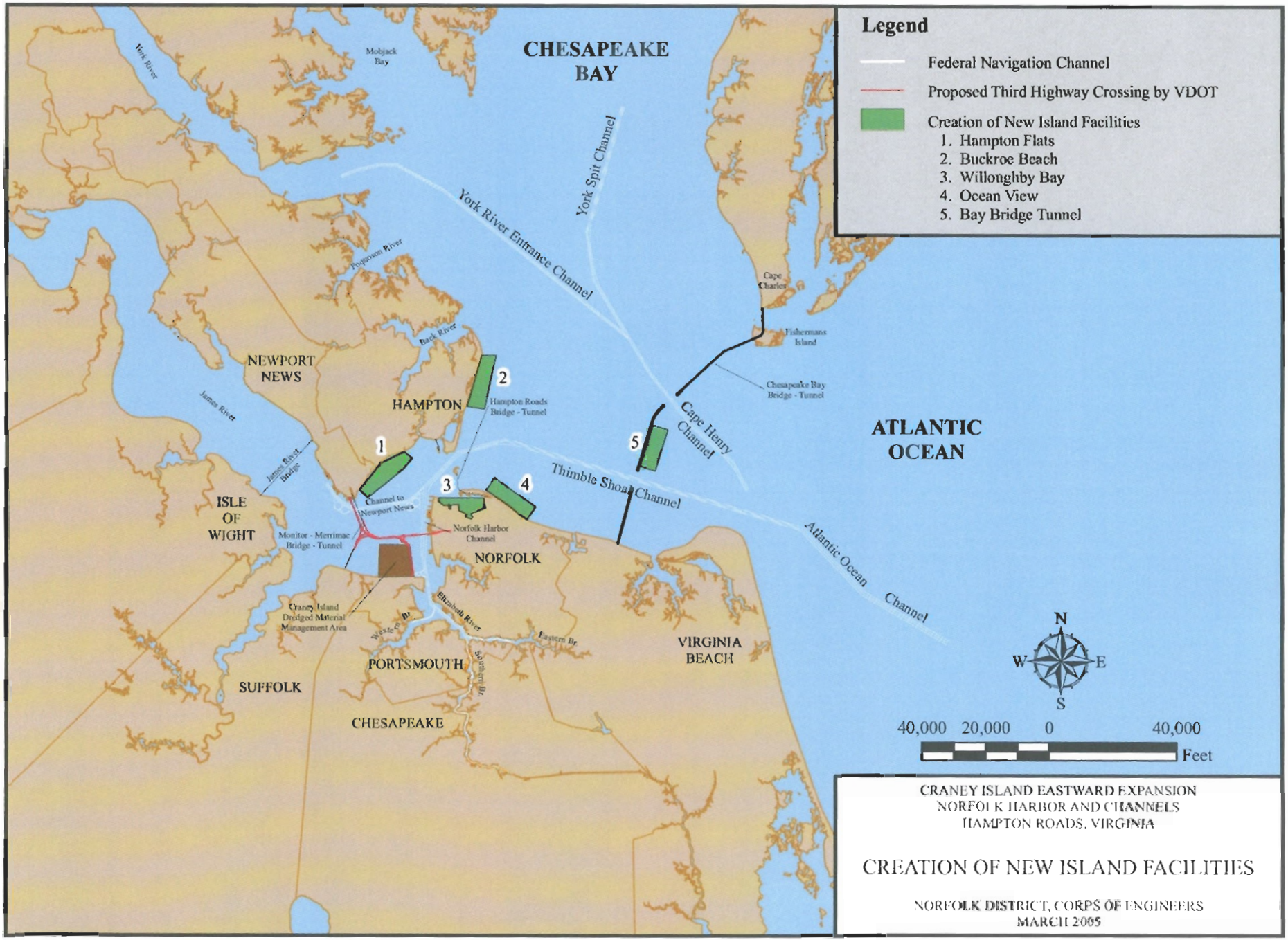
CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA
BENEFICIAL USE OF DREDGED MATERIAL
NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 21


Legend
Federal Navigation Channel
Proposed Third Highway Crossing by VDOT
Creation of New Island Facilities
1. Hampton Flats
2. Buckroe Beach
3. Willoughby Bay
4. Ocean View
5. Bay Bridge Tunnel
CHESAPEAKE BAY
ATLANTIC OCEAN
York River
Mobjack Bay
York Spit Channel
York River Entrance Channel
Poquoson River
Back River
NEWPORT NEWS
HAMPTON
James River
James River Bridge
Hampton Roads Bridge - Tunnel
Cape Charles
Fishermans Island
Chesapeake Bay Bridge - Tunnel
Cape Henry Channel
Thimble Shoal Channel
Atlantic Ocean Channel
ISLE OF WIGHT
Channel to Newport News
Monitor - Merrimac Bridge - Tunnel
Norfolk Harbor Channel
NORFOLK
Craney Island Dredged Material Management Area
Elizabeth River
Western Br.
Eastern Br.
Southern Br.
PORTSMOUTH
SUFFOLK
CHESAPEAKE
VIRGINIA BEACH
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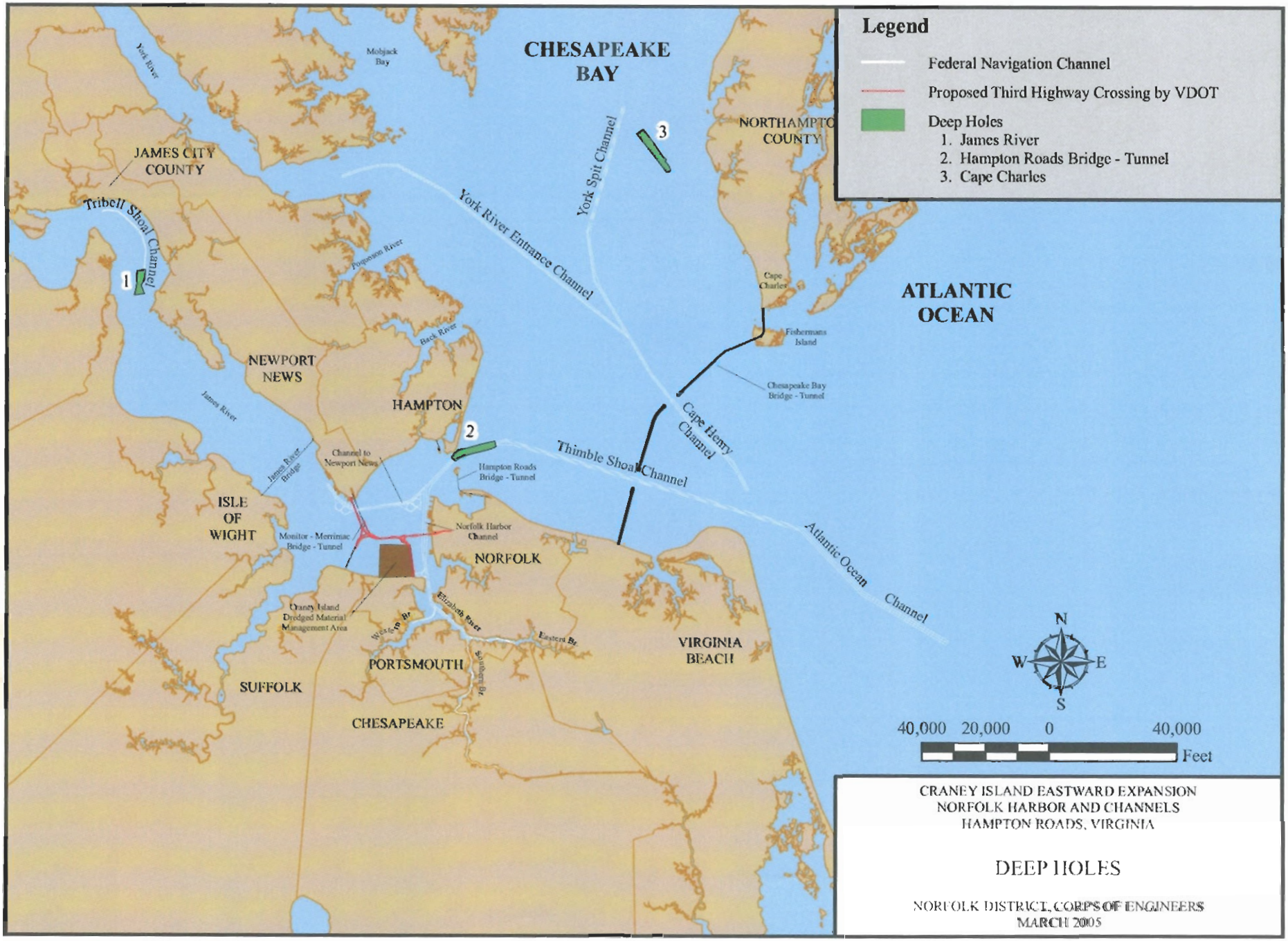
CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA
CREATION OF NEW ISLAND FACILITIES
NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 22


Legend
Federal Navigation Channel
Proposed Third Highway Crossing by VDOT
Deep Holes
1. James River
2. Hampton Roads Bridge - Tunnel
3. Cape Charles
CHESAPEAKE BAY
ATLANTIC OCEAN
JAMES CITY COUNTY
NORTHAMPTON COUNTY
NEWPORT NEWS
HAMPTON
ISLE OF WIGHT
SUFFOLK
CHESAPEAKE
PORTSMOUTH
NORFOLK
VIRGINIA BEACH
Mobjack Bay
York River
Tribell Shoal Channel
York River Entrance Channel
York Spit Channel
Poquoson River
Back River
James River
James River Bridge
Channel to Newport News
Hampton Roads Bridge - Tunnel
Thimble Shoal Channel
Cape Henry Channel
Atlantic Ocean Channel
Norfolk Harbor Channel
Monitor - Merrimac Bridge - Tunnel
Craney Island Dredged Material Management Area
Elizabeth River
Western Br.
Eastern Br.
Southern Br.
Cape Charles
Fishermans Island
Chesapeake Bay Bridge - Tunnel
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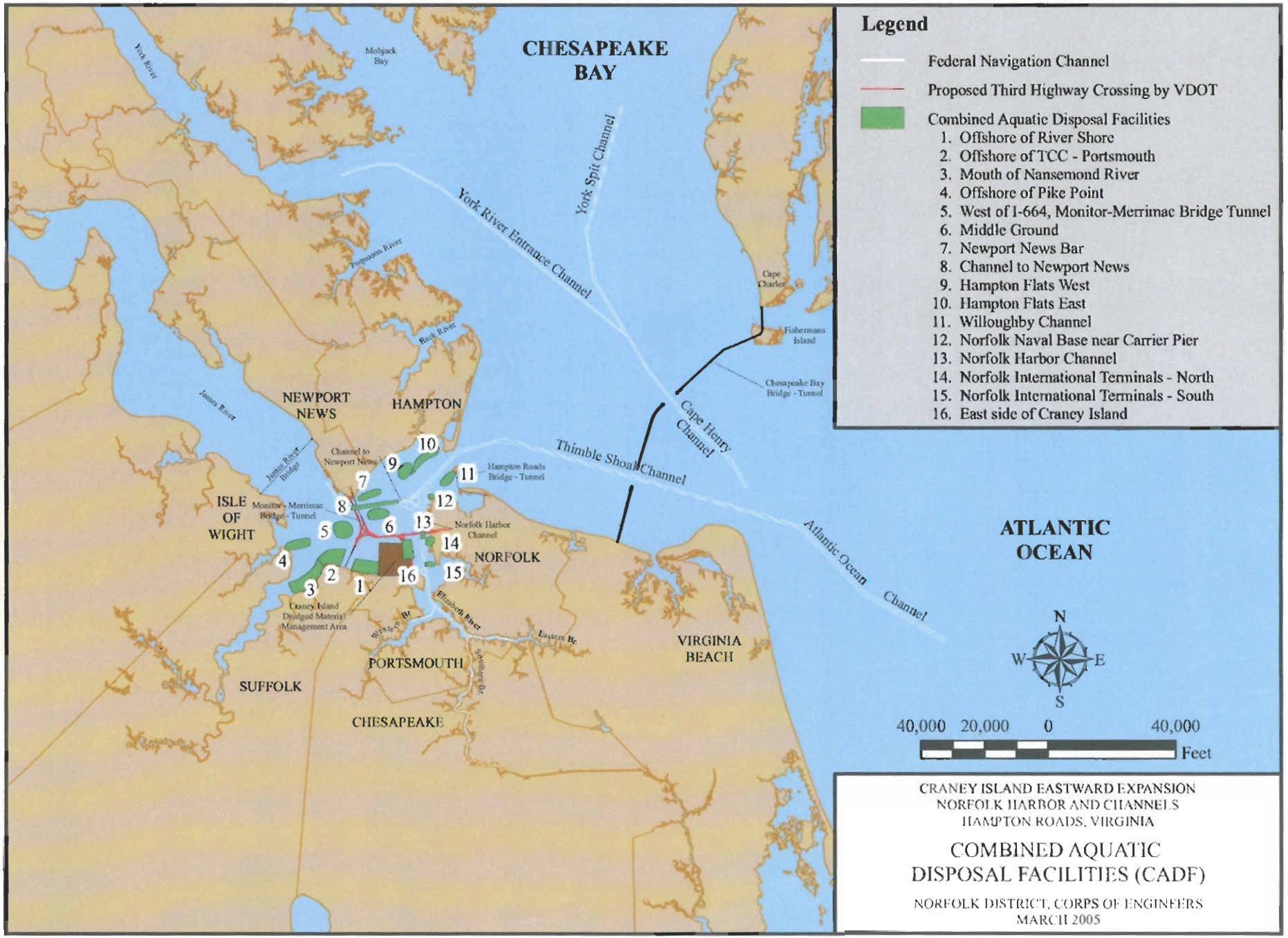
CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA
DEEP HOLES
NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 23

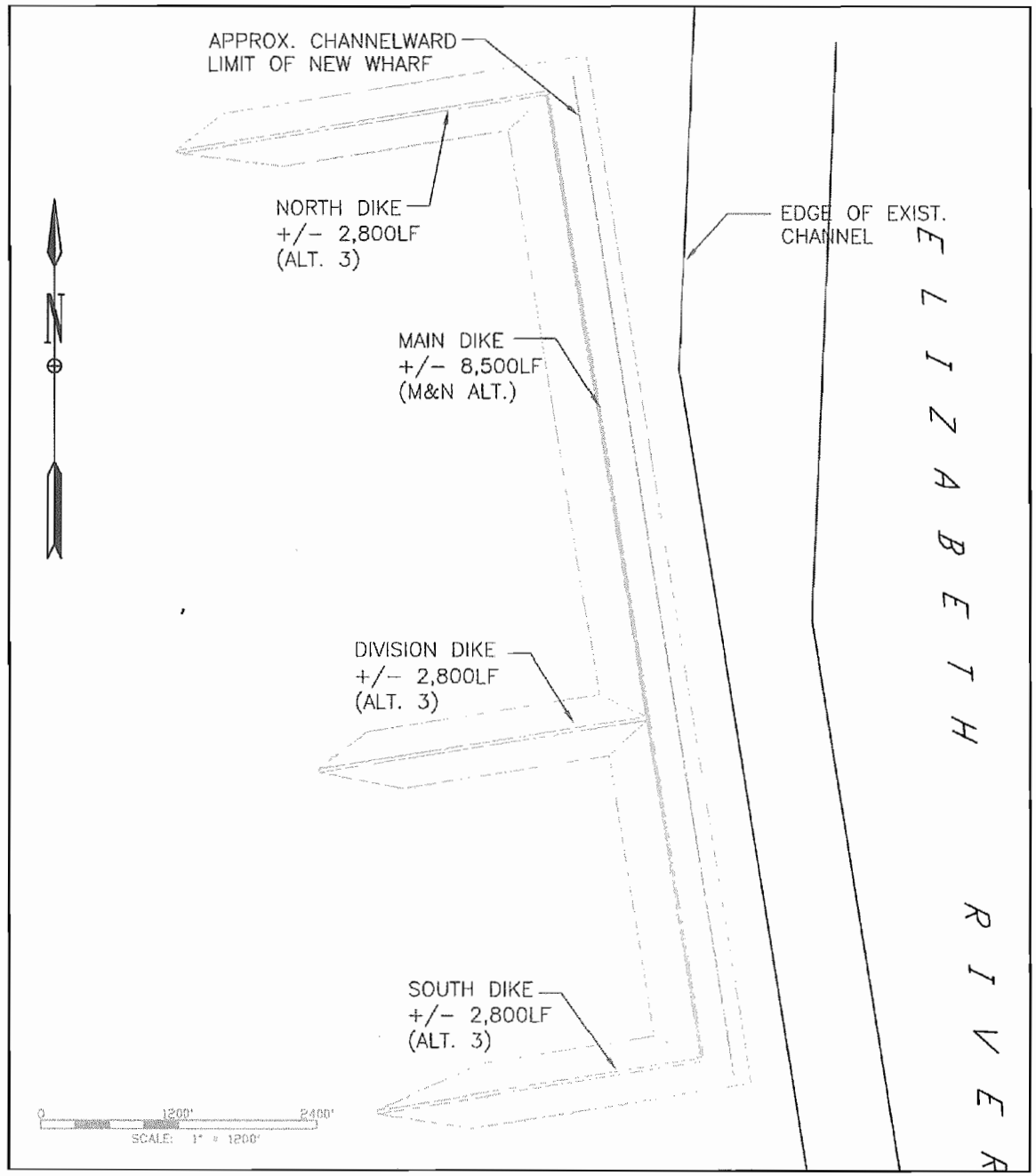


CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

COMBINED AQUATIC DISPOSAL FACILITIES (CADF)

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 24



CRANEY ISLAND EASTWARD EXPANSION
NORFOLK HARBOR AND CHANNELS
HAMPTON ROADS, VIRGINIA

DIKE LAYOUT

NORFOLK DISTRICT, CORPS OF ENGINEERS
MARCH 2005

PLATE 25