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DREDGED MATERIAL MANAGEMENT STRATEGY TAMPA BAY, FLORIDA

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Tampa Bay Estuary Program

Syllabus

The Tampa Bay Estuary Program (TBEP) document "Charting the Course For Tampa Bay" calls for development of a long-term management plan for dredged material and dredged material management in the Tampa Bay area (Action Plan item DR-1). This report is that plan. The intent of the plan is to provide information to ports, agencies, and maritime interests and to foster coordination of dredging and dredged material management to maximize shared placement and beneficial use opportunities while minimizing the environmental impacts and costs associated with these activities.

This report presents the results of three tasks, as follows: 1) develop dredged material volumes and describe dredged material quality, 2) identify existing and potential placement options, and 3) calculate the placement area capacity shortfall. The planning timeframe for the report is 25 years.

The following table summarizes the results of the three tasks:

	Volume Per Year (Cubic yards)	Volume Over 25 Years (Cubic yards)
DREDGING		
Maintenance Dredging		
All Federal channels	900,000	24,400,000
Non-Federal channels, berthing areas, private dredging	300,000	7,400,000
New Work Dredging		
All Federal channels		6,100,000
Non-Federal channels, berthing areas, private dredging		4,100,000
TOTAL	1,200,000	42,000,000
PLACEMENT (figures may not match dredging figures exactly due to rounding)		
Offshore Dredged Material Disposal Site (ODMDS)		11,800,000
CMDA 2-D		5,700,000
CMDA 3-D		14,000,000
Beach		1,800,000
Beneficial Use		4,400,000
Other (Upland, Beneficial Use)		5,800,000
TOTAL		43,500,000
SHORTFALL		
ODMDS		Unknown[1]
CMDA 2-D (without enlargement)		(4,900,000)
CMDA 3-D (without enlargement)		(10,400,000)
Beach		Unknown[1]
Beneficial Use		Unknown[1]
Other		Unknown[1]
TOTAL		(15,300,000)
Note: 1) Unknown values assumed to be equal to zero in determination of total quantities.		

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INTRODUCTION

The Tampa Bay Estuary Program (TBEP) document "Charting the Course For Tampa Bay" calls for development of a long-term management plan for dredged material and dredged material management (Action Plan Item DR-1). This report is that plan. Available information from ongoing projects serves as the data for plan generation. No extensive field data was collected for this plan.

The intent of the plan is to provide information to ports, agencies, and maritime interests and to foster coordination of dredging and dredged material management to maximize shared placement and beneficial use opportunities while minimizing the environmental impacts and costs associated with these activities. Coordinated planning among ports and industries in the Tampa Bay area will help ensure that the most environmentally sensitive and cost-effective strategies are pursued, especially in regard to long-range dredged material placement. It will allow bay managers to explore options for beneficial uses of dredged material, minimize impacts to nesting birds on existing placement islands, and promote best available technologies to reduce sediment resuspension during dredging.

This plan reflects conditions at the time it was prepared. The plan is meant to be updated and expanded as needed. The study area addressed in the plan is all of Tampa Bay (further described below). The plan is not intended to be an end in and of itself, but to provide information and foster coordination. In addition, any sites mentioned in the plan as possible depositories for dredged material must be evaluated by the customary planning and permitting processes prior to use. The intention of listing possible fill sites for habitat restoration or otherwise is to raise awareness of the existence of these sites.

Pursuant to the January 1999 Memorandum of Understanding (MOU) between the Tampa Bay Regional Planning Council and the Department of the Army, the U.S. Army Corps of Engineers (Corps) was retained "to perform the 'consultant and professional services'" defined in the agreement, with funds contributed from the U.S. Environmental Protection Agency. Pursuant to the MOU, the Corps agreed to consult with the Tampa Bay Dredged Material Advisory Committee (TBDMAC) identified in the Dredging and Dredged Material Management Action Plan of the Comprehensive Conservation and Management Plan for Tampa Bay. The Corps is to facilitate the meetings of the TBDMAC and respond to comments by individual members of the TBDMAC. Implementation of the MOU also requires coordination with governmental agencies and identification of projects that meet "conceptual" approval by the various agencies, perhaps requiring intergovernmental meetings or workshops. Regardless of the fact that the Corps' work under the MOU may involve analysis of Corps' implementation of Federal projects, the Corps' role in preparing the DMMP is in its capacity as a contractor to the Tampa Bay Regional Planning Council and as a facilitator for the

TBDMAC. Neither the meetings of the TBDMAC nor this report are for the purpose of directing the Corps with regard to its projects.

The Corps prepares Dredged Material Management Plans for Federal navigation projects in the Tampa Bay area, as well as other areas of the country, under the National Harbors Program. A Dredged Material Management Plan Preliminary Assessment for the Tampa Harbor project has been prepared and is dated December 30, 1994. A Preliminary Assessment for St. Petersburg Harbor has been prepared and is dated April 4, 1996. A Preliminary Assessment for the Intracoastal Waterway-Caloosahatchee River to Anclote River is scheduled for completion in September 2000.

This report presents the results of three tasks, as follows: 1) develop dredged material volumes and describe dredged material quality, 2) identify existing and potential placement options, and 3) calculate the placement area capacity shortfall. Each of these tasks is further defined below. The report contains a conceptual plan developed in consultation with the Tampa Bay Dredged Material Advisory Committee. Additional study of dredged material volumes and placement may be necessary for more detailed future work as this report is based on readily accessible data only.

This report considers dredging and dredged material placement projections for the next 25 years, that is, from 2000-2025. The area of interest is Tampa Bay, specifically Tampa Bay as defined for the National Estuary Program. This includes portions of Sarasota, Manatee, Polk, Pasco, Hillsborough, and Pinellas Counties. Figure 1 shows the boundary of the study area.

The average natural water depth in Tampa Bay is 12 feet. The ship channels and berths have depths up to 43 feet and must be dredged periodically to remove shoaled sediments. Regular dredging of ship channels and berths serves area ports and industries. Efficient management of the sizeable volume material dredged throughout Tampa Bay is a challenge.

The TBDMAC is the primary source of data for this plan. While the TBDMAC is open to all, the following members provided data for this plan:

- Tampa Bay Estuary Program (TBEP)
- U.S. Army Corps of Engineers (as contractor to TBEP)
- City of St. Petersburg
- TECO
- Manatee County Government
- Egmont Key Alliance
- TampaBayWatch, Inc.
- Florida Department of Environmental Protection (FDEP)
- Tampa Port Authority
- IMC-Agrico

- City of Tampa
- Board of County Commissioners, Pinellas County
- Hillsborough County

Information was also provided by the following:

- Roy R. Lewis, Lewis Environmental Services, Inc.
- Gahagan & Bryant Associates, Inc.

The format for this report is the following: after the introduction, general information refines the scopes of the three tasks identified above; then, discussion explains how the three tasks were completed; finally, conclusions summarize the main points brought out elsewhere in the text. Following the text are figures, then tables, and lastly, supplements which contain pertinent information.

TASKS

Dredged Material Volumes and Dredged Material Quality

Shoal estimates have been developed for the volume of material expected to require dredging over the next 25 years for construction or maintenance of channels in Tampa Bay. These channels include Federal channels, non-Federal channels, berthing areas, and private channels/marinas. Federal channels are channels constructed or maintained with the assistance of the U.S. Army Corps of Engineers. The Federal government funds the work at these channels in whole or in part. The work is generally classified as either new work or maintenance work. The dredging for these channels is coordinated with, and may be funded in part by, a non-Federal sponsor. Non-Federal sponsors in the Tampa Bay area include West Coast Inland Navigation District; Pinellas County; Manatee Port Authority; Board of County Commissioners, Manatee County; City of St. Petersburg; and Tampa Port Authority. Federal channels are included in the River and Harbor Projects for Intracoastal Waterway (Caloosahatchee River to Anclote River), Johns Pass, Manatee Harbor, Manatee River, Pass-A-Grille Pass, St. Petersburg Harbor, and Tampa Harbor, including Hillsboro River, Alafia River and Upper Channels. These projects are shown on Figures 2 through 11. Non-Federal channels are channels constructed or maintained without Federal funding (Figure 12). Berthing areas are those places, commonly adjacent to channels, where larger vessels are moored, loaded or discharged. Marinas are boat basins with facilities for smaller vessels.

The results of the shoal estimation are reported for each major source of dredged material (Federal channel, non-Federal channel, berthing area or private dredging) and for each major bay segment. The years in which dredging is expected to occur are listed, as are the probable methods of dredging. The physical and chemical qualities of the materials to be dredged are characterized. Project sponsors are identified.

Existing and Potential Placement Options

Capacities of existing dredged material placement sites were identified. Information is provided about each site, including the facility operator and restrictions on the types of material accepted. Estimates of the storage capacity of new disposal sites and planned expansions to existing facilities are compiled. Relevant information is provided on each site. Potential fill sites, including beneficial use sites, are identified. Quantities of fill required, fill material quality and potential permitting or logistic problems are identified. The acceptability of the potential sites is commented on, with a focus on permitting, logistical and cost issues. Agencies requested to comment on the potential sites are U.S. Army Corps of Engineers, FDEP, TPA Sovereign Lands Division, Florida Game and Freshwater Fish Commission, Southwest Florida Water Management District, and local government environmental management agencies.

Capacity Shortfall

The anticipated shortfall in placement area capacity was estimated for the next 25 years. In assessing the shortfall, the cost of using particular placement sites in relation to the point of the dredged material production is considered.

All data collected for this DMMP and all calculations performed to determine the shortfall are found in Tables 1-12. The numbers in the tables have been rounded for simplicity where possible. The numbers presented in the following text are generally further rounded for ease of reading.

Conceptual Plan

A conceptual plan is presented to meet placement needs for the 25-year planning timeframe. An effort is begun to build consensus on projects meeting conceptual approval from permitting agencies by listing such projects in tables accompanying this plan. The projects on the list should, as a goal, meet U.S. Army Corps of Engineers requirements for dredged material placement.

DISCUSSION

Dredged Material Volumes and Description of Dredged Material Quality

Methodology. Tables 1-8 show dredged material volumes, characteristics, and other pertinent information for maintenance and new work dredging. **Table 1** lists shoal estimates for maintenance dredging for the Federal channels in the study area. Channels are identified by Federal project name. The Tampa Harbor project is further described by reach. The shoaling estimates are given as per year averages and are then projected until 2025. Three sets of shoaling estimates are provided for comparison purposes. One set is average shoal estimates computed from data in the Jacksonville District dredging history database. The second is shoal estimates from the Corps' 1993 Disposal Area Study (DAS). Note that the DAS does not cover the Intracoastal Waterway, Manatee Harbor, Manatee River, St. Petersburg Harbor, John's Pass, or Pas-A-Grill Pass projects. The shoaling estimates shown under the columns for the dredging history database for the Tampa Harbor Project reaches are based on dredging events since 1990 for comparison with the shoal estimates computed for the DAS. The DAS uses information available at the end of 1992. The two-year overlap is to take into consideration the delay in recording dredging events in official District records since some time may elapse between the date a dredging event physically ends and the date the contracting and reporting procedure is complete. That is to say, the two-year overlap is intended to take into consideration dredging events in the early 1990s for which information may not have been available when the DAS was completed. The third set of shoaling estimates is taken from the Tampa Port Authority's Dredged Material Management Plan dated October 1998. Note that this plan only covers the Tampa Harbor Project. Wherever possible the quantities used in the shoaling analysis computed from the District database are pay quantities, as opposed to bid volumes. Bid volumes are typically estimated based on surveys taken prior to dredging and include a projected shoaling quantity to account for material that settles in an area to be dredged between the time the surveys are collected and the dredging is accomplished. Pay quantities are determined subsequent to dredging and may be more accurate estimates of the quantity of material removed since they are computed after dredging has taken place. Seddon Channel is listed in this table and in Table 5 without a quantity for removal since this channel was deauthorized in the Water Resources Development Act of 1981 from a width of 300 feet to 200 feet and from a depth of 30 feet to 12 feet. The turning basin at the junction of the Hillsborough River, Seddon Channel, and Garrison Channel was deauthorized in the Water Resources Development Act of 1986. The section of Garrison Channel between the bridges has also been deauthorized. This channel is not listed in the tables under the Federal projects.

The total annual shoaling estimate for maintenance material for all of the Federal projects in the study area, based on the District dredging history database, is approximately 938,000 cubic yards. For the Tampa Harbor Project alone it is 828,000 cubic yards. The DAS total annual shoaling estimate (Tampa Harbor Project only) is approximately 873,000 cubic yards. The total annual shoaling estimate computed using data from the Tampa Port Authority's dredged material management plan for the Tampa Harbor Project is 731,000 cubic yards. Thus, the range in yearly amounts of maintenance material removed from the Tampa Harbor Project is 731,000-828,000 cubic yards. A conservative, rounded figure for the total volume of material maintenance dredged from all Federal channels in the study area is 900,000 cubic yards per year. For the Tampa Harbor Project it is 800,000 cubic yards per year.

Until the end of the year 2025, approximately 24,400,000 cubic yards of material are projected to be maintenance dredged from Federal channels in the study area.

Table 2. Table 2 lists shoal estimates for maintenance dredging for non-Federal channels, berthing areas, and private dredging locations (by county) in the study area. The shoaling estimates are given as per year averages and are then projected for the next 25 years. Data for the shoal estimation for non-Federal channels, berthing areas, and private dredging come from several sources, including the Jacksonville District dredging history database (since berthing areas are often dredged under the same contract that adjacent channels are dredged [and funded in whole by non-Federal parties]), the Tampa Port Authority Dredged Material Management Plan, various District reports and dredging plans and specifications, and the members of the TBDMAC.

The total annual shoaling estimate for non-Federal channels, berthing areas, and private dredging locations is approximately 300,000 cubic yards. Up to the end of the year 2025 the total shoaling estimate for non-Federal channels, berthing areas, and private dredging locations is approximately 7,400,000 cubic yards.

Combining all the maintenance dredging, approximately 1,200,000 cubic yards of maintenance material is removed from the study area waterbodies per year. This is 31,800,000 cubic yards over the next 25 years.

Table 3. Table 3 lists known new work Federal dredging projects expected to occur in the Tampa Bay area. New work Federal dredging usually consists of widening or deepening an existing Federal channel or enlarging another project feature such as a turning basin. Proposals for new work Federal dredging come from the non-Federal sponsors of navigation projects on a fairly steady basis. Undoubtedly additional studies will be undertaken for enlargement of Federal projects during the next 25 years. The total amount of dredged material anticipated to be removed from known new work Federal construction projects is about 6,100,000 cubic yards.

The Federal government is in the planning stage or in the preconstruction, engineering, and design stage for the following projects: Tampa Harbor project-Port Sutton Terminal Channel, Ybor Turning Basin, Alafia River; Manatee Harbor Project; Big Bend Channel. The following new work has been authorized but is not scheduled for construction or is in the pre-planning stage: St. Petersburg Harbor (deepening); Tampa Harbor anchorage area (construction). Details on the anchorage area study are not available yet, however, this study would focus on relieving traffic congestion in the existing Tampa Harbor project.

Table 4. Table 4 lists new work dredging projects expected to occur within the planning timeframe in channels that are presently non-Federal, in berthing areas

and in other private locations. The total amount of dredged material anticipated to be removed from new work non-Federal, berthing area, and private construction projects is about 4,100,000 cubic yards.

The total volume of dredged material projected to be removed during new work dredging for all areas of Tampa Bay included in this study is approximately 10,200,000 cubic yards.

Thus, the total volume of dredged material expected for removal in the period 2000-2025 as a result of maintenance dredging or new work dredging is 42,000,000 cubic yards.

Table 5. Table 5 (four pages total) shows the years each waterbody identified in Table 1 is expected to be maintenance dredged over the planning period 2000-2025, along with the amount of material expected to be removed. The average annual shoaling rates used to compute the volumes removed are taken from the sources shown in Table A. The frequencies of removal are taken from the sources shown in Table B.

Table A Average Annual Shoaling Rate Sources	
Segment	**Source**
Egmont 1	Dredging history database
Egmont 2	Assumed to be included in Egmont 1 amount
Mullet Key	Assumed to be included in Egmont 1 amount
Cut A	DAS
Cut B	DAS
Cut C	DAS
Cut D	DAS
Cut E	DAS
Cut F	DAS
Cut G	Dredging history database
Cut J	Dredging history database-assumed to be included in Cut G amount
Cut J2	Dredging history database-assumed to be included in Cut G amount
Cut K	Dredging history database-assumed to be included in Cut G amount
Gadsen Point Cut	Dredging history database
Cut A (Hillsborough Bay)	Dredging history database
Cut C (Hillsborough Bay)	Dredging history database
Port Sutton Channel and Turning Basin	Dredging history database
East Bay	Dredging history database
Cut D (Hillsborough Bay)	Dredging history database
Sparkman Channel	Dredging history database
Ybor Channel	Dredging history database
Seddon Channel	Not expected to be dredged (deauthorized to 12 foot project depth)
Alafia River	Dredging history database
Intracoastal Waterway	Dredging history database
Manatee Harbor	Dredging history database
Manatee River	None available
St. Petersburg Harbor	Dredging history database
John’s Pass	Dredging history database
Pas-A-Grill Pass	Dredging history database
Big Bend	1996 Feasibility Report
Port Sutton Terminal Channel	1991 General Design Memorandum
Blind Pass	1992 Inlet Management Plan
Big Bend Berthing Areas	TBDMAC
Intracoastal Waterway Berthing Areas	None available
Manatee Harbor Berthing Areas	Dredging history database
Manatee River Berthing Areas	None available
Port Sutton Terminal Channel Berthing Areas	TBDMAC
St. Petersburg Harbor Berthing Areas	None available
Tampa Harbor Berthing Areas	Tampa Port Authority 1998 DMMP
John’s Pass Berthing Areas	None available
Pas-A-Grill Pass Berthing Areas	None available
Hillsborough County	TBDMAC
Manatee County	TBDMAC
Pinellas County	TBDMAC
St. Petersburg County	TBDMAC
Miscellaneous	TBDMAC

Table B Frequency of Removal Sources	
Segment	**Source**
Egmont 1	Jacksonville District 5-year O&M schedule[1]
Egmont 2	Included with Egmont 1
Mullet Key	Included with Egmont 1
Cut A	Jacksonville District 5-year O&M schedule[1]
Cut B	Included with Cut A
Cut C	Included with Cut A
Cut D	Included with Cut A
Cut E	Included with Cut A
Cut F	Included with Cut A
Cut G	Jacksonville District 5-year O&M schedule[1,2]
Cut J	Included with Cut G
Cut J2	Included with Cut G
Cut K	Included with Cut G
Gadsen Point Cut	Based on a 10-year schedule with last event in 1992[3]
Cut A (Hillsborough Bay)	Jacksonville District 5-year O&M schedule[1]
Cut C (Hillsborough Bay)	Included with Cut A (Hillsborough Bay)
Port Sutton Channel and Turning Basin	Based on a 5-year schedule with last event in 1999[2]
East Bay	Based on a 5-year schedule with last event in 1999[2]
Cut D (Hillsborough Bay)	Included with Cut A (Hillsborough Bay)
Sparkman Channel	Assumes maintenance dredging at time of new work construction in Ybor Turning Basin, then 5-year maintenance events
Ybor Channel	Included with Sparkman Channel
Seddon Channel	Project deauthorized to –12'MLW, not expected to be maintenance dredged in planning timeframe
Alafia River	Jacksonville District 5-year O&M schedule[1]
Intracoastal Waterway	Jacksonville District 5-year O&M schedule[1]
Manatee Harbor	Jacksonville District 5-year O&M schedule[1]
Manatee River	Not expected to be dredged
St. Petersburg Harbor	Jacksonville District 5-year O&M schedule[1]
John's Pass	Jacksonville District 5-year O&M schedule[1]
Pas-A-Grill Pass	Based on frequency of past events as given in Jacksonville District dredging history database
Big Bend	Based on a 3-year cycle as provided by TBDMAC
Port Sutton Terminal Channel	Based on a 3-year cycle as provided by TBDMAC
Blind Pass	Dredging history in Inlet Management Plan indicates a 5-year interval, last dredging in 1990
Big Bend Berthing Areas	Based on a 3-year cycle as provided by TBDMAC
Intracoastal Waterway Berthing Areas	No information available
Manatee Harbor Berthing Areas	No information available
Manatee River Berthing Areas	Not expected to be dredged
Port Sutton Terminal Channel Berthing Areas	Based on a 3-year cycle as provided by TBDMAC
St. Petersburg Harbor Berthing Areas	No information available
Tampa Harbor Berthing Areas	No information available
John's Pass Berthing Areas	No information available
Pas-A-Grill Pass Berthing Areas	No information available
Hillsborough County	Information provided by TBDMAC
Manatee County	Information provided by TBDMAC
Pinellas County	No information available
St. Petersburg County	Information provided by TBDMAC
Miscellaneous	Information provided by TBDMAC
Notes: 1. This schedule is subject to funding and, therefore, change. 2. Five years is assumed to be the dredging interval unless available information dictates otherwise. 3. Ten years is assumed to be the maximum dredging interval, unless otherwise noted.	

The total amount of material to be removed during all maintenance events is about 33,300,000 cubic yards. This figure is not too far off from the 31,800,000 cubic yards calculated for removal during maintenance events over the next 25 years using the yearly removal amounts from Tables 1 and 2. Approximately 26,400,000 cubic yards of the total of 33,300,000 cubic yards is from Federal channels (79%); the remaining 6,900,000 cubic yards from non-Federal channels, berthing areas, and private locations (21%).

Table 6. Table 6 lists the probable methods of dredging for each major bay segment. The information contained in this table is historic in origin, that is, it is based on methods used in the past. Many factors contribute to the selection of one dredging method. Among these factors are the physical characteristics of the material to be dredged, the quantity of material to be removed, the dredging depth, the distance to the placement area, the physical environment of and between the dredging and placement areas, the contamination level of the sediments, the method of placement, the production required, and the types of dredges available. Probable methods of dredging are often dictated as a permit condition. For example, the permit issued by FDEP for maintenance dredging in Upper Hillsborough Bay restricts dredging activities to hydraulic (specific condition number 4).

Dredging equipment employs either mechanical or hydraulic means to remove sediment from a specific location. There are three principal types of dredges, as follows: hydraulic pipeline types (cutterhead, dustpan, plain suction, and sidecaster), hopper dredges, and mechanical types (clamshell and dipper). The sediment is then transported to a placement location. Transportation methods generally include pipelines, barges or scows, and hopper dredges. Pipeline transport is associated with hydraulic dredges. Barges and scows are associated with mechanical dredging. Hopper dredges transport dredged material in self-contained hoppers. Additional information on dredging is found in the U.S. Army Corps of Engineers' document entitled, "Dredging and Dredged Material Placement" (Engineer Manual [EM] 1110-2-5025). This document is available on the Internet at the following address: http://www.usace.army.mil/inet/usace-docs.

Sediment resuspension during dredging may impact biological resources. Resuspension of contaminated sediment during dredging may also be a concern. Studies have been conducted to address resuspension (McLellan et al., 1989; Cullinane et al., 1986). In general, hydraulic dredging uses large quantities of water to remove and transport sediment. Water may make up 80 or 90% of the slurry resulting from hydraulic dredging. This is more of a concern during placement than removal, particularly if the placement is in a confined upland area. On the other hand, the concern for resuspension during mechanical dredging may be greater during removal than placement as turbidity can be created when water rushes into the space created as material is removed by the bucket (clamshell) and as the bucket is lifted up through the water. Sediment resuspension can be minimized at the excavation site or at the placement site. The following excavation site controls and operational techniques can be used to minimize turbidity: cutterhead rotation speed, depth of cut, swing speed, and clamshell bucket descent speed (McLellan et al., 1989; Cullinane et al. 1986). Among placement site controls are turbidity containment technologies such as cofferdams, dikes, sediment traps, and silt curtains. The U.S. Army Corps of Engineers has developed two computer models to address sediment resuspension; STFATE (Short Term FATE), a dredged material fate model required for open water placement consideration (for example, placement by split hull barge), and LTFATE (Long Term FATE), a dredged material fate model that addresses stability of dredged material after placement. The U.S. Army Corps of Engineers Technical Note DOER-E6, 'Estimating Dredging Sediment Resuspension Sources', is found with the supplemental information at the end of this report. The technical note addresses sediment resuspension sources and their estimation for input into a third model called SSFATE (Suspended Sediment FATE). This model computes suspended sediment plumes resulting from a dredging operation, for example, a clamshell dredge. Sediment resuspension is another topic covered in EM 1110-2-5025. Two pages discussing sediment resuspension have been extracted from the EM and are found in the supplemental information section at the end of this document. Sediment resuspension is addressed by the FDEP as a dredging permit condition requiring turbidity controls and monitoring so that a turbidity level of 29 NTUs (turbidity units) over background levels is not exceeded. Turbidity is further discussed below.

Table 7. The intention of Table 7 is to identify the physical and chemical qualities of the material to be removed. The chemical qualities are presented in the table as flagged chemicals of concern, those chemicals identified during testing as significant in light of the analyses performed, or as 'no chemicals of concern identified'. References to laboratory reports or websites giving information pertinent to the specific testing events are included in the table if they are available. Contact persons are listed if they have been identified.

The primary tool used by the Corps of Engineers for testing of material to be dredged is the testing manual entitled, 'Evaluation of Dredged Material Proposed for Ocean Disposal' (EPA 503/8-91/001 February 1991). The following three paragraphs are excerpted from this manual. The entire manual can be found on the Environmental Protection Agency's website at the following address: www.epa.gov/owow/oceans/gbook.

> This manual, commonly referred to as the "Green Book," is an update of *Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters* (EPA/USACE, 1977). The manual contains technical guidance for determining the suitability of dredged material for ocean disposal through chemical, physical, and biological evaluations. The technical guidance is intended for use by dredging applicants, laboratory scientists, and regulators in evaluating dredged-material compliance with the United States Ocean Dumping Regulations.

> Integral to the manual is a tiered-testing procedure for evaluating compliance with the limiting permissible concentration (LPC) as defined by the ocean-dumping regulations. The procedure comprises four levels (tiers) of increasing investigative intensity that generate information to assist in making ocean-disposal decisions. Tiers I and II utilize existing or easily acquired information and apply relatively inexpensive and rapid tests to predict environmental effects. Tiers III and IV contain biological evaluations that are more intensive and require field sampling, laboratory testing, and rigorous data analysis.
>
> This manual provides National technical guidance for use in making LPC compliance determinations for proposed discharges of dredged material; it does not provide comprehensive guidance on other factors that should be considered during the sediment-evaluation process. Decision-making, involving the evaluation of regulations and local policies, site conditions, and project-specific management actions to limit environmental impacts, is addressed in other Environmental Protection Agency (EPA)/United States Army Corps of Engineers (USACE) guidance manuals.

A water quality parameter of potential concern during dredging is turbidity. The Florida surface water quality criterion for turbidity is less than or equal to 29 nephelometric turbidity units above natural background conditions (Florida Administrative Code 62-302.530). This criterion holds for all classes of water. The classes follow:

CLASS I Potable Water Supplies
CLASS II Shellfish Propagation or Harvesting
CLASS III Recreation, Progagation and Maintenance of a Healthy,
Well-Balanced Population of Fish and Wildlife
CLASS IV Agricultural Water Supplies
CLASS V Navigation, Utility and Industrial Use

“Natural background” means the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department of Environmental Protection. The establishment of a natural background for an altered waterbody may be based upon a similar unaltered waterbody or on historical pre-alteration data (62,302.400, F.A.C.).

Turbidity is defined by the American Public Health Association as an “expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample”. There are several units in which turbidity is measured, including jackson turbidity units, turbidity units, and nephelometric turbidity units (NTU). Turbidity standards have been made from many substances, including silica, Fuller’s earth, diatomaceous earth, acid-washed stream bed sediment, and formazin. The recognized measurement at present is NTU and the standard is a formazin suspension. Equipment used to measure turbidity includes the turbidimeter, the spectrophotometer, and submersible-sensor instruments such a multiparameter instrument with a turbidity sensor. There are USEPA-approved specifications for turbidity instruments and the U.S. Geological Survey's publication "Techniques of Water-Resources Investigations" Book 9 describes turbidity equipment and supplies. A complete listing of the books in the TWRI series is available on-line at the following address: http://oregon.usgs.gov/pubs_dir/twri-list.html.

An example of a specific FDEP permit condition, from a permit issued to the Corps, requiring turbidity monitoring follows. This is the type of turbidity monitoring typically performed for Corps dredging jobs.

> *Turbidity in Nephelometric Turbidity Units shall be measured twice daily (am and pm, at least 4 hours apart) during dredging according to the following plan. All measurements shall be made on site as soon as possible after the samples are collected.*
>
> *Dredging Site:*
>
> *Compliance—one (1) sample at each of two (2) depths (surface and mid-depth) at a point 150 meters downcurrent from the dredge within the densest portion of any visible turbid plume.*
>
> *Background—one (1) sample at a point at least 500 meters up-current of the area influenced by the dredging operation and away from any visible turbid plume.*
>
> *Disposal Site:*
>
> *Compliance—one (1) sample at each of two (2) depths (surface and mid-depth) at a point 150 meters downcurrent from the outfall of the disposal site within the densest portion of any visible turbid plume.*
>
> *Background—one (1) sample at a point at least 500 meters up-current of the area influenced by the outfall of the disposal site and away from any visible turbid plume.*
>
> *After Violations:*
>
> *If a turbidity violation is noted, sampling after corrective actions have been taken is required at the site of the violation (dredging or disposal). The samples shall be taken in the same manner as the routine monitoring and at the same locations at 2-hour intervals until the samples indicate no violation is present.*
>
> *If monitoring shows turbidity at any of the compliance stations exceeds that of the background station by more than 29 NTUs, all appropriate actions shall be taken to reduce turbidity to below this level. The actions taken shall include dredge shut down if necessary. Any such occurrence shall also be immediately reported to the Department of Environmental Protection.*

Table 8. Table 8 correlates dredging locations with their project sponsors. All Federal navigation projects have a non-Federal sponsor to participate in decision making and to assist in funding the project, if cost sharing is required.

The data presented in Tables 1-8 are meant to be revised in the event additional historical data becomes available and as more dredging events occur.

There is quite a bit of uncertainty in the data used to generate the shoaling estimates presented in Tables 1-8. Federal dredging records and data collections are improving with time and uncertainty will be lessened in the future as accuracy and thoroughness in recordkeeping advance. For this reason it is recommended that this plan be updated from time to time. Non-Federal dredging records (including non-Federal channels, berthing areas, and private areas) were scarcer and therefore the data presented in this plan may not be comprehensive. Undoubtedly more dredging of marinas takes place than that given in this plan. Better estimates of shoaling will be produced from better (more) non-Federal (channels, berthing areas, and marinas) data. The City of Tampa is developing a Residential Canal Dredging manual for the City of Tampa canals and lagoons on Davis Island and the Westshore area. Information contained in this manual may contribute to a better estimate of shoaling in private areas. A copy of a portion of the draft manual is included in the supplemental information section of this report. According to page 3 of the draft manual approximately 387,700 cubic yards of material require removal from the canals. The canals are identified in the tables following this text, however, the specific volume is not included in the calculations for shoaling since not enough information was available to permit computation of a shoaling rate or identification of a removal schedule.

Existing and potential placement options

Dredged material placement is categorized as open-water placement, confined (diked) placement, or placement for beneficial use. Open-water placement occurs in rivers, lakes, estuaries, or oceans. Some types of open-water placement are submerged discharge, lateral containment, thin-layer placement, and capping and contained aquatic placement. Confined placement occurs in diked areas located nearshore or upland. Beneficial use placement is intended to serve a productive use. Beneficial use placement can be open-water, confined, or unconfined placement. Examples of beneficial use placement are beach nourishment, habitat restoration/enhancement (wetland, upland, island, aquatic sites for use by waterfowl and other birds), aquaculture, parks and recreation, agriculture, forestry, and horticulture, strip mine reclamation, landfill cover, shoreline stabilization and erosion control (fills, artificial reefs, nearshore berms), construction and industrial use (port development, airports, urban, and residential), and material transfer (fill, dikes, levees, parking lots, roads). The U.S. Army Corps of Engineers' Engineer Manual entitled, "Beneficial Uses of Dredged Material" (EM 1110-2-5026) contains detailed information on each of these types of beneficial use. This document is available on the Internet at the following address: http://www.usace.army.mil/inet/usace-docs.

The proceeding discussion on beneficial use of dredged material is conceptual, however, the Corps has three programs under which it studies and constructs projects intended to benefit the environment. These three programs are the following:

1. Section 204 of the Water Resources Development Act of 1992, *as amended*

Section 204 gives the Secretary of the Army the authority to enter into cooperative projects with non-Federal sponsors to use dredged material from new or existing Federal projects to protect, restore, or create aquatic and ecologically related habitats, including wetlands. The environmental, economic, and social benefits, monetary and non-monetary, must justify the costs, and the project must not result in environmental degradation. The cost sharing (25% non-Federal, 75% Federal) would be applied to the incremental cost above the least cost method of dredged material disposal consistent with engineering and environmental criteria.

2. Section 206 of the Water Resources Development Act of 1996

Section 206 authorizes the Secretary of the Army to carry out aquatic ecosystem restoration projects that will improve the quality of the environment, are in the public interest, and are cost-effective. Individual projects are limited to $5 million in Federal cost. Non-Federal interests must contribute 35% of the cost of construction and 100% of the cost of operation, maintenance, replacement, and rehabilitation. The program has an annual program limit of $25 million. This program received initial funding of $6 million in fiscal year 1998.

3. Section 1135 of the Water Resources Development Act of 1986, as amended

The Corps of Engineers has the authority to make modifications to the structures and operations of water resources projects constructed by the Corps of Engineers to improve the quality of the environment. The primary goal of these projects is ecosystem restoration with an emphasis on projects benefiting fish and wildlife. To qualify under this program, projects must be justified—that is, the benefits resulting from constructing the project both monetary and non-monetary must justify the cost of the project. The project also must be consistent with the authorized purposes of the project being modified, environmentally acceptable, and complete within itself. Each separate project is limited to a total cost of not more that $5 million, including studies, plans and specifications, and construction.

Tables 9 through 11 list placement sites in the Tampa Bay area for dredged material and give some information on site owners, site operators, site capacities, and restrictions on material acceptable for placement at the sites. For many sites capacity estimates are unknown. Sites listed as potential fill sites are included in this report to indicate they have been given consideration as components of habitat restoration projects. Any sites mentioned in the plan as possible depositories for dredged material must be evaluated by the customary planning and permitting processes prior to construction. The intention of listing possible fill sites for habitat restoration is to raise awareness of the existence of these sites.

U.S. Army Corps of Engineers policy (Engineer Regulation 1105-2-100) addresses placement of dredged material on beaches as follows:

> Construction and maintenance dredging of Federal navigation projects shall be accomplished in the least costly manner possible (Engineer Regulation 1130-2-307). When placement of dredged material (beach quality sand) on a beach is the least costly acceptable means for disposal, then such placement is considered integral to the project and cost shared accordingly. In cases were [sic] placement of dredged material on a beach is more costly than the least costly alternative, the corps may participate in the additional placement costs when (1) requested by the state; (2) the Secretary of the Army considers it in the public interest; and (3) the added cost of disposal is justified by hurricane and storm damage benefits (see Section IV). When all local cooperation requirements are met the Corps may cost share the additional costs 50 percent (Section 933, WRDA 1986, as amended). In cases where the additional costs for placement of the dredged material is not justified, the Corps may still perform the work if the State requests it, and the state or other sponsor contributes 100 percent of the added cost. If the State requests, the Corps may enter into an agreement with a political subdivision of the State to place the sand on its beaches, with the subdivision responsible for the additional costs. The Corps should consider and accommodate to the degree reasonable and practicable a state's or subdivision's schedule For providing its cost share. Each placement event should be supported by a separate decision document. Subsequent decision reports may be supplements to the original Section 933 decision document.

The U.S. Army Corps of Engineers has made a commitment to consider for placement on Egmont Key any beach quality dredged material removed from Federal projects in the Tampa Bay area if to do so is economical and environmentally sound. Cost sharing partners will be sought to assist in funding such an effort if necessary. Cost sharing may involve funding added costs over those for the least cost placement method. Documentation of the Jacksonville District's commitment to place beach quality material on Egmont Key is included at the end of this report. Historically, beach quality material has not been available from the Tampa Harbor project for placement on Egmont Key from locations that are cost-effective.

Beach quality material is removed from the St. Johns Pass and Pass-A-Grill Pass Federal navigation projects and placed on Pinellas County beaches as the least cost placement method. The policy cited above is not used in these cases since beach placement is the least cost placement method. The policy is, however, available for use if beach quality material is available and beach placement is not the least cost method. This may be the case for some of the upper reaches of the Tampa Harbor project, for example, Cut C, and it is recommended that this and other possible cases be studied and beach placement implemented where possible.

Table 9. Table 9 lists existing placement sites. The sites that receive material from Federal projects are the ocean dredged material disposal site (ODMDS), the nearshore confined dredged material placement area known as 2-D, the nearshore confined dredged material placement area known as 3-D, an upland placement area owned by Port Manatee, and the Pinellas County beaches, which have in the past received beach quality material. Sites receiving material from non-Federal projects include Cargill's Alafia River Site 'C', and the Big Bend sites IMC/Agrico, TECO DA-1, and TECO DA-5.

The ODMDS is located approximately 21 miles west of Tampa, in the Gulf of Mexico (Figure 13). It was designated as an EPA-approved ocean placement site for the placement of suitable dredged material on Thursday, May 11, 1995. The final site designation is found at the end of this report. The final Environmental Impact Statement for the ODMDS was prepared by EPA and is dated September 1994. Designation of the ODMDS as EPA-approved provides an environmentally acceptable option for the ocean placement of dredged material. However, all placement activities are evaluated by the Corps on a case-by-case basis. Management of the site is a responsibility of the Corps and the EPA. The Corps issues permits to private applicants for ocean placement while the EPA assumes overall responsibility for site management. Before material can be placed in the ODMDS a permit must be issued for placement. Dredged material must be deemed suitable for placement in the site. The site is not restricted to Federal use only and private applicants may request a permit to place suitable material at the site. The limitations on the quantity of material that may be placed at the site are unknown.

Construction and maintenance disposal areas 2-D and 3-D (CMDA 2-D and CMDA 3-D) [Figure 14] were created as part of the deepening of the Federal Tampa Harbor project between 1978 and 1982. The construction of CMDA 2-D was to require approximately 5,500,000 cubic yards of dredged material and it was to hold approximately 16,000,000 cubic yards of material. The construction of CMDA 3-D was to require approximately 4,500,000 cubic yards of dredged material and it was to hold approximately 13,000,000 cubic yards of material. The capacity remaining for 2-D of 441,000 cubic yards is based on a 1998 survey and the knowledge that material dredged during two maintenance events since then will have gone into the placement area. The capacity remaining for 3-D of 3,614,000 cubic yards is based on a 1990 survey.

Four privately-owned upland placement areas are listed in Table 9 for placement of material from the Alafia River and Big Bend channels. These have no remaining capacity. The areas adjacent to the Alafia River may be candidates for enlargement by raising the dikes.

One upland placement area is listed in Table 9 for placement of material from the Federal Manatee Harbor project. This area is owned by Port Manatee. Material is mined from the placement area as needed and when available. The present capacity of the placement area is unknown. A study is underway to examine the feasibility of raising the dikes on this placement area to increase capacity. No details on the expansion are available at this time.

The Pinellas County beaches are listed as an entry in Table 9. Beach quality material removed from Federal and non-Federal dredging is placed on these beaches when it is economically and environmentally acceptable to do so. No capacity figures are given for the beaches since placement depends on the amount of beach quality material available for dredging and needed on the beaches. Placement intervals depend similarly on dredging and beach requirements.

Table 10. Table 10 lists planned expansions to existing placement areas and proposed new placement areas. Expansions are planned for both CMDA 2-D and CMDA 3-D. Raising the dike heights on both islands will increase the capacity of each area by approximately 10,000,000 cubic yards. The capacity estimates will be refined as studies for both areas progress. The increased capacity figure for CMDA 2-D comes from the Tampa Port Authority's Dredged Material Management Plan whereas the figure for CMDA 3-D comes from the Corps' 1997 Big Bend Channel Feasibility Report. Both figures are based on raising the dike heights to +40 feet (present dike heights are about +20 feet). Information is not included on the expansion of the Port Manatee placement area as it is unavailable at this time.

Table 11. This table lists potential fill sites and includes habitat restoration and other beneficial use sites. This list is taken primarily from the July 25, 1997 'Prioritizing Habitat Restoration Sites in the Tampa Bay Region' Workshop Summary. Some of these sites are located on Figures 15a and 15b. The intention of listing possible fill sites for habitat restoration is to raise awareness of the existence of these sites, not to skirt or expedite any planning or permitting process. Any sites listed in this table as possible depositories for dredged material must be evaluated by the customary planning and permitting processes prior to construction. Most fill sites would receive material one time only to meet the environmental objectives established for the area. Several sites are currently being filled with dredged material and one site has a recurring need for material. This is the Lena Road Landfill in Manatee County. Two sites listed in the table that could repeatedly receive dredged material are Egmont Key and Ben T. Davis Beach. The need for material at Egmont Key is discussed in the Egmont Key Erosion Control Project Feasibility Study, a report prepared in 1997 by Coastal Planning & Engineering, Inc for the FDEP.

The quantity of fill required by these sites, the quality of the fill, and potential permitting or logistical problems need to be determined. For example, possible conflicts exist between filling for beneficial use and not filling for recreational fishing. As another example, the shell mining pits in central and upper Tampa Bay need to be located and surveyed (Taylor). The U.S. Army Corps of Engineers Technical Note DOER-C2 (May 1999) addresses the nature and types of physical, engineering, chemical, and biological characterization tests appropriate for determining the potential for beneficial uses of dredged material. A copy of the paper is found in the supplemental information section at the end of this document.

Several beneficial use placements are in the planning stages for U.S. Army Corps of Engineers projects. These are as follows: raising the bottom surface elevation of the deauthorized Federal Garrison Channel; filling Hooker's Point (construction fill); creating wetlands east of CMDA 2-D; creating additional bird nesting habitat just south of Bird Island; and filling mining pits near Cockroach Bay.

Several notes can be gleaned from these tables. These are as follows:

- There is an offshore placement site of unlimited capacity. To date this site has been cost effective for placement of material dredged from Federal channels in the lower end (closest to the Gulf) of Tampa Bay. This site is available to all users subject to permitting.
- The usual placement area for material from Federal channels in the upper reaches of Tampa Bay is either CMDA 2-D or CMDA 3-D, whichever is closer to the site of the dredging. These placement areas are nearing capacity and expansions of these areas (by raising the dikes) are planned.
- Historically there have been some upland placement areas available for material dredged from Federal channels. There are several upland placement areas available for material dredged from non-Federal channels, berthing areas, and other private areas. These upland areas have been or are being filled to capacity. The 1998 Tampa Port Authority Dredged Material Management Plan states, "As a result of past growth management legislation, and very intense development pressures for this area, the entire area under study is subject to development constraints…acquisition of a 1000 acre site for a disposal area and the necessary buffers could cost in excess of $25 million. Such a [sic] expenditure is simply not feasible for the Authority, even if the land were to be available and could be redesignated under the land use plan."
- A substantial amount of beach quality dredged material is unavailable.
- Areas exist where dredged material might be placed to benefit the environment or for environmental restoration. However, little information exists on the quantities and qualities of fill required for these sites.

Capacity shortfall

Table 12 determines the anticipated shortfall in placement area capacity for the next 25 years. Both maintenance dredging and new work dredging are included in Table 12. Shortfall volumes are calculated considering the cost of using particular placement sites in relation to the point of the dredged material production. The ODMDS is typically the placement site for material dredged from Federal channels near the lower end of Tampa Bay. Approximately 11,800,000 cubic yards of material will be placed there over the next 25 years. While the capacity of the ODMDS is unknown, there is no anticipated shortfall volume for the ODMDS.

CMDAs 2-D and 3-D are typically the placement sites for material dredged from Federal channels in the upper part of Tampa Bay. Approximately 5,700,000 cubic yards of material will be dredged from areas in Tampa Bay that typically use CMDA 2-D for placement. The estimated capacity of CMDA 2-D is 800,000 cubic yards, therefore, the anticipated shortfall volume is about 4,900,000 cubic yards. Raising the dikes on CMDA 2-D may bring the capacity to 10,800,000 cubic yards with no shortfall. Approximately 14,000,000 cubic yards of material will be dredged from areas in Tampa Bay that typically use CMDA 3-D for placement. The estimated capacity of CMDA 3-D is 3,600,000 cubic yards, therefore, the anticipated shortfall volume is about 10,400,000 cubic yards. Raising the dikes on CMDA 3-D may bring the shortfall to 400,000 cubic yards.

Another way to increase the capacity of a confined disposal area such as CMDA 2-D or 3-D is to mine the material in the area for use at another location. For example, beach quality material could be extracted and placed on a beach. Material suitable for construction fill could be removed and used elsewhere. Confined disposal area mining should be investigated for both CMDA 2-D and 3-D.

Approximately 1,800,000 cubic yards of material will be dredged from the Tampa Bay area that is suitable for beach placement. There appears to be no shortage of placement areas for beach quality material in the Tampa Bay area, only a shortage of material to place there. The Pinellas County beaches are the usual placement areas for this material. However, Egmont Key is another possible location for placement of beach quality material. The Egmont Key feasibility study presents several placement plans, requiring between 3,000,000 and 30,000,000 cubic yards of beach quality material.

About 4,400,000 cubic yards of material will be dredged from the Tampa Bay area and used for beneficial uses.

Approximately 5,800,000 cubic yards of material will be dredged from other areas in Tampa Bay (non-Federal channels, berthing areas, marinas) over the next 25 years. Historically a range of locations has been used for placement of this material. Some of the material could go into the ODMDS, some into CMDA 2-D or 3-D, some for beneficial uses, but most likely the majority will go into upland placement areas. As indicated in the tables, the 1993 U.S. Army Corps of Engineers Disposal Area Study, and the Tampa Port Authority dredged material management plan, securing upland placement areas is difficult due to land use issues and cost.

Capacity shortfall is not singular to Tampa Bay. The document entitled, 'Long-Term Management Strategy (LTMS) For the Placement of Dredged Material in the San Francisco Bay Region' identifies a physical capacity limitation at one of its in-Bay sites as a driving factor in the generation of the strategy. The Port of New York/New Jersey has a considerable shortfall in terms of currently available and permitted placement sites. The Dredged Material Management Plan (DMMP) for the Port evaluated a number of possible containment and treatment options for the Federal and non-Federal maintenance and deepening material projected to be dredged there over the next forty years. In addition, it also looked at measures to reduce future sediment contamination as well as other innovative management techniques. While a shortfall in fully permitted and operating sites exists, the DMMP lays out a process for implementing additional sites as needed throughout the next forty years. Given the strong desire to use dredged material beneficially in the region, only environmentally preferable options are recommended for implementation with reliable containment options developed as contingency. The fact sheet found in the supplemental information section at the end of this report provides additional information on the DMMP.

The following paragraphs relating to nationwide placement area capacity are taken from the Corps' Institute For Water Resources webpage on the National Harbors Study. The webpage can be viewed at: http://www.wrsc.usace.army.mil/iwr/Services/PDCPNHarbors.htm.

> In May of 1996, the Policy and Special Studies Division of the Corps' Institute For Water Resources wrapped up its National study on the *Need for Changes in Dredged Material Disposal Policy*. The study included a nationwide survey of potential disposal problems and needs at Corps projects. Corps Districts reported that 123 deep draft projects will require new disposal options within 20 years, all of which will experience problems in siting and developing disposal areas. In a majority of cases, the problems are considered to be readily resolvable before traffic is adversely affected. However, 53 projects present moderate to substantial disposal problems, the economic consequences of which could be severe if not resolved in a timely manner. Most of these 53 projects will require more costly disposal options to avoid adverse environmental effects. Rough estimates indicate that the potential incremental costs for meeting all environmental requirements could range up to $3.4 billion over the next 20 years, about $1.5 billion of which would be a non-Federal responsibility under pre-WRDA '96 policy; and all of which would have been a non-Federal responsibility under present budgetary constraints.
>
> The cost sharing changes constitute a compromise solution to a longstanding problem. For one-third of existing projects, LERRs [lands, easements, relocations and rights-of-way] would have been a Federal responsibility. WRDA

'96 provides that CDF [confined disposal facility] construction costs will be cost shared if non-Federal interests agree to provide all LERRs.

In summary, without increasing the capacities of CMDA 2-D and CMDA 3-D, a significant shortfall in dredged material placement capacity is anticipated for the Tampa Bay area. The shortfall is expected to be greatest for material dredged between Cut G and Cut C (Hillsborough Bay), and then for material dredged north of Cut C (Hillsborough Bay). Even with increased capacity in both CMDA 2-D and CMDA 3-D a shortfall is anticipated. This shortfall is expected for material dredged between Cut G and Cut C (Hillsborough Bay). Dredging in these areas is both Federal and non-Federal. A shortfall is cause for concern as it may imply inability to maintain sufficient water depths for commerce.

Economics is an important factor in dredging and the placement area plays a role in the economics. Federal projects must use the least cost, environmentally acceptable method of dredging and placement. As the placement area capacity decreases, the cost of dredging is expected to increase. One reason for this is that material may have to be transported further to an acceptable placement area. With this increase in dredging cost may come an increased interest in innovative technologies, such as the beneficial uses listed later in this plan. An analysis of Federal dredging events between 1980 and 2000 yields the following results. The analysis was conducted by reach according to the typically practiced placement; dredging events from the entrance channel to Cut G usually place material in the ODMDS, dredging events between Cut G and Cut C (Hillsborough Bay) usually place material in CMDA-3D, and dredging events north of Cut C (Hillsborough Bay) usually place material in CMDA-2D.

Reach	Average Cost	High Cost	Low Cost	Trend
A	$2.08	$3.14	$1.51	Up
B	$3.57	$6.94	$1.25	Up
C	$4.11	$7.40	$2.06	Down

The data on which this cursory analysis is based are found in the Supplemental Information section. Note that the ODMDS was unavailable for placement between approximately 1985 and 1995.

CONCEPTUAL PLAN

The goal of the conceptual plan is the creation of a list of placement alternatives whose capacity total is the same as, or greater than, the projected volume of material to be dredged in the next 25 years.

A list of projects intended for conceptual approval from permitting agencies is contained in Tables 9, 10, and 11 accompanying this plan. The projects on the list should, as a goal, meet U.S. Army Corps of Engineers requirements for dredged material placement.

The following ideas/actions make up the conceptual plan. Volumes to be accommodated by the conceptual plan placement options are listed in Table C.

1. **Beach placement.** Beach quality material should be placed on Tampa Bay area beaches whenever possible. To assist in assuring that beach quality material is placed on beaches whenever possible it is recommended that further analysis be conducted to identify sources of beach quality material, placement beaches, non-Federal sponsors (to bear the cost of beach placement, if necessary) and funding sources.

2. **Beneficial use.** Beneficial use should be made of dredged material whenever possible. To ensure beneficial use options are fully explored it is recommended that two areas be analyzed in further detail: in general, beneficial use options need to be better defined and, specifically, more detailed information needs to be gathered for the habitat restoration projects already listed.

3. **Traditional placement.** Maximum use should be made of existing placement options, namely, the ODMDS, CMDA 2-D and CMDA 3-D. These sites should be aggressively managed, for example, CMDA 2-D and CMDA 3-D could be further dewatered by wicking or other techniques. The dikes on CMDA 2-D and CMDA 3-D can be raised. CMDA 2-D and CMDA 3-D can be mined for usable material. The ODMDS can be monitored to gain as much information as is needed to fully use this site, for example, field studies can be conducted and modeling performed to describe and predict the dispersive nature of the site and to attempt to define the limitations of the site.

4. **Upland placement/placement of material dredged by non-Federal and private interests.** While the beach, ODMDS, CMDA 2-D and CMDA 3-D sites are traditionally used for placement of material from Federal projects, placement areas are needed for material from non-Federal and private projects. In order to provide these placement areas, a list of upland sites should be developed, as well as a list of beneficial use/habitat restoration sites/projects, that may be available specifically for non-Federal/private use. Sharing of all sites by all parties should be addressed.

TABLE C
Conceptual Plan Placement Sites and Volumes

Site	Table Reference	Volume
Beach	12	1,800,000
Beneficial Use	11	25,600,000
ODMDS	12	11,800,000
CMDA 2-D (dikes raised)	12	10,800,000
CMDA 3-D (dikes raised)	12	13,600,000
	Total	63,600,000

CONCLUSION

This report presents the results of three tasks, as follows: 1) develop dredged material volumes and describe dredged material quality, 2) identify existing and potential placement options, and 3) calculate the placement area capacity shortfall.

The total volume of dredged material expected for removal in the period 2000-2025 as a result of maintenance dredging or new work dredging in the Tampa Bay area is 42,000,000 cubic yards. The ODMDS offers a placement site for an unlimited amount of material at a reasonable cost for the lower region of Tampa Bay. CMDAs 2-D and 3-D are the standard placement alternative for material dredged from the upper region of Tampa Bay. These confined placement areas will reach capacity and must be enlarged or mined if they are to remain standard placement alternatives. Some material will be placed in upland placement areas as well as beaches. Some material will be put to beneficial use although this alternative requires additional study if it is to be applied widely. The total placement area capacity shortfall for the period 2000-2025 is 15,300,000 cubic yards. The shortfall for placement area CMDA 2-D is 4,900,000 cubic yards and the shortfall for placement area CMDA 3-D is 10,400,000 cubic yards. No shortfall is anticipated for the ODMDS, beach placement, or beneficial use placement. The shortfall for other placement areas (upland) is unknown.

The conceptual plan to meet the needs of placement capacity for the next 25 years involves four components, as follows: beach placement, beneficial use, traditional placement, and upland placement/placement of material dredged by non-Federal and private interests. Additional work is necessary in order to put the conceptual plan into action. A list of the additional work follows:

1. identify sources of beach quality material, placement beaches, non-Federal sponsors (to bear the cost of beach placement, if necessary) and funding sources
2. better define beneficial use options and gather more detailed information for the habitat restoration projects already listed
3. aggressively manage CMDA 2-D and CMDA 3-D, raise the dikes on CMDA 2-D, mine CMDA 2-D and CMDA 3-D for usable material, monitor the ODMDS to gain as much information as is needed to fully use this site
4. develop a list of upland sites, as well as a list of beneficial use/habitat restoration sites/projects, specifically for non-Federal/private use and address sharing of all sites by all parties.

The conceptual plan provides capacity for 63,600,000 cubic yards of dredged material. This more than meets the requirement of 42,000,000 cubic yards.

Suggestions for Further Study

In addition to periodic revision and expansion of this DMMP and implementation of the conceptual plan, the following are recommended for further action:

1. Additional study of dredged material volumes and placement, as this report is based on readily accessible data only. For example, the quantity of dredged material removed by private interests is most likely under-represented in the data and with a more extensive effort a more accurate volume might be determined. Federal dredging records could be examined in light of technical, surveying, reporting, and regulatory variations throughout the history of their collection. Such an examination might produce a refined estimate of the material dredged from Federal channels and therefore a better starting point for projecting future dredging volumes. In addition, an attempt could be made to better project a growth or decline in the amount of material dredged from the bay area. Dredged material volumes could be presented as ranges for all the categories considered.

2. Collection of dredged material characteristic data. Available data on dredged material characteristics were scarce. Characteristics of interest include physical characteristics, chemical characteristics, contamination and toxicity, and fate and movement.

3. Development/refinement of a computer-based circulation/salinity/sediment movement model for Tampa Bay. Either develop a new or revise an existing circulation model for Tampa Bay that would give an overall picture of circulation patterns in the bay and that would allow refinement of the model to give a detailed picture of circulation in specific locations. This effort would provide ready access to information on water flow patterns for planning and permitting purposes.

4. An analysis of dredging and disposal methods commonly used in the Tampa Bay area, with the goal of better understanding the physical processes that occur during removal and placement of sediments and a focus on impacts. This analysis could include a detailed investigation of environmental effects, including sediment resuspension. A purpose of this analysis would be to provide information on environmental acceptability, technical feasibility, and economic feasibility, factors upon which management decisions can be made.

5. An investigation of beneficial uses of dredged material (including habitat development and commercial applications). Beneficial use options need to be further analyzed since they offer great promise as a “placement” alternative and since they provide an opportunity for improvement or restoration of environmentally significant habitats. There are many ways to beneficially use dredged material. Some of these ways are the following:

1) Habitat development

a) Wetlands (salt marsh, freshwater tidal, riverine, lacustrine/depressional)
b) Thin-layer dredged material placement
c) Confined disposal facility/recreational site
d) Seagrass restoration using dredged material substrates (including offshore transverse bars to protect and restore seagrasses)

2) Commercial applications

a) Aquaculture
b) Manufactured soil
c) Superfund site cover
d) Landfill cover
e) Mining site cover
f) Brownfield redevelopment
g) Topsoil
h) Parks
i) Bagged soil
j) Golf courses
k) Landscaping
l) Ornamental figurines/statues
m) Construction fill
n) Patio garden construction
o) Building blocks

Not only should all of these uses be considered in a further examination of beneficial use of dredged material, but also the mining of placement areas CMDA 2-D and 3-D should be considered since without mining these placement areas have finite capacity, even if their dikes are raised.

6. An inventory of the environment, with a focus on the aquatic environments of the Gulf of Mexico and Tampa Bay and the upland environments in the area of interest.

7. An examination of the economic activity (commercial and recreational) that creates the demand for dredging, including the financing of dredging and placement.

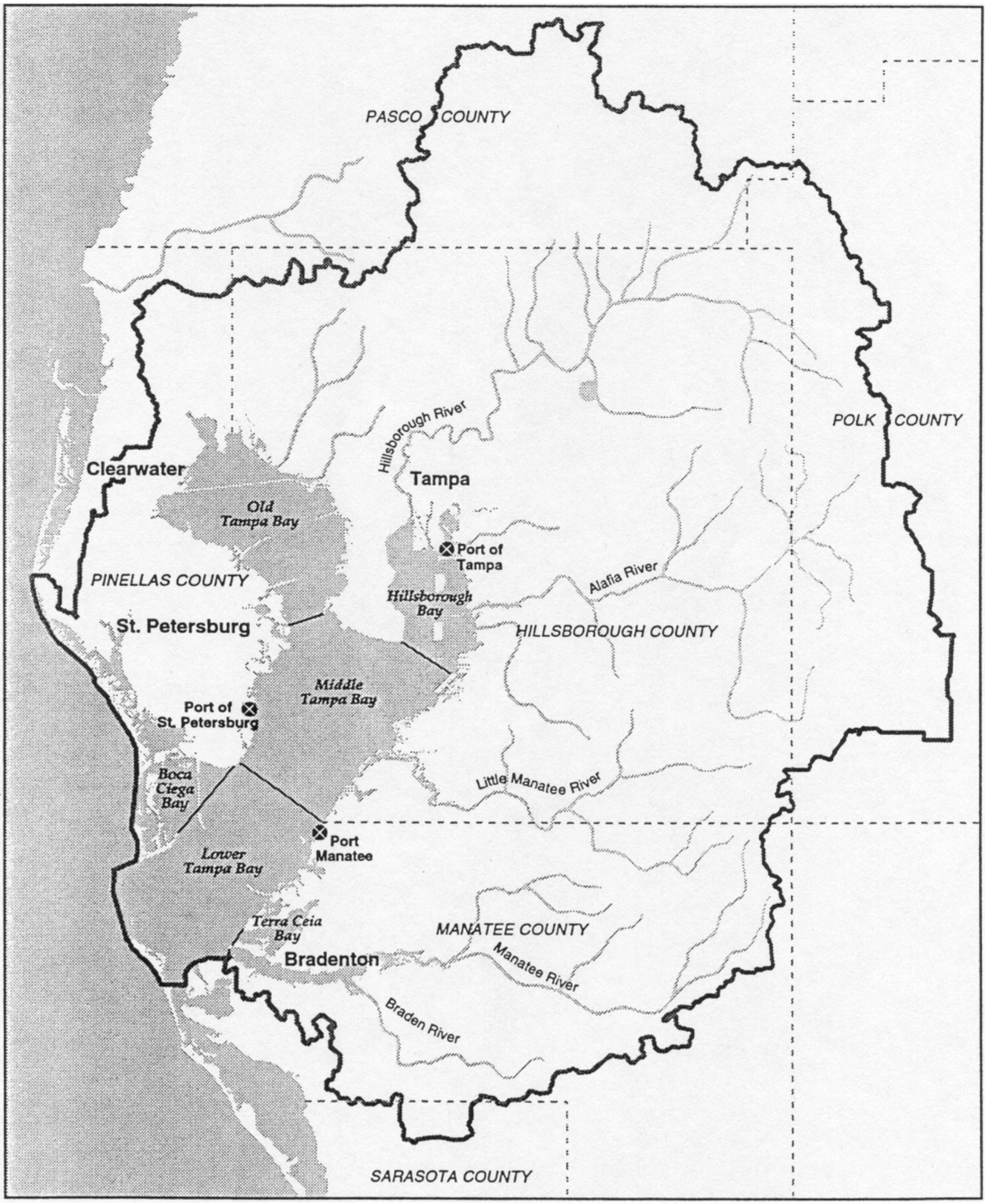
8. A summary of the regulations that guide dredging and placement, including permitting. This effort could include descriptions of the roles of Federal, State and local agencies and how the agencies coordinate. A focus of the summary might be to highlight the funding policies that could support the conceptual plan.

9. A discussion on implementing regional sediment management, with a focus on identifying roadblocks that might stand in the way of implementation. Regional sediment management considerations might include an upland, or a confined, placement area (with re-use of material) that is sponsored and used by

a number of interests. This would be in contrast to present management, where the Federal placement areas are primarily the ODMDS and the two CMDAs and the other placement areas are upland. A tool that might encourage regional sediment management is a geographic information systems product that makes available, via the internet, all of the data presented in this DMMS. The computer software product DMSMART developed under the Dredging Operations and Environmental Research (DOER) program and applied within New York District as DAN-NY might serve as a springboard from which to create such a tool. A copy of the Corps of Engineers' Technical Note DOER-N2, entitled "Dredged Material Spatial Management, Analysis, and Record Tool (DMSMART)" is found in the Technical Notes section of the Supplemental Information at the end of this report. This paper describes the dredging and placement site management challenges that are well-suited to the capabilities of a GIS-based software system, and describes DAN-NY and DMSMART.

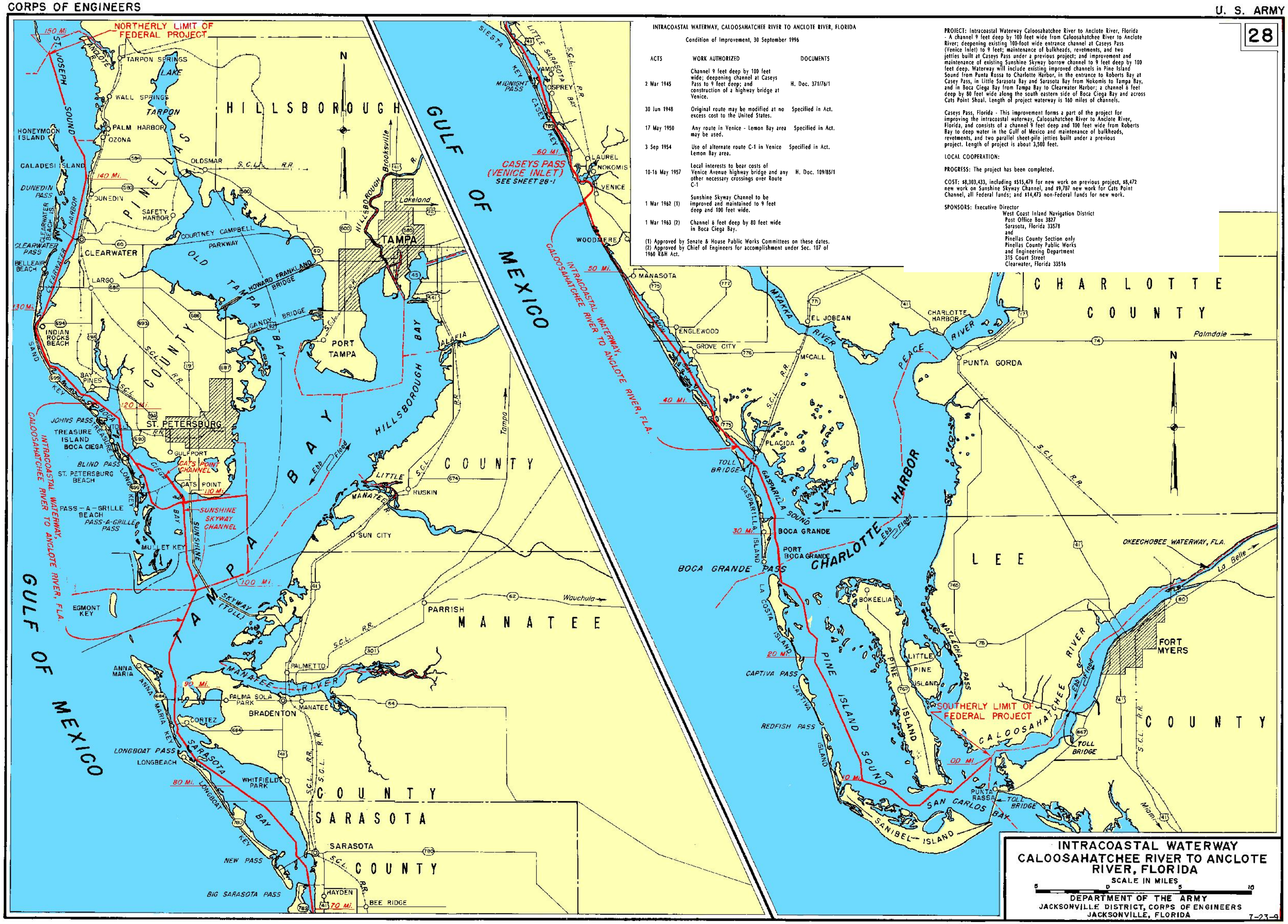
CHARTING the COURSE FOR TAMPA BAY

Tampa Bay Watershed Boundaries and Bay Segments



More than 2 million people reside in the 2,200-square-mile Tampa Bay watershed, which reaches into Sarasota, Pasco and Polk counties and includes three major seaports. Tampa Bay is Florida's largest open-water estuary, covering almost 400 square miles.

Tampa Bay Dredged Material Management Plan
Boundaries of Tampa Bay as Defined by NEP
Figure 1.



INTRACOASTAL WATERWAY, CALOOSAHATCHEE RIVER TO ANCLOTE RIVER, FLORIDA

Condition of Improvement, 30 September 1996

ACTS	WORK AUTHORIZED	DOCUMENTS
2 Mar 1945	Channel 9 feet deep by 100 feet wide; deepening channel at Caseys Pass to 9 feet deep; and construction of a highway bridge at Venice.	H. Doc. 371/76/1
30 Jun 1948	Original route may be modified at no excess cost to the United States.	Specified in Act.
17 May 1950	Any route in Venice - Lemon Bay area may be used.	Specified in Act.
3 Sep 1954	Use of alternate route C-1 in Venice Lemon Bay area.	Specified in Act.
10-16 May 1957	Local interests to bear costs of Venice Avenue highway bridge and any other necessary crossings over Route C-1	H. Doc. 109/85/1
1 Mar 1962 (1)	Sunshine Skyway Channel to be improved and maintained to 9 feet deep and 100 feet wide.	
1 Mar 1963 (2)	Channel 6 feet deep by 80 feet wide in Boca Ciega Bay.	

(1) Approved by Senate & House Public Works Committees on these dates.
(2) Approved by Chief of Engineers for accomplishment under Sec. 107 of 1960 R&H Act.

PROJECT: Intracoastal Waterway Caloosahatchee River to Anclote River, Florida - A channel 9 feet deep by 100 feet wide from Caloosahatchee River to Anclote River; deepening existing 100-foot wide entrance channel at Caseys Pass (Venice Inlet) to 9 feet; maintenance of bulkheads, revetments, and two jetties built at Caseys Pass under a previous project; and improvement and maintenance of existing Sunshine Skyway borrow channel to 9 feet deep by 100 feet deep. Waterway will include existing improved channels in Pine Island Sound from Punta Rossa to Charlotte Harbor, in the entrance to Roberts Bay at Casey Pass, in Little Sarasota Bay and Sarasota Bay from Nokomis to Tampa Bay, and in Boca Ciega Bay from Tampa Bay to Clearwater Harbor; a channel 6 feet deep by 80 feet wide along the south eastern side of Boca Ciega Bay and across Cats Point Shoal. Length of project waterway is 160 miles of channels.

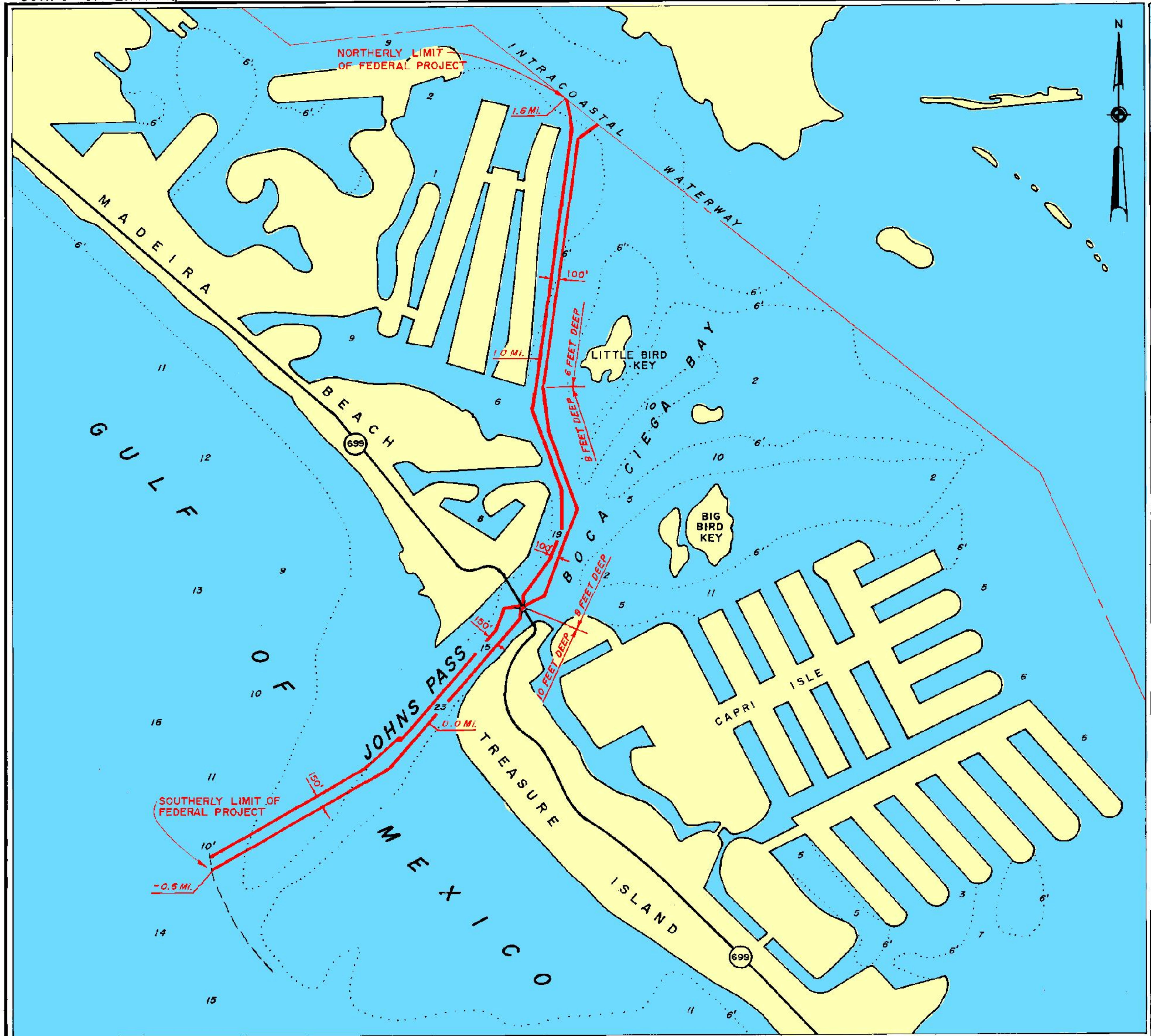
Caseys Pass, Florida - This improvement forms a part of the project for improving the intracoastal waterway, Caloosahatchee River to Anclote River, Florida, and consists of a channel 9 feet deep and 100 feet wide from Roberts Bay to deep water in the Gulf of Mexico and maintenance of bulkheads, revetments, and two parallel sheet-pile jetties built under a previous project. Length of project is about 3,500 feet.

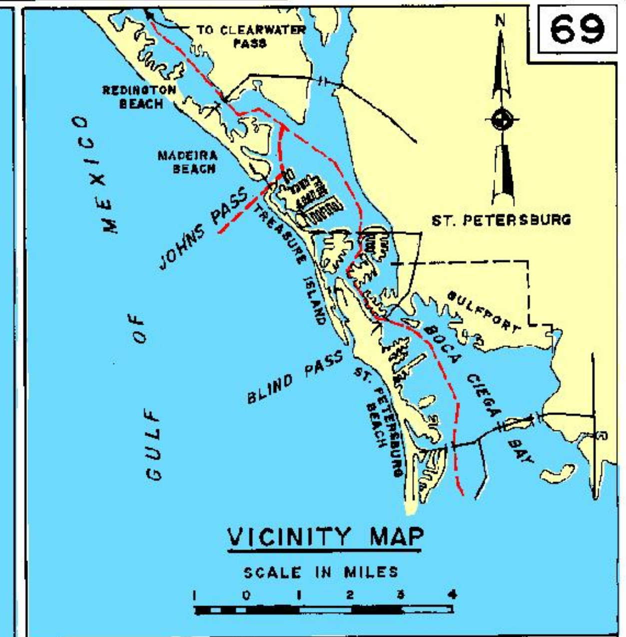
LOCAL COOPERATION:

PROGRESS: The project has been completed.

COST: $8,303,433, including $515,479 for new work on previous project, $8,472 new work on Sunshine Skyway Channel, and $9,707 new work for Cats Point Channel, all Federal funds; and $14,473 non-Federal funds for new work.

SPONSORS: Executive Director
West Coast Inland Navigation District
Post Office Box 3827
Sarasota, Florida 33578
and
Pinellas County Section only
Pinellas County Public Works
and Engineering Department
315 Court Street
Clearwater, Florida 33516





JOHN PASS
PINELLAS COUNTY, FLORIDA

Condition of Improvement, 30 September 1996

ACTS	WORK AUTHORIZED	DOCUMENTS
14 Jul 1960 (1)	Entrance channel at Johns Pass 10 feet deep by 150 feet wide across the gulf bar, 8 feet deep by 100 feet wide into the pass, and 6 feet deep by 100 feet wide to the Intracoastal Waterway.	

(1) Approved by the Chief of Engineers 2 December 1964, under Section 107.

PROJECT: Provide and maintain an entrance channel at Johns Pass 10 feet deep by 150 feet wide across the gulf bar, thence 8 feet deep by 100 feet into the pass, thence 6 feet deep by 100 feet wide to the Intracoastal Waterway. Length of project is about 2.2 miles.

LOCAL COOPERATION:

PROGRESS: The project was completed in May 1968.

COST: $1,066,873 Federal funds and $53,732 non-Federal funds.

SPONSOR: Pinellas County
440 Court Street
Clearwater, Florida 33616-9999

JOHNS PASS, PINELLAS COUNTY, FLA.

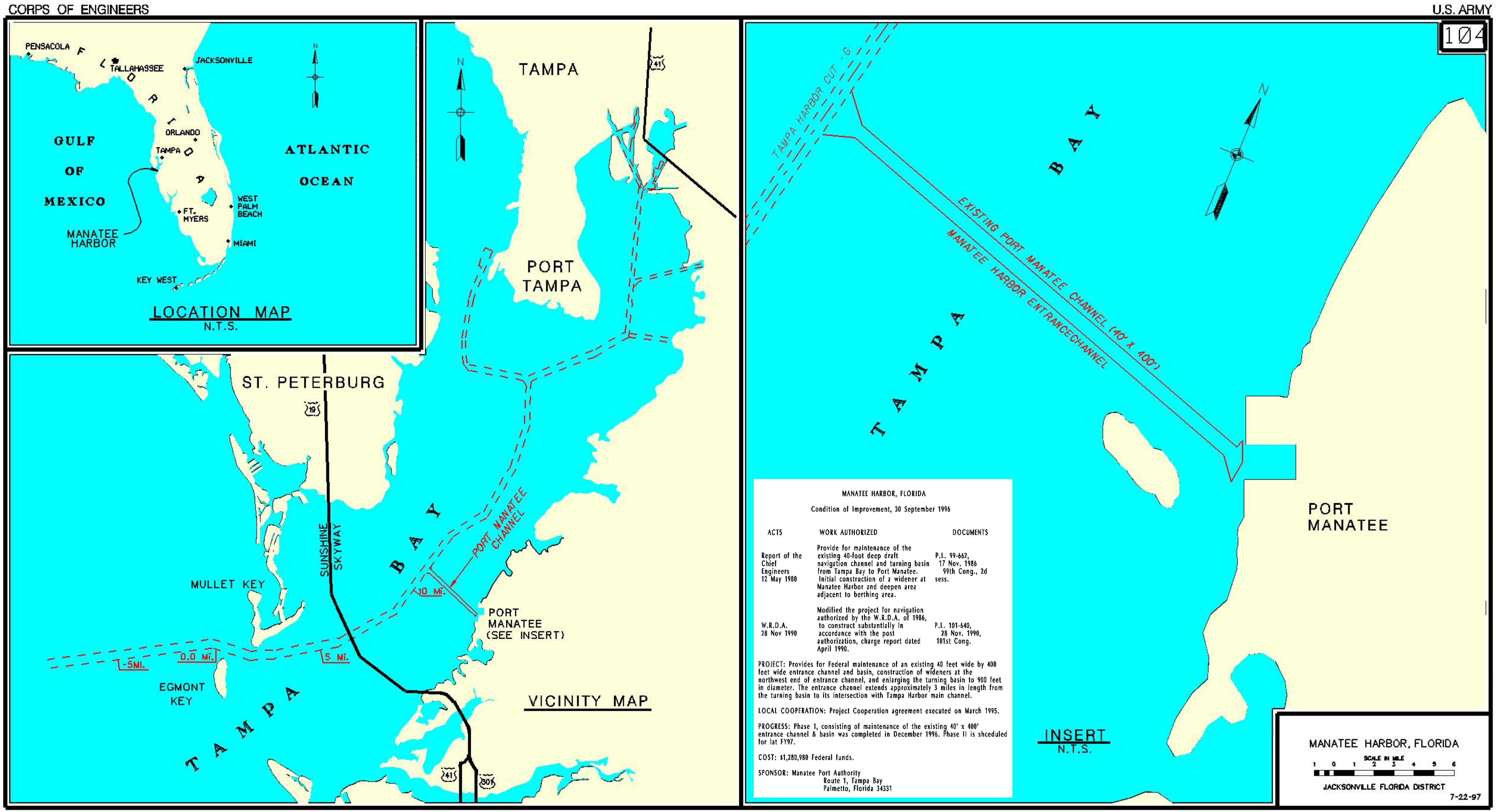
SCALE IN FEET

500 0 500 1000 1500

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

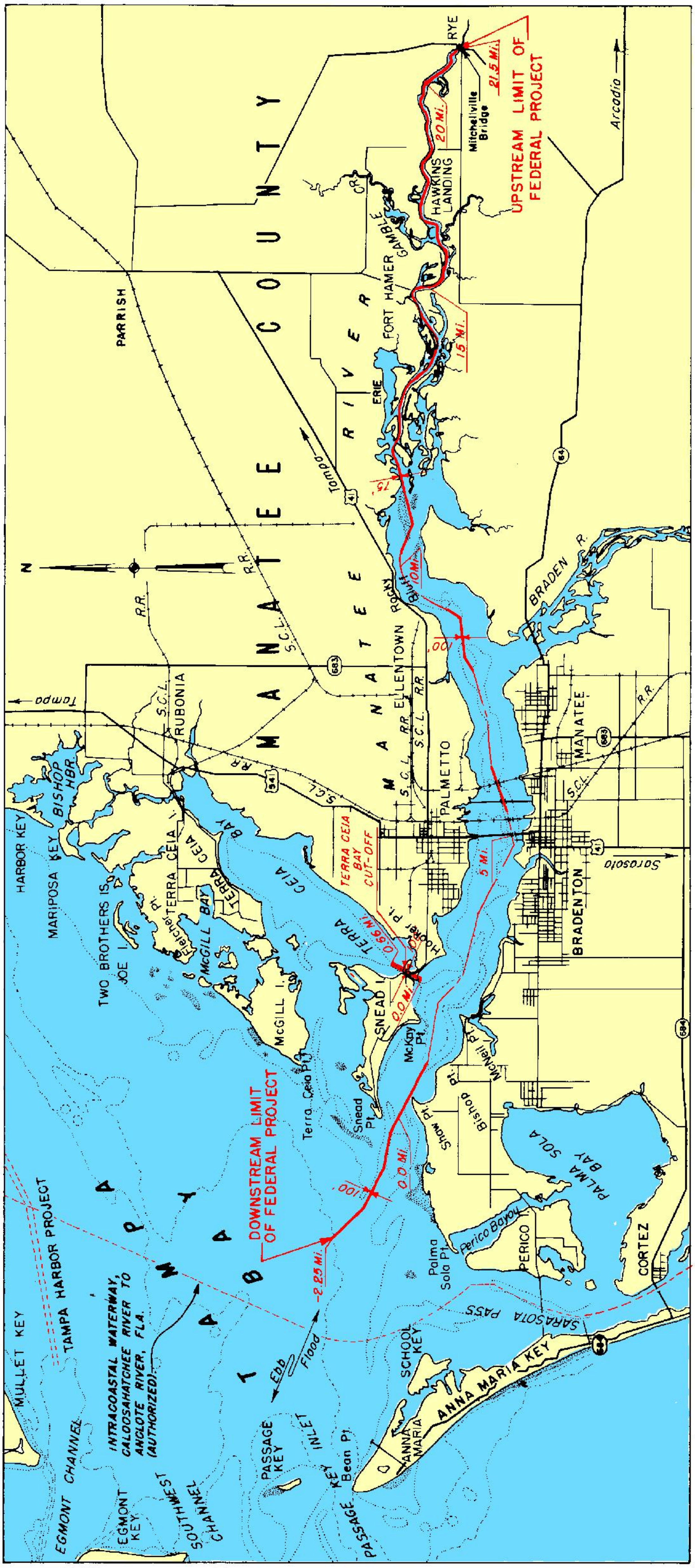
7-30-97

Tampa Bay Dredged Material Management Strategy
Figure 3



Tampa Bay Dredged Material Management Strategy
Figure 4

30



MANATEE RIVER, FLORIDA

Condition of Improvement, 30 September 1996

ACTS	WORK AUTHORIZED	DOCUMENTS
2 Aug 1882	Channel 13 feet deep by 100 feet wide from Tampa Bay to McNeil Point.	A.R. for 1882 p. 1319
3 Jun 1896	Cut-Off 6 feet deep by 100 feet wide into Terra Ceia Bay	Specified in Act.
3 Mar 1905	Channel 9 feet deep by 100 feet wide from McNeil Point to Rocky Bluff, thence 4 feet deep by 75 feet wide to Rye.	H. Doc. 117/58/2
27 Jul 1916	Established upper project limit at Mitchellville bridge	Specified in Act.
5 Aug 1977	Bottom 1 foot of entrance channel deauthorized.	Sec. 12 Public Law 93-251

PROJECT: A channel 12 feet deep and 100 feet wide from Tampa Bay to McNeil Point, thence 9 feet deep and 100 feet wide to Rocky Bluff, and thence 4 feet deep and 75 feet wide to Mitchellville bridge; and a cut-off 6 feet deep and 100 feet wide into Terra Ceia Bay. Length of project is 23.75 miles in the river and 0.66 mile in the cut-off.

LOCAL COOPERATION:

PROGRESS: The project is complete. Work remaining is removal of a small amount of rock from the entrance channel at a depth of 12 feet. This bottom 1 foot of entrance was deauthorized 5 August 1977.

COST: $124,744 Federal funds.

SPONSOR: Board of County Commissioners
Manatee County
Bradenton, Florida 33506

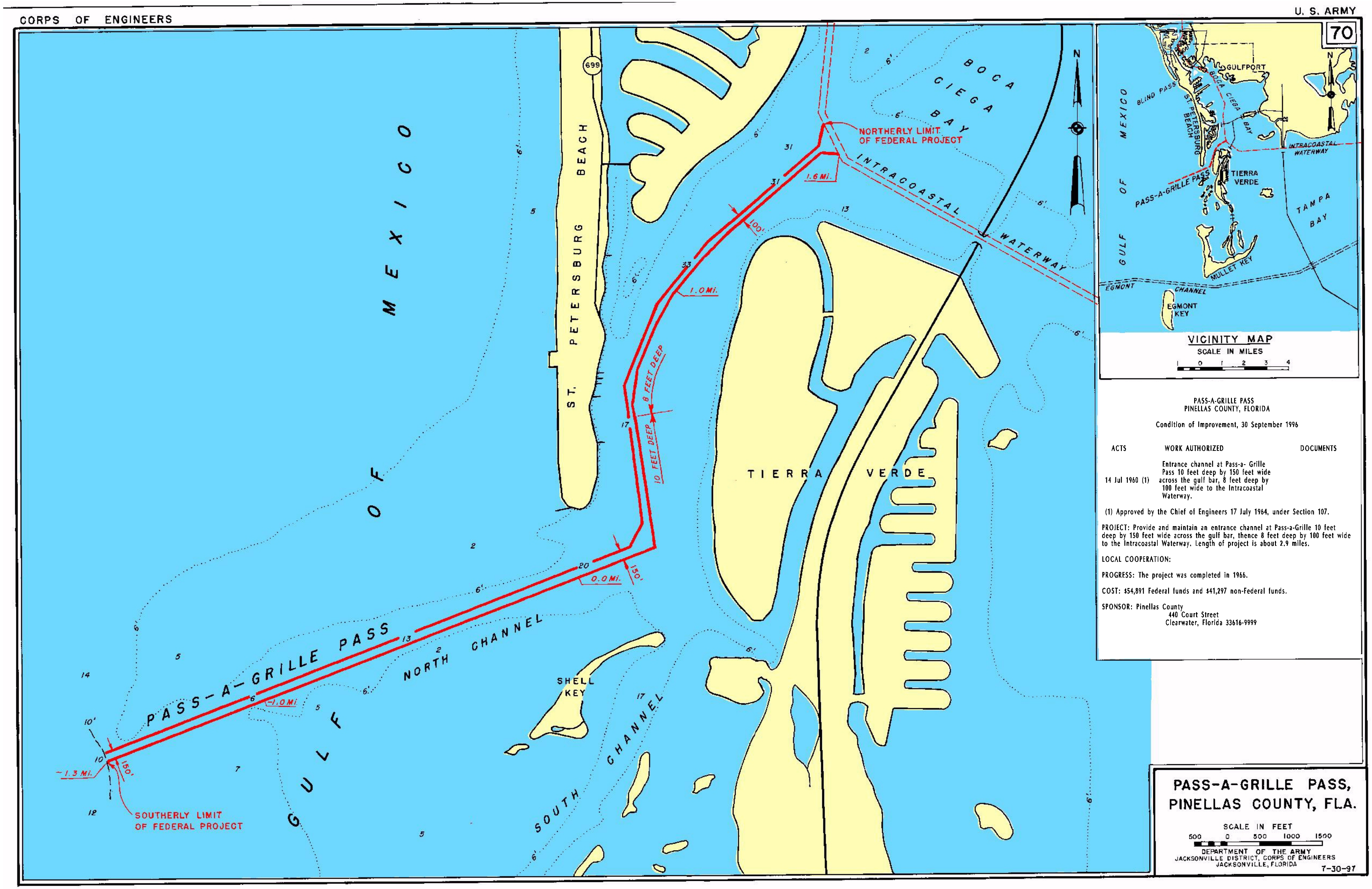
MANATEE RIVER, FLA.

SCALE IN MILES

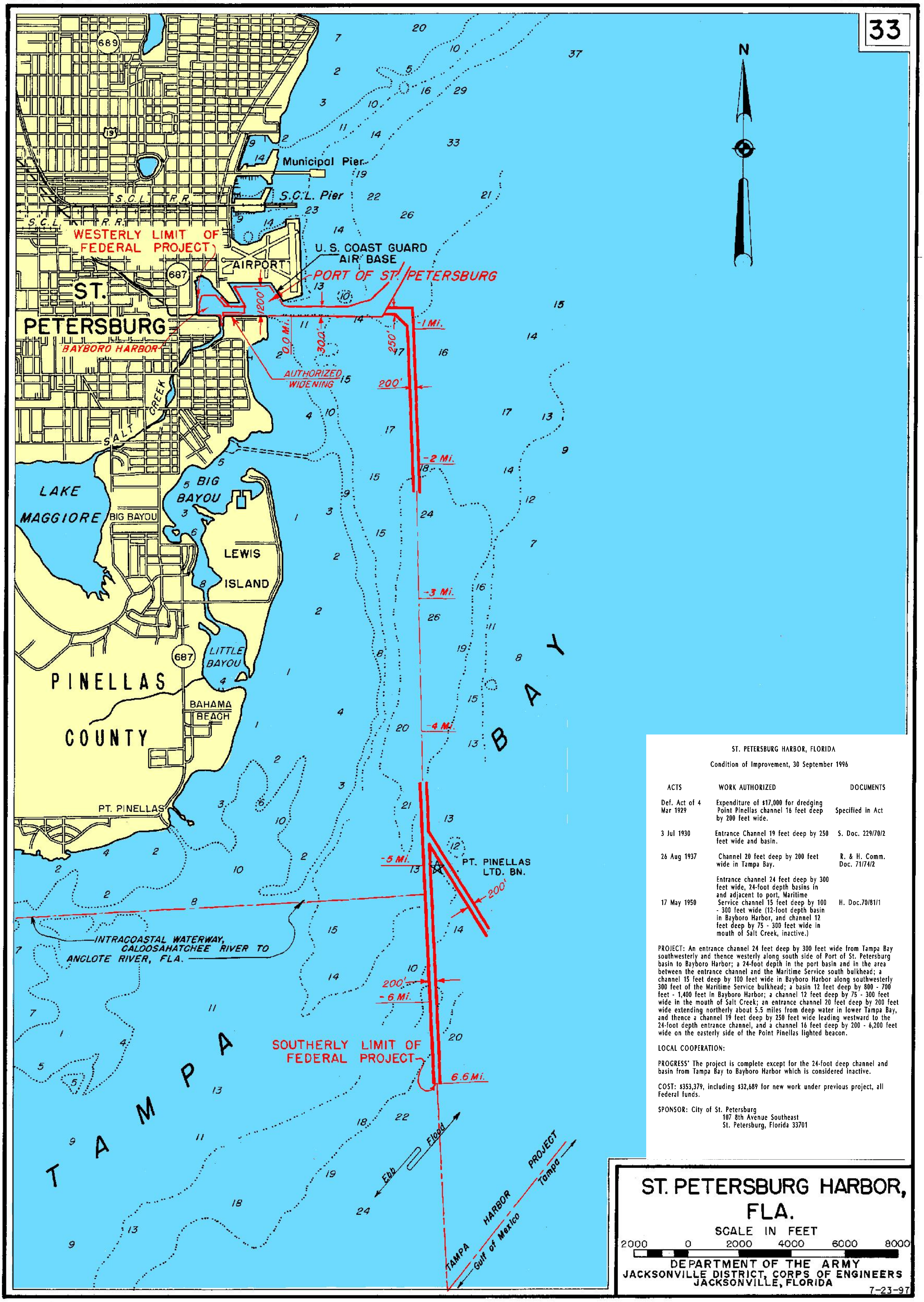
1 0 1 2 3 4 5

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

7-22-97


CORPS OF ENGINEERS
U. S. ARMY
70
GULF OF MEXICO
ST. PETERSBURG BEACH
699
BOCA CIEGA BAY
NORTHERLY LIMIT OF FEDERAL PROJECT
INTRACOASTAL WATERWAY
1.6 Mi.
100'
1.0 Mi.
8 FEET DEEP
10 FEET DEEP
TIERRA VERDE
0.0 Mi.
150'
PASS-A-GRILLE PASS
NORTH CHANNEL
SOUTH CHANNEL
SHELL KEY
-1.0 Mi.
-1.3 Mi.
SOUTHERLY LIMIT OF FEDERAL PROJECT
VICINITY MAP
SCALE IN MILES
GULFPORT
BLIND PASS
ST. PETERSBURG BEACH
BOCA CIEGA BAY
INTRACOASTAL WATERWAY
TIERRA VERDE
PASS-A-GRILLE PASS
TAMPA BAY
MULLET KEY
EGMONT CHANNEL
EGMONT KEY
PASS-A-GRILLE PASS
PINELLAS COUNTY, FLORIDA
Condition of Improvement, 30 September 1996
ACTS
WORK AUTHORIZED
DOCUMENTS
14 Jul 1960 (1)
Entrance channel at Pass-a- Grille Pass 10 feet deep by 150 feet wide across the gulf bar, 8 feet deep by 100 feet wide to the Intracoastal Waterway.
(1) Approved by the Chief of Engineers 17 July 1964, under Section 107.
PROJECT: Provide and maintain an entrance channel at Pass-a-Grille 10 feet deep by 150 feet wide across the gulf bar, thence 8 feet deep by 100 feet wide to the Intracoastal Waterway. Length of project is about 2.9 miles.
LOCAL COOPERATION:
PROGRESS: The project was completed in 1966.
COST: $54,891 Federal funds and $41,297 non-Federal funds.
SPONSOR: Pinellas County
440 Court Street
Clearwater, Florida 33616-9999
PASS-A-GRILLE PASS, PINELLAS COUNTY, FLA.
SCALE IN FEET
500 0 500 1000 1500
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
7-30-97

CORPS OF ENGINEERS U. S. ARMY



ST. PETERSBURG HARBOR, FLORIDA

Condition of Improvement, 30 September 1996

ACTS	WORK AUTHORIZED	DOCUMENTS
Def. Act of 4 Mar 1929	Expenditure of $17,000 for dredging Point Pinellas channel 16 feet deep by 200 feet wide.	Specified in Act
3 Jul 1930	Entrance Channel 19 feet deep by 250 feet wide and basin.	S. Doc. 229/70/2
26 Aug 1937	Channel 20 feet deep by 200 feet wide in Tampa Bay.	R. & H. Comm. Doc. 71/74/2
17 May 1950	Entrance channel 24 feet deep by 300 feet wide, 24-foot depth basins in and adjacent to port, Maritime Service channel 15 feet deep by 100 - 300 feet wide (12-foot depth basin in Bayboro Harbor, and channel 12 feet deep by 75 - 300 feet wide in mouth of Salt Creek, inactive.)	H. Doc.70/81/1

PROJECT: An entrance channel 24 feet deep by 300 feet wide from Tampa Bay southwesterly and thence westerly along south side of Port of St. Petersburg basin to Bayboro Harbor; a 24-foot depth in the port basin and in the area between the entrance channel and the Maritime Service south bulkhead; a channel 15 feet deep by 100 feet wide in Bayboro Harbor along southwesterly 300 feet of the Maritime Service bulkhead; a basin 12 feet deep by 800 - 700 feet - 1,400 feet in Bayboro Harbor; a channel 12 feet deep by 75 - 300 feet wide in the mouth of Salt Creek; an entrance channel 20 feet deep by 200 feet wide extending northerly about 5.5 miles from deep water in lower Tampa Bay, and thence a channel 19 feet deep by 250 feet wide leading westward to the 24-foot depth entrance channel, and a channel 16 feet deep by 200 - 6,200 feet wide on the easterly side of the Point Pinellas lighted beacon.

LOCAL COOPERATION:

PROGRESS" The project is complete except for the 24-foot deep channel and basin from Tampa Bay to Bayboro Harbor which is considered inactive.

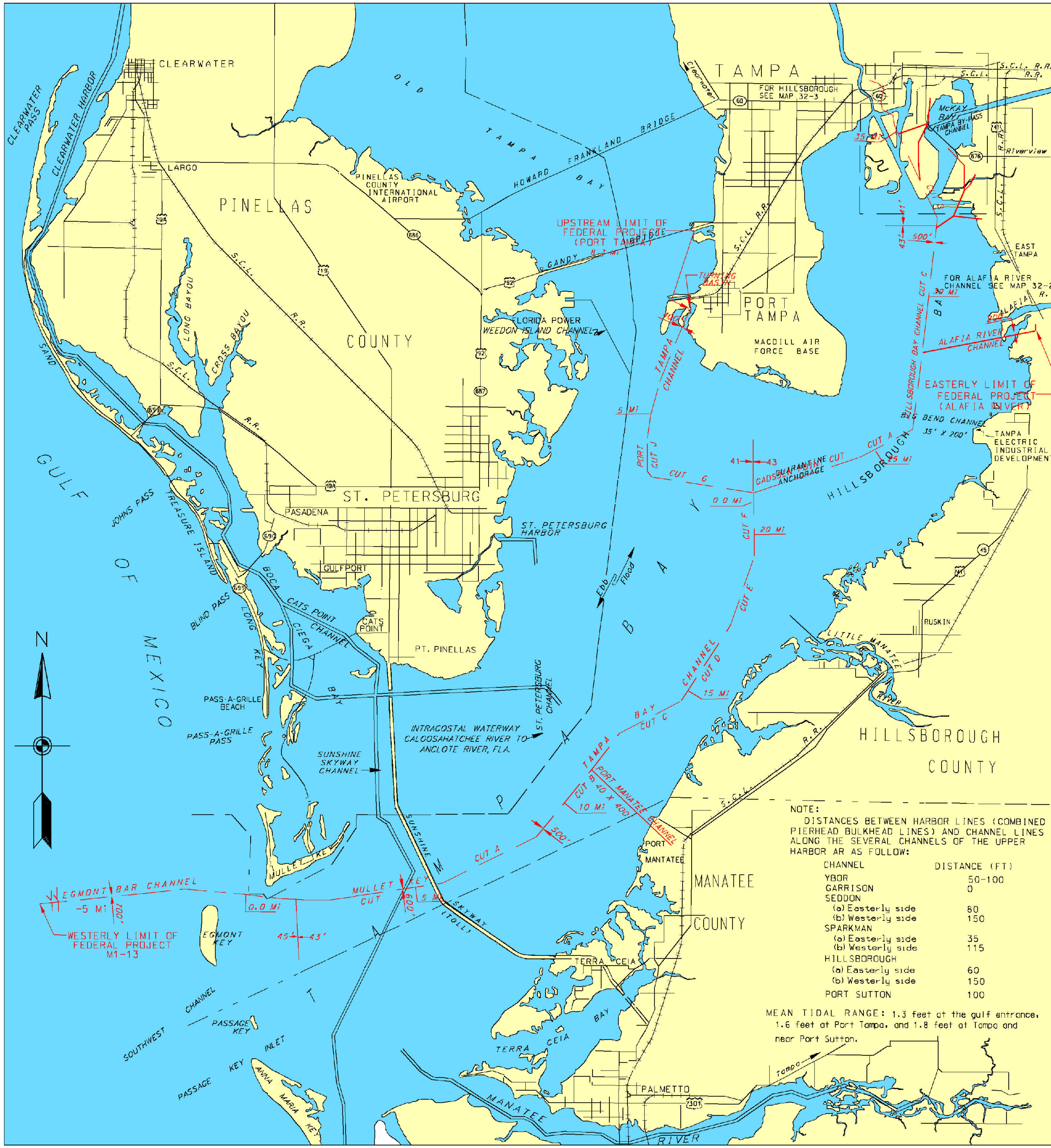
COST: $353,379, including $32,689 for new work under previous project, all Federal funds.

SPONSOR: City of St. Petersburg
107 8th Avenue Southeast
St. Petersburg, Florida 33701

Tampa Bay Dredged Material Management Strategy

Figure 7

Tampa Bay Dredged Material Management Strategy
Figure 8



PROJECT: Tampa Harbor - Bottom 1-foot of all project segments authorized in 1970 in "inactive" category Channel from Gulf of Mexico to Port Tampa and Tampa, 45 feet deep by 700 feet wide on Egmont Bar, 43 feet deep by 600 feet wide in Mullet Key Cut, 43 feet deep by 500 feet wide from Mullet Key Cut through Tampa Bay to the junction of Hillsborough Bay and Port Tampa Channels; 43 feet deep by 500 feet wide in Hillsborough Bay Channel from the junction with Tampa Bay and Port Tampa Channels to the junction with Port Sutton entrance channel, and thence deepening to a depth of 42 feet at the existing width to the junction with Seddon and Sparkman Channels; 30 feet deep by 300 feet wide in Seddon and Garrison Channels, widening of bend between Sparkman Channel and Cut D of Hillsborough Bay Channel by 250 feet; a turning basin 30 feet deep at the mouth of Hillsborough River involving cutting back northwest corner of Seddon Island by 150 feet; 43 feet deep by 400 feet wide in Port Sutton entrance channel, and like depth in a turning basin with a turning diameter of 1,200 feet; 41 feet deep by 400 feet wide in Sparkman Channel, 39 feet deep by 300 feet wide in Ybor Channel; enlargement of turning basin at the entrance to Ybor Channel to a depth of 41 feet and an additional width of 200 feet on the Southwest edge of the present basin; 41 feet deep by 400 feet wide in Port Tampa Channel, and 41 feet deep by 900 feet and 2,000 feet wide in Port Tampa turning basin; 43 feet deep by 400 feet - 500 feet wide in East Bay entrance channel North from the Port Sutton turning basin for distance of about 2,000 feet; a turning basin in East Bay 43 feet deep with a turning diameter of 1,200 feet; an approach channel 43 feet deep by 300 feet wide North from East Bay turning basin for a distance of about 2,500 feet; maintenance of Port Sutton terminal channel to a depth of 43 feet, 200 feet wide and 4,000 feet long; and maintenance of a channel 12 feet deep by 200 feet wide in Hillsborough River from basin at mouth to a point 100 feet south of Lafayette Street bridge, 2,400 feet; and provision of a channel 9 feet deep by 100 feet wide to a point, 2,000 feet above Columbus Drive Bridge, 2.4 miles, and removal of snags, wrecks, and piling thence to City Water Works Dam, 7.2 miles; a channel 30 feet deep by 200 feet wide from Hillsborough Bay to and including a turning basin 30 feet deep by 700 feet and 1,200 feet wide in Alafia River, 3.6 miles; and a breakwater at Peter O. Knight Field, Davis Islands about 2,000 feet long, maintenance by local interests; maintenance of Port Sutton Channel, 150 feet wide and about 3,000 feet long, and turning basin 500 feet by 1,300 feet in area, both at a depth of 30 feet; Length of project is about 67 miles, including 10 miles in Hillsborough River, 3.6 miles in Alafia River.

TAMPA HARBOR, FLA

SCALE IN MILES
1 0 1 2 3 4 5 6

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

6-13-97

TAMPA HARBOR, FLORIDA
UPPER CHANNELS

Condition of Improvement, 30 September 1996

ACTS	WORK AUTHORIZED	DOCUMENTS
TAMPA BAY		
3 Mar 1899	Channel 27 feet deep by 300-500 feet wide from Gulf of Mexico to Port Tampa	Specified in Act & H. Doc. 52/55/3
3 Mar 1905	Channel depth of 26 feet with sufficient width	Specified in Act.
TAMPA AND HILLSBOROUGH BAYS		
25 Jun 1910	Depth of 24 feet in Hillsborough Bays	H. Doc. 634/61/2
8 Aug 1917	Channels 27 feet deep by 200-500 feet wide from Gulf of Mexico to and in Hillsborough Bay, and basins at mouth of Hillsborough River and Ybor Estuary.	H. Doc. 1345/64/1
HILLSBOROUGH RIVER		
3 Mar 1899	Channel 12 feet deep by 200 feet wide to within 100 feet of Lafayette St. Bridge (maintenance only)	H. Doc. 545/55/2 & A.R. for 1898 p. 1357
TAMPA HARBOR		
22 Sep 1922	Consolidation of above projects	Specified in Act.
3 Jul 1930	Egmont Channel 29 feet deep and Sparkman Channel 300 feet wide.	H. Doc. 100/70/1
30 Aug 1935	Egmont Bar Channel 32 feet deep by 600 feet wide; Mullet Key Cut 30 feet deep by 400 feet deep; other project channels in Tampa Harbor, except in Hillsborough River, 30 feet deep by 300 feet wide and basin at Port Tampa 550 feet by 2,000 feet.	S. Doc. 22/72/1
20 Jun 1938	Widen bend between Sparkman Channel and Cut D, Hillsborough Bay Channel by 250 feet; Ybor Channel 400 feet wide; and extend Hillsborough River basin easterly 300 feet.	S. Doc. 164/75/3
20 Jun 1938	Breakwater at Peter O. Knight Field.	S. Comm. Print 76/1
2 Mar 1945	Sparkman and Ybor Channels 400 and 500 feet wide; extend Ybor basin westerly 250 feet, and Hillsborough River basin easterly 150 feet in lieu of 300 feet.	S. Doc. 183/78/2
2 Mar 1945	Channel 9 feet deep by 100 feet wide in Hillsborough River and removal of obstructions to Florida Ave. Bridge.	H. Doc.119/77/1
2 Mar 1945	Channel 25 feet deep by 150 feet wide and basin in Alafia River	S. Doc.16/77/1
17 May 1950	Egmont Channel 36 feet deep; Mullet Key Cut 34 feet deep by 500 feet wide; Tampa Bay, Hillsborough Bay, Port Tampa Channels 34 feet deep by 400 feet wide; Port Tampa turning basin 34 feet deep by 750 feet by 2,000 feet wide; Sparkman Channel and Ybor turning basin 34 feet deep; and channel 30 feet deep by 200 feet wide to and including turning basin 700 feet by 1,200 feet in Alafia River.	H. Doc. 258/81/1
3 Sep 1954	Removal of obstructions in Hillsborough River from Florida Ave. Bridge to City Water Works Dam (maintenanceto be assumed by local interests).	H. Doc. 567/81/2
23 Oct 1962	Channel and turning basin at Port Sutton 30 feet deep; Ybor Channel 34 feet deep and 400 feet wide.	H. Doc. 529/87/2
31 Dec 1970	Egmont Bar Channel 46 feet deep by 700 feet wide; Mullet Key Cut Channel 44 feet deep by 600 feet wide; Tampa Bay Channel 44 feet deep by 500 feet wide to junction of Hillsborough Bay and Port Tampa Channels; Hillsborough Bay Channel 44 feet deep by 500 feet wide to junction with Port Sutton entrance channel, thence 42 feet deep by 400 feet wide; Ybor Channel 40 feet deep by 300 feet wide; Port Tampa Channel 42 feet deep by 400 feet wide from junction with Hillsborough and Tampa Bay Channels to Port Tampa turning basin; Port Tampa turning basin.	H. Doc. 91-401/91/2
31 Dec 1970	42 feet deep, 2,000 feet long and 900 feet wide; Port Sutton entrance channel 44 feet deep by 400 feet wide; Port Sutton 44 feet deep with turning diameter of 1,200 feet; enlargement of turning basin at the entrance of Ybor Channel and deepening to 42 feet; East Bay entrance channel 44 feet deep by 400 feet and 500 feet wide about 2,000 feet North from Port Sutton turning basin; East Bay turning basin 44 feet deep with 1,200 feet turning diameter; East Bay approach channel 44 feet deep by 300 feet about 2,500 feet North from the East Bay turning basin; and maintenance of Port Sutton terminal channel 44 feet deep by 200 feet wide for a distance of 4,000 feet. Bottom 1 foot of all project segments in 'inactive' category.	H. Doc. 91-401/91/2
17 Nov 1986	Maintenance of local channel and turning basin to a depth of 34 feet in Tampa East Bay.	Public Law 99-662
17 Nov 1986	Maintenance of local Port Manatee Channel 40 feet deep by 400 feet wide and enlargement of 40 feet deep turning basin and turn wider at the Tampa Bay Channel.	Public Law 99-662
17 Nov 1988	Port Sutton Channel deepening to 43 feet over length of 3,700 feet.	Public Law 100-676

PROJECT: Tampa Harbor - Bottom 1-foot of all project segments authorized in 1970 in "inactive" category Channel from Gulf of Mexico to Port Tampa and Tampa, 45 feet deep by 700 feet wide on Egmont Bar, 43 feet deep by 600 feet wide in Mullet Key Cut, 43 feet deep by 500 feet wide from Mullet Key Cut through Tampa Bay to the junction of Hillsborough Bay and Port Tampa Channels; 43 feet deep by 500 feet wide in Hillsborough Bay Channel from the junction with Tampa Bay and Port Tampa Channels to the junction with Port Sutton entrance channel, and thence deepening to a depth of 42 feet at the existing width to the junction with Seddon and Sparkman Channels; 30 feet deep by 300 feet wide in Seddon and Garrison Channels, widening of bend between Sparkman Channel and Cut D of Hillsborough Bay Channel by 250 feet; a turning basin 30 feet deep at the mouth of Hillsborough River involving cutting back northwest corner of Seddon Island by 150 feet; 43 feet deep by 400 feet wide in Port Sutton entrance channel, and like depth in a turning basin with a turning diameter of 1,200 feet; 41 feet deep by 400 feet wide in Sparkman Channel, 39 feet deep by 300 feet wide in Ybor Channel; enlargement of turning basin at the entrance to Ybor Channel to a depth of 41 feet and an additional width of 200 feet on the Southwest edge of the present basin; 41 feet deep by 400 feet wide in Port Tampa Channel, and 41 feet deep by 900 feet and 2,000 feet wide in Port Tampa turning basin; 43 feet deep by 400 feet - 500 feet wide in East Bay entrance channel North from the Port Sutton turning basin for distance of about 2,000 feet; a turning basin in East Bay 43 feet deep with a turning diameter of 1,200 feet; an approach channel 43 feet deep by 300 feet wide North from East Bay turning basin for a distance of about 2,500 feet; maintenance of Port Sutton terminal channel to a depth of 43 feet, 200 feet wide and 4,000 feet long; and maintenance of a channel 12 feet deep by 200 feet wide in Hillsborough River from basin at mouth to a point 100 feet south of Lafayette Street bridge, 2,400 feet; and provision of a channel 9 feet deep by 100 feet wide to a point, 2,000 feet above Columbus Drive Bridge, 2.4 miles, and removal of snags, wrecks, and piling thence to City Water Works Dam, 7.2 miles; a channel 30 feet deep by 200 feet wide from Hillsborough Bay to and including a turning basin 30 feet deep by 700 feet and 1,200 feet wide in Alafia River, 3.6 miles; and a breakwater at Peter O. Knight Field, Davis Islands about 2,000 feet long, maintenance by local interests; maintenance of Port Sutton Channel, 150 feet wide and about 3,000 feet long, and turning basin 500 feet by 1,300 feet in area, both at a depth of 30 feet; Length of project is about 67 miles, including 10 miles in Hillsborough River, 3.6 miles in Alafia River, Garrison Channel and that part of Seddon Channel in excess of 200-foot width and 12-foot depth were deauthorized by Public Law 97-128, 29 December 1981.

Hillsborough River - This improvement forms a part of the project for improving Tampa Harbor, Florida, and consists of the maintenance of a channel 12 feet deep by 200 feet wide from the basin at mouth to a point 100 feet south of Lafayette St. Bridge, 2,400 feet; thence a channel 9 feet deep by 100 feet wide to a point 2,000 feet above Columbus Drive bridge, 2.4 miles; and removal of snags, wrecks, and piling thence to City Water Works Dam, 7.2 miles. Length of project in Hillsborough River is 10.0 miles.

Alafia River - This improvement forms a part of the project for improving Tampa Harbor, Florida, and consists of a channel 30 feet deep and 200 feet wide from the ship channel in Hillsborough Bay to and including a turning basin 700 feet wide and 1,200 feet long in Alafia River. Length of project is about 3.6 miles.

LOCAL COOPERATION:

PROGRESS: About 65 percent complete of work authorized by R&H Act of 1970 (HD 401/91/2).

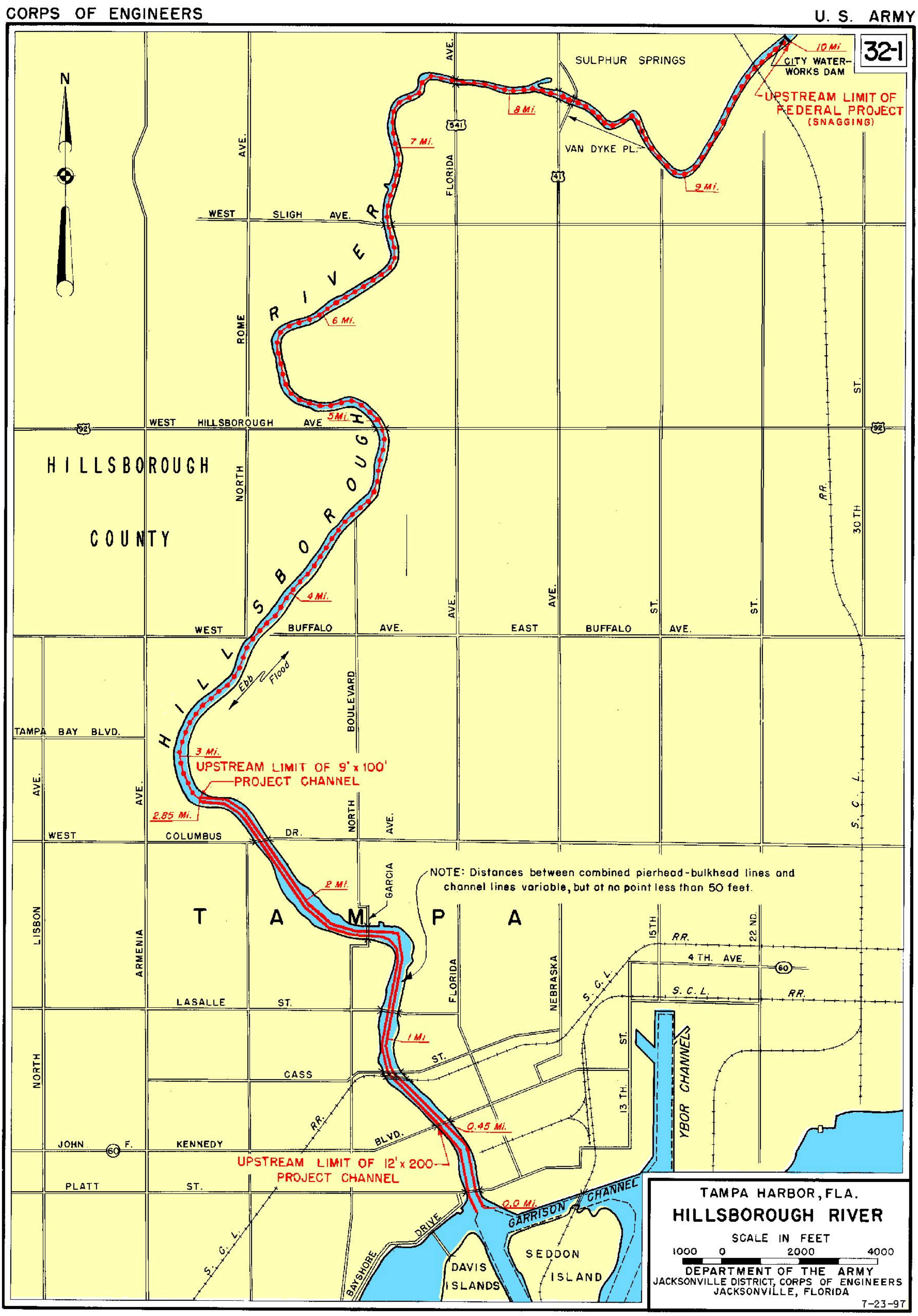
COST: $197,708643 for main project, including $853,050 for new work on previous project; excludes $270,466 for Hillsborough River and $13,939 for new work from contributed funds, includes $215,000 appropriation for new work East Bay Channel, all Federal funds; and $1,029,962 non-Federal funds for new work.

SPONSOR: Tampa Port Authority
Post Office Box 2192
Tampa, Florida 33601

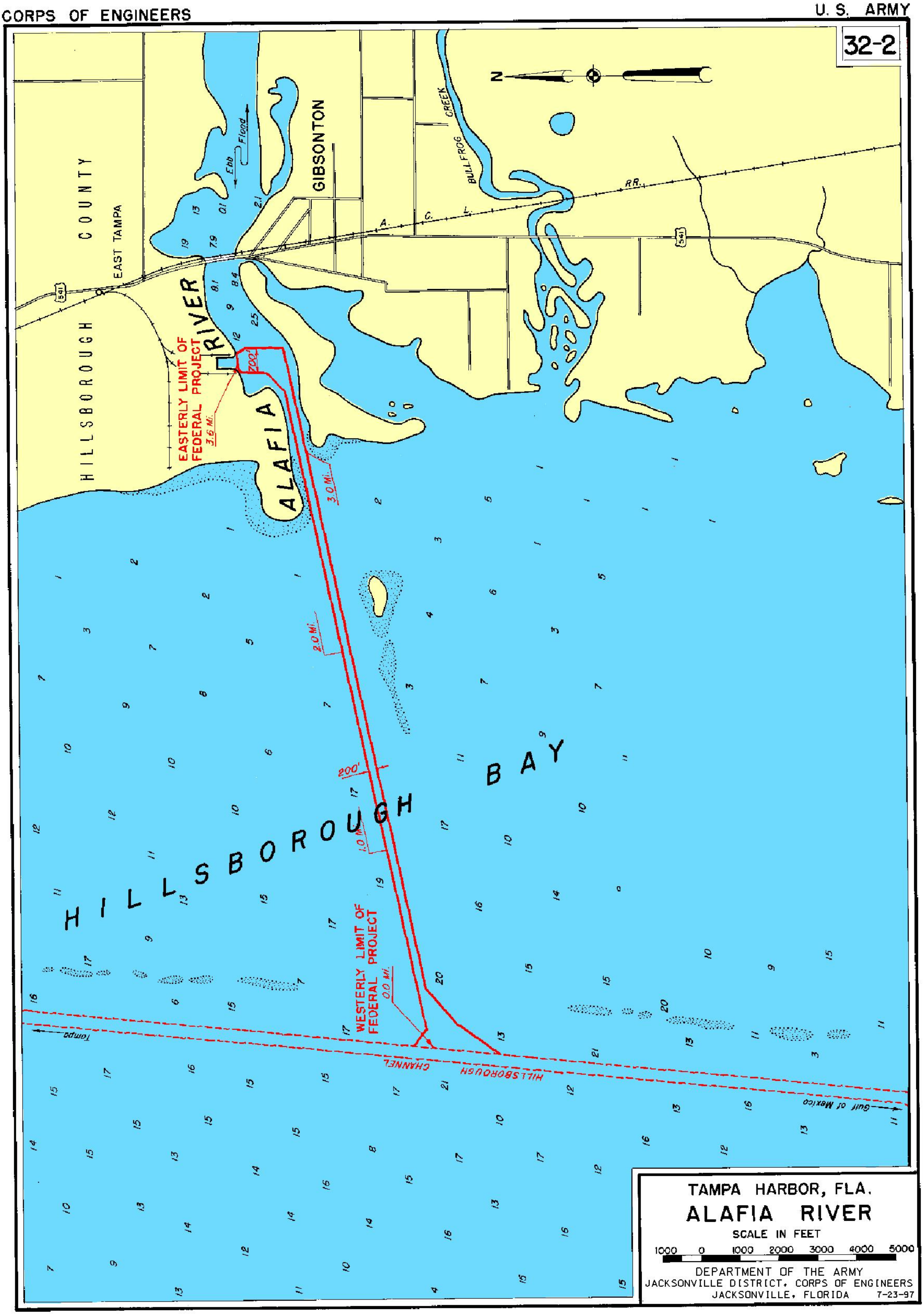
Tampa Bay Dredged Material Management Strategy

Authorizations

Figure 8

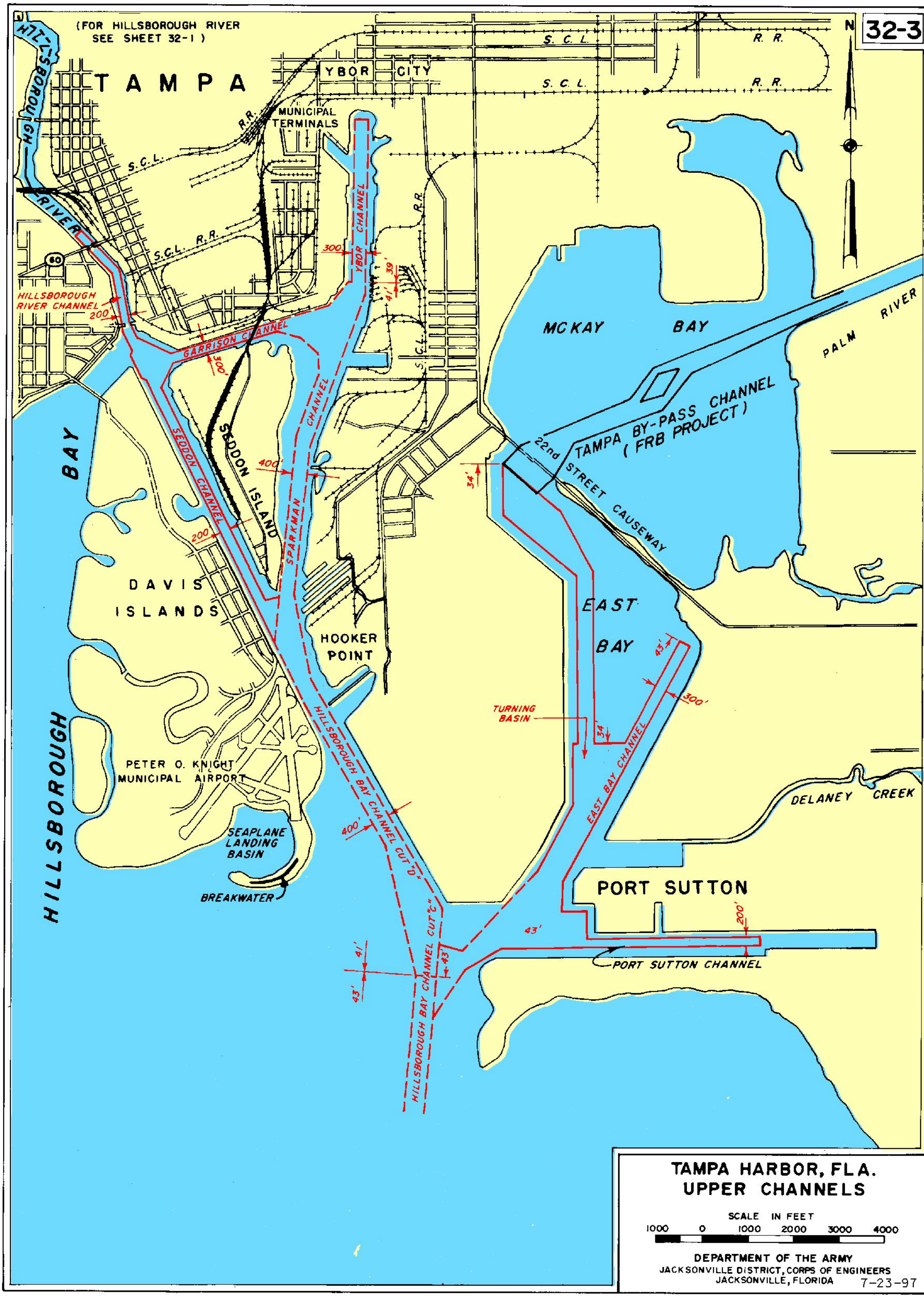


Tampa Bay Dredged Material Management Strategy
Figure 9



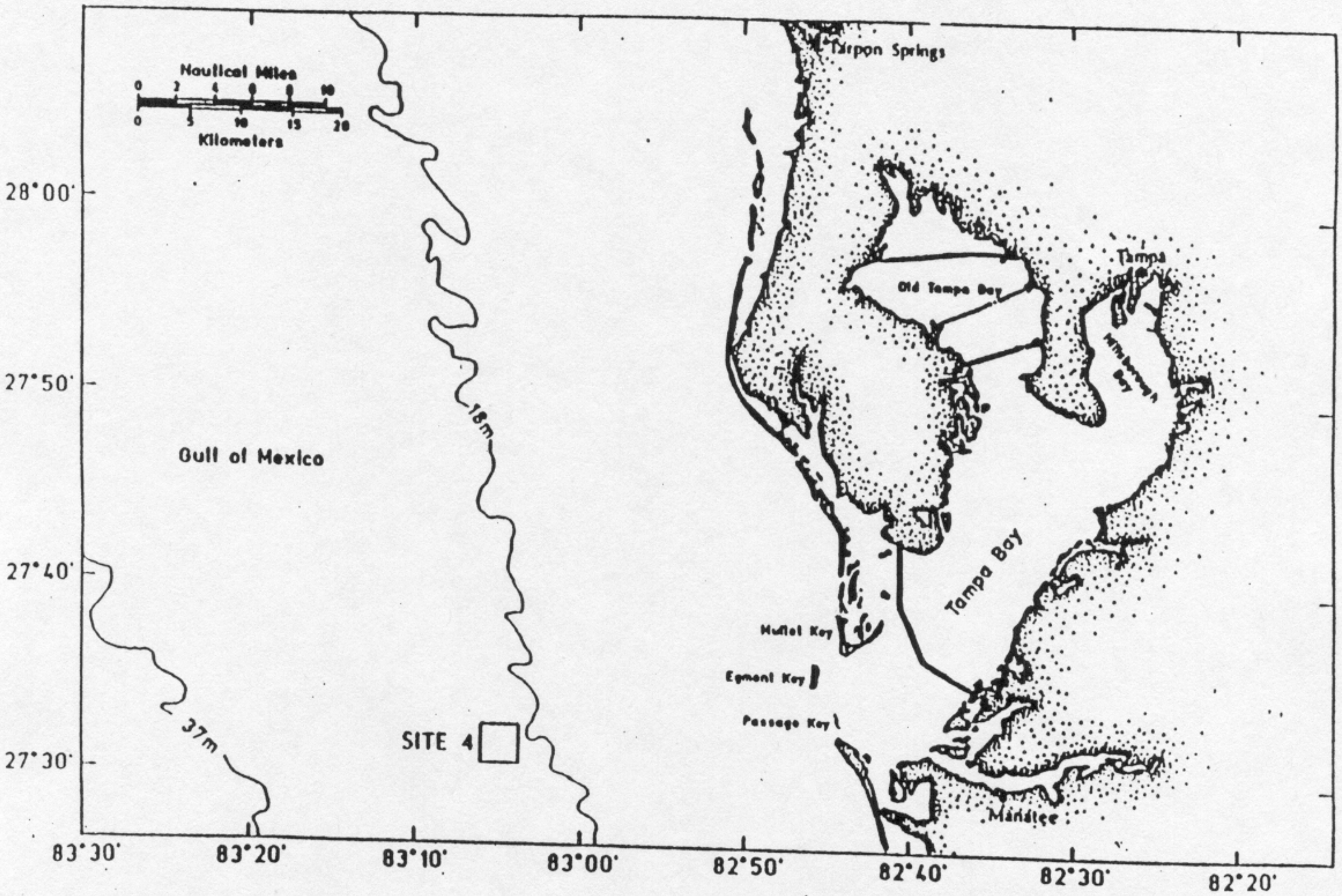
Tampa Bay Dredged Material Management Strategy

Figure 10



Tampa Bay Dredged Material Management Strategy
Figure 11

Tampa Bay Dredged Material Management Strategy
Other Dredging Locations
Figure 12



Site Map

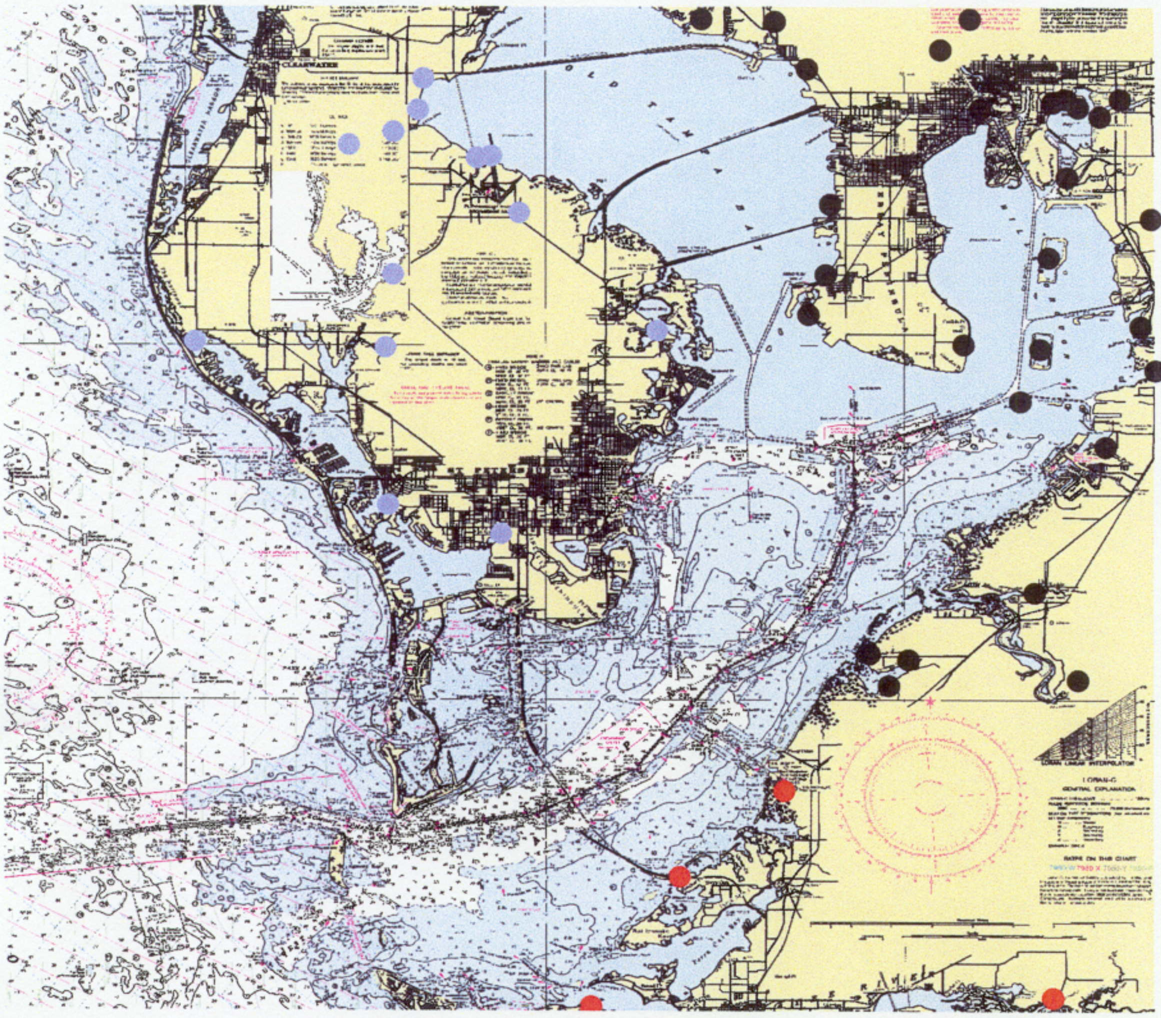
NW 27°32'27"N, 83°06'02"W
NE 27°32'27"N, 83°03'46"W
SW 27°30'27"N, 83°06'02"W
SE 27°30'27"N, 83°03'46"W

Boundary Coordinates

Tampa Bay Dredged Material Management Plan
Location of Offshore Dredged Material Disposal Site
Figure 13.

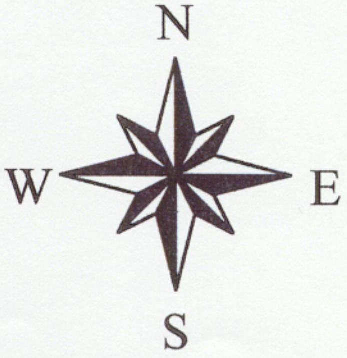
Tampa Bay Dredged Material Management Strategy
Existing Placement Locations
Figure 14

Habitat Restoration Sites in Tampa Bay



Site Locations

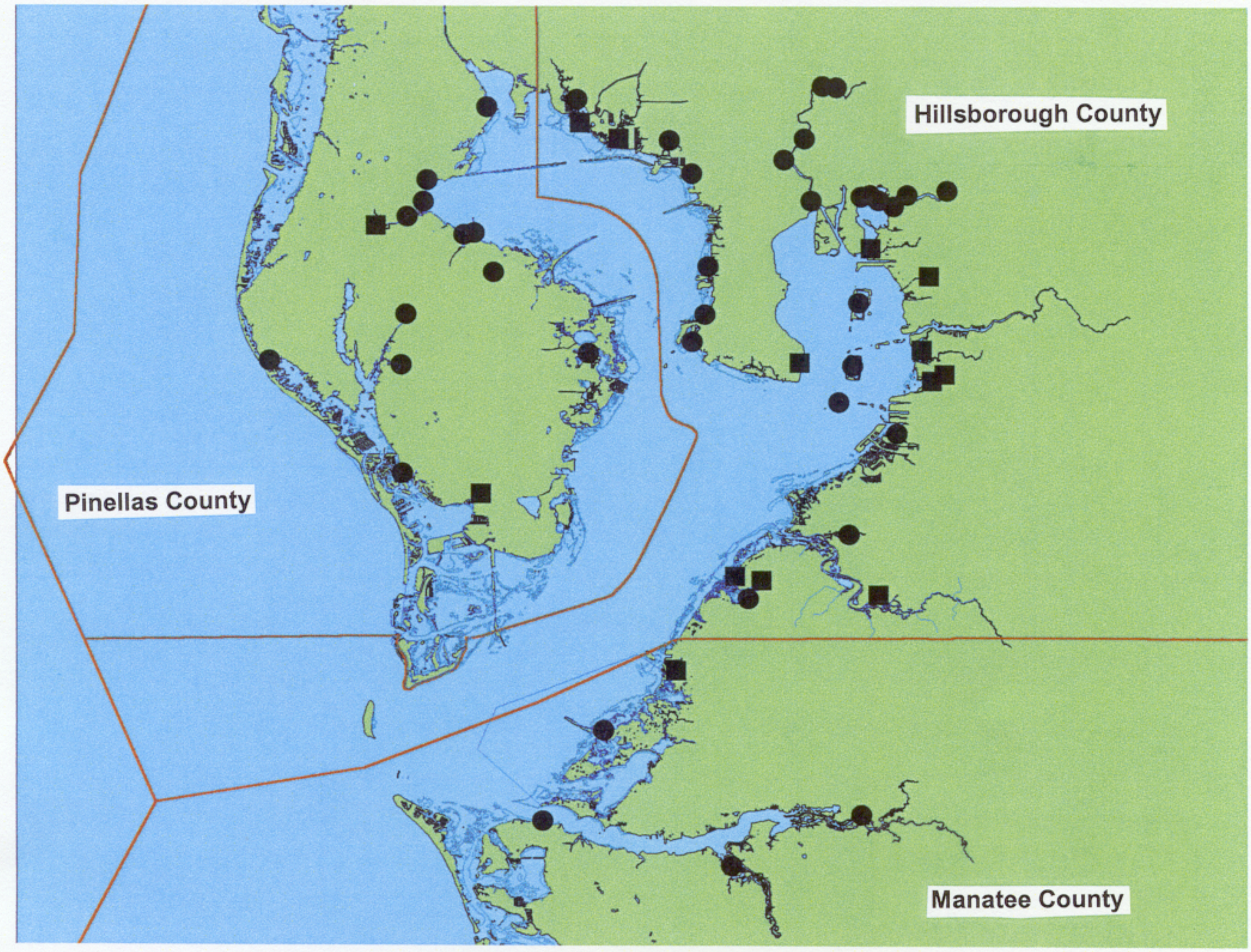
- Hillsborough
- Manatee
- Pinellas



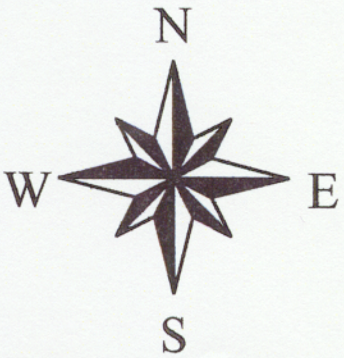
Habitat Restoration Sites By County
Figure 15a.

Figure provided by Tampa BayWatch, Inc.
From "A Conservation Blueprint For Habitat Restoration in Tampa Bay", Nov. 1998

Restoration Maps



Aquatic Preserves
Seagrass Beds
County Boundaries
Restoration Sites by Class
■ A
● B
Tampa Bay Geographic Features
LAND
WATER



Habitat Restoration Sites By Class

Figure 15b.

Figure provided by Tampa BayWatch, Inc.

From "A Conservation Blueprint For Habitat Restoration in Tampa Bay", Nov. 1998

Table 1. Tampa Bay Dredged Material Management Plan								
Shoal Estimates-Maintenance Material, Federal Channels								
			Jacksonville District dredging history database		DAS shoal estimate (CY)		Tampa Port Authority DMMP	
			Per Year	Up to year end 2025	Per Year	Up to year end 2025	Per Year	Up to year end 2025
Major Source	Major Bay Segment	Minor Bay Segment						
Federal Channels								
	Tampa Harbor Project	Egmont 1	316,000	8,216,000	320,000	8,320,000		
		Egmont 2			500	13,000		
		Mullet Key Channel			2,500	65,000		
		Cut A			15,000	390,000		
		Cut B			11,000	286,000		
		Cut C			100	2,600		
		Cut D			2,000	52,000		
		Cut E			400	10,400		
		Cut F			6,000	156,000		
		Cut G	81,000	2,106,000	65,000	1,690,000	66,000	1,716,000
		Cut J			300	7,800		
		Cut J2			25	650		
		Cut K			1,000	26,000	2,000	52,000
		Gadsen Point Cut	19,000	494,000	20,000	520,000	38,000	988,000
		Cut A (Hillsborough Bay)	90,000	2,340,000	39,000	1,014,000	39,000	1,014,000
		Cut C (Hillsborough Bay)	20,000	520,000	110,000	2,860,000	110,000	2,860,000
		Port Sutton Channel and Turning Basi	57,000	1,482,000	75,000	1,950,000	87,000	2,262,000
		East Bay	20,000	520,000	20,000	520,000	100,000	2,600,000
		Cut D (Hillsborough Bay)	10,000	260,000	35,000	910,000	113,000	2,938,000
		Sparkman Channel	60,000	1,560,000	30,000	780,000	43,000	1,118,000
		Ybor Channel			10,000	260,000	3,000	78,000
		Seddon Channel			0	0		
		Alafia River	155,000	4,030,000	110,000	2,860,000	130,000	3,380,000
	Intracoastal Waterway		6,000	156,000				
	Manatee Harbor		68,000	1,768,000				
	Manatee River							
	St. Petersburg Harbor		20,000	520,000				
	John's Pass		12,000	312,000				
	Pas-A-Grill Pass		4,000	104,000				
		TOTAL	938,000	24,388,000	872,800	22,693,500	731,000	19,006,000

Table 2. Tampa Bay Dredged Material Management Plan				
Shoal Estimates-Maintenance Material, Non-Federal Channels				
			Shoal estimate (CY)	
			Per Year	Up to year end 2025
Major Source	Major Bay Segment	Minor Bay Segment		
Non-Federal Channels				
	Big Bend		74,700	1,942,200
	Port Sutton Terminal Channel		20,000	520,000
	Blind Pass		42,000	1,092,000
Berthing Areas				
	Big Bend		5,300	137,800
	Intracoastal Waterway			
	Manatee Harbor		53,500	1,391,000
	Manatee River			
	Port Sutton Terminal Channel		5,000	130,000
	St. Petersburg Harbor			
	Tampa Harbor		50,000	1,300,000
	John's Pass			
	Pas-A-Grill Pass			
Private Dredging	Hillsborough County	City of Tampa residential canals		
(Marinas, Finger Canals, Othe	Manatee County	Manatee County	8,100	210,600
	Pinellas County	Neptune Lagoon and others	500	13,000
	St. Petersburg County	City of St. Petersburg arterial waterways and channels, Farragut Yacht Ba	24,500	613,000
	Miscellaneous	All counties	200	5,200
		TOTAL	283,800	7,354,800

Table 3. Tampa Bay Dredged Material Management Plan
New Work Dredging Projection
Federal Dredging

Major Source	Major Bay Segment	Minor Bay Segment	Description of Work	Volume of Materia To Be Removed	Placement Area(s) and Notes	
Federal Channels						
	Tampa Harbor Project	Egmont 1				
		Egmont 2				
		Mullet Key Channel				
		Cut A				
		Cut B				
		Cut C				
		Cut D				
		Cut E				
		Cut F				
		Cut G				
		Cut J				
		Cut J2				
		Cut K				
		Gadsen Point Cut				
		Cut A (Hillsborough Bay)				
		Cut C (Hillsborough Bay)				
		Port Sutton Channel and Turning Bas	Deepen channel to 43 feet	245,000	February 1991 report places material in CMDA 2-D	
		East Bay				
		Cut D (Hillsborough Bay)				
		Sparkman Channel				
		Ybor Channel	Enlarge Ybor Turning Basin	478,000	Hooker's Point (264,000 CY) and Garrison Channel (215,000 CY)	
		Seddon Channel				
		Alafia River	Deepen and widen	3,000,000	Subject to funding, ODMDS and CMDA 2-D under consideration, as well as beneficial uses	
		Anchorage Area	Construct (Details uncertain at present)			
	Intracoastal Waterway					
	Manatee Harbor		Deepen to 40 feet, construct wideners, and enlarge turning ba	2,400,000	Authorized but never completed, proposal to place dredged material in Buckeye Pit	
	Manatee River					
	St. Petersburg Harbor		Current channel 23 feet deep, authorized to 24 feet		No plans to construct deeper channel	
	John's Pass					
	Pas-A-Grill Pass					
			Total	6,123,000		

Table 4. Tampa Bay Dredged Material Management Plan					
New Work Dredging Projection					
Non-Federal Dredging					
Major Source	Major Bay Segment	Minor Bay Segment	Description of Work	Volume of Materia	Placement Area(s) and Notes
Non-Federal Channels					
	Big Bend		Deepen and widen channels and turning basin,	3,500,000	September 1997 report places material in CMDA 3-D, construction subject to funding
			and become part of Federal Tampa Harbor project		
	Port Sutton Terminal Channel		Deepen channel and become part of Federal Tampa Harbor proj	345,000	Upland site near channel (may no longer be practical-from 1985 study)
	Blind Pass				
Berthing Areas					
	Big Bend		Deepen	195,000	In association with construction of Federal project
	Intracoastal Waterway				
	Manatee Harbor				
	Manatee River				
	Port Sutton Terminal Channel		Deepen	65,000	In association with construction of Federal project
	St. Petersburg Harbor		Deepen if necessary		In association with construction of Federal project
	Tampa Harbor				
Private Dredging	Hillsborough County				
(Marinas, Finger Canals, Other)	Manatee County				
	Pinellas County				
	St. Petersburg County				
			Total	4,105,000	
			Grand Total	10,228,000	

Table 5 (Page 1 of 4). Tampa Bay Dredged Material Management Plan

Years Expected To Be Dredged

				Years Expected To Be Dredged												
Major Source	Major Bay Segment	Minor Bay Segment	Average Annual Shoaling Rat	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Federal Channels																
	Tampa Harbor Project	Egmont 1	316,000		948,000			948,000			######			######		
		Egmont 2 (included in Egmont 1)														
		Mullet Key Channel (included in Egmont 1)														
		Cut A (includes Cuts A-F)	15,000		104,000			104,000			######			######		
		Cut B	11,000													
		Cut C	100													
		Cut D	2,000													
		Cut E	400													
		Cut F	6,000													
		Cut G (includes Cuts G,J,J2,K, Port Tampa)	81,000	######					######					######		
		Cut J														
		Cut J2														
		Cut K														
		Gadsen Point Cut	19,000			######										######
		Cut A (Hillsborough Bay) [includes Cuts A, C, and D]	90,000	######		######		240,000		######		######		######		######
		Cut C (Hillsborough Bay)	20,000													
		Port Sutton Channel and Turning Basin	57,000					285,000					285,000			
		East Bay	20,000					100,000					100,000			
		Cut D (Hillsborough Bay)	10,000													
		Sparkman Channel (includes Ybor Channel and Turning Bas	60,000	######					######					######		
		Ybor Channel														
		Seddon Channel	not expected to be dredged													
		Alafia River	155,000	######			######			######			465,000			######
	Intracoastal Waterway		6,200			31,000					31,000					31,000
	Manatee Harbor		68,000			######				######				######		
	Manatee River															
	St. Petersburg Harbor		20,000		400,000											
	John's Pass		12,000		60,000					60,000					60,000	
	Pas-A-Grill Pass		4,000								84,000					
		TOTAL	972,700													

Table 5 (Page 2 of 4). Tampa Bay Dredged Material Management Plan																
Years Expected To Be Dredged																
				Years Expected To Be Dredged												
Major Source	Major Bay Segment	Minor Bay Segment	Average Annual Shoaling Rat	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Non-Federal Channels																
	Big Bend		74,700					373,500					373,500			
	Port Sutton Terminal Channel		20,000					100,000					100,000			
	Blind Pass		42,000	210,000					210,000					210,000		
Berthing Areas																
	Big Bend	IMC-Agrico	5,300			16,000			16,000			16,000			16,000	
	Intracoastal Waterway															
	Manatee Harbor		53,500			######				214,000				214,000		
	Manatee River															
	Port Sutton Terminal Channe	IMC-Agrico	5,000				15,000			15,000			15,000			15,000
	St. Petersburg Harbor															
	Tampa Harbor		50,000		100,000					250,000					######	
	John's Pass															
	Pas-A-Grill Pass															
Private Dredging	Hillsborough County	Residential canals														
(Marinas, Finger Canals, Othe	Manatee County	Manatee County/Homeowners	8,100		21,000	14,210										
	Pinellas County		500													
	St. Petersburg County	Small boat channels A through (	24,500	105,000	105,000	######	######	105,000	105,000							
	Miscellaneous		200	200	200	200	200	200	200	200	200	200	200	200	200	200
		TOTAL	283,800	#######	#######	######	######	#######	#######	#######	#######	256,200	1,338,700	#######	######	######

Table 5 (Page 3 of 4). Tampa Bay Dredged Material Management Plan

Years Expected To Be Dredged

				Years Expected To Be Dredged													
Major Source	Major Bay Segment	Minor Bay Segment	Average Annual Shoaling Rat	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Federal Channels																	
	Tampa Harbor Project	Egmont 1	316,000	948,000			######			948,000			######			948,000	#######
		Egmont 2 (included in Egmont 1)															0
		Mullet Key Channel (included in Egmont 1)															0
		Cut A (includes Cuts A-F)		104,000			######			104,000			######			104,000	936,000
		Cut B															0
		Cut C															0
		Cut D															0
		Cut E															0
		Cut F															0
		Cut G (includes Cuts G,J,J2,K,Port Tampa)	81,000			405,000					######					405,000	#######
		Cut J															0
		Cut J2															0
		Cut K															0
		Gadsen Point Cut	19,000										######				570,000
		Cut A (Hillsborough Bay)	90,000		240,000		######		######		######		######		240,000		#######
		Cut C (Hillsborough Bay)	20,000														0
		Port Sutton Channel and Turning Basin	57,000				######					285,000					#######
		East Bay	20,000				######					100,000					400,000
		Cut D (Hillsborough Bay)	10,000														0
		Sparkman Channel (includes Ybor Channel and Turning Bas	60,000			300,000					######					300,000	#######
		Ybor Channel															0
		Seddon Channel	not expected to be dredged														0
		Alafia River	155,000			465,000			######			465,000			465,000		#######
	Intracoastal Waterway		6,200					31,000					31,000				155,000
	Manatee Harbor		68,000	272,000				272,000				272,000				272,000	#######
	Manatee River																0
	St. Petersburg Harbor		20,000											######			840,000
	John's Pass						60,000					60,000					300,000
	Pas-A-Grill Pass		4,000														84,000

Table 5 (Page 4 of 4). Tampa Bay Dredged Material Management Plan																	
Years Expected To Be Dredged																	
				Years Expected To Be Dredged													
Major Source	Major Bay Segment	Minor Bay Segment	Average Annual Shoaling Rat	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Non-Federal Channels																	
	Big Bend		74,700		373,500					373,500					373,500		1,867,500
	Port Sutton Terminal Channel		20,000		100,000					100,000					100,000		500,000
	Blind Pass		42,000			210,000					210,000					210,000	1,260,000
Berthing Areas																	0
	Big Bend	IMC-Agrico	5,300		16,000			16,000			16,000			16,000			128,000
	Intracoastal Waterway																0
	Manatee Harbor		53,500		214,000				######				214,000				1,230,500
	Manatee River																0
	Port Sutton Terminal Channe	IMC-Agrico	5,000			15,000			15,000			15,000			15,000		120,000
	St. Petersburg Harbor																0
	Tampa Harbor		50,000				250,000					250,000					1,100,000
Private Dredging	John's Pass																0
(Marinas, Finger Canals, Othe	Pas-A-Grill Pass																0
	Hillsborough County	Residential canals															0
	Manatee County	Manatee County/Homeowners	8,100														35,210
	Pinellas County		500														0
	St. Petersburg County	Small boat channels A through (	24,500														630,000
	Miscellaneous		200	200	200	200	200	200	200	200	200	200	200	200	200	200	5,200
			Total	1,324,200	943,700	1,395,200	1,987,200	######	######	1,525,700	1,171,200	1,447,200	1,727,200	456,200	1,193,700	2,239,200	
														Grand Total		33,272,410	
														Federal		26,396,000	
														Non-Federal		6,876,410	
														Check		33,272,410	
														Yearly X 2(	Fed	24,388,000	
														Yearly X 2(	Non-Fed	7,378,800	
														Sum		31,766,800	

Table 6. Tampa Bay Dredged Material Management Plan				
Dredging Methods				
Major Source	Major Bay Segment	Minor Bay Segment	Probable Method of Dredging	
Federal Channels	Tampa Harbor Project	Egmont 1	Hopper	
		Egmont 2	Hopper	
		Mullet Key Channel	Hopper	
		Cut A	Hopper	
		Cut B		
		Cut C		
		Cut D	Closed clamshell	
		Cut E		
		Cut F		
		Cut G	Closed clamshell	
		Cut J		
		Cut J2		
		Cut K		
		Gadsen Point Cut	Closed clamshell	
		Cut A (Hillsborough Bay)	Hydraulic	
		Cut C (Hillsboroug Bay)	Hydraulic	
		Port Sutton Channel and Turning Basi	Hydraulic	
		East Bay	Hydraulic	
		Cut D (Hillsborough Bay)	Hydraulic	
		Sparkman Channel	Hydraulic	
		Ybor Channel	Hydraulic	
		Seddon Channel	Hydraulic	
		Alafia River		
	Intracoastal Waterway			
	Manatee Harbor		Hydraulic/cutter suction	
	Manatee River			
	St. Petersburg Harbor			
	John's Pass			
	Pas-A-Grill Pass			
Non-Federal Channels	Big Bend		Hydraulic/Sealed Clamshell	
	Port Sutton Terminal Channel		Hydraulic	
	Blind Pass		Hydraulic	
Berthing Areas	Big Bend		Clamshell	
	Intracoastal Waterway			
	Manatee Harbor		Clamshell	
	Manatee River			
	Port Sutton Terminal Channel		Clamshell	
	St. Petersburg Harbor			
	Tampa Harbor			
Private Dredging	Hillsboro County	Residential canals		
(Marinas, Finger Canals, Other)	Manatee County		Hydraulic	
	Pinellas County			
	St. Petersburg County		Hydraulic	

Table 7. Tampa Bay Dredged Material Management Plan						
Dredged Material Quality						
Major Source	Major Bay Segment	Minor Bay Segment	Physical Qualities	Chemical Concerns	Reference	Contact Person
Federal Channels	Tampa Harbor Project	Egmont 1	Silt			
		Egmont 2	Silt			
		Mullet Key Channel	Silt			
		Cut A	Silt			
		Cut B				
		Cut C				
		Cut D	Silt			
		Cut E				
		Cut F				
		Cut G	Silt			
		Cut J				
		Cut J2				
		Cut K				
		Gadsen Point Cut	Silt			
		Cut A (Hillsborough Bay)	Silt			
		Cut C (Hillsboroug Bay)	Silt			
		Port Sutton Channel and Turning Basin				
		East Bay				
		Cut D (Hillsborough Bay)	Silt			
		Sparkman Channel				
		Ybor Channel				
		Seddon Channel				
		Alafia River				
	Intracoastal Waterway		Beach quality			
	Manatee Harbor		Beach quality and non-beach quality			
	Manatee River					
	St. Petersburg Harbor		Fine Sand and Silty, Clayey Fine Sand			
	John's Pass		Beach quality			
	Pas-A-Grill Pass		Sand			
Non-Federal Channels	Big Bend		Sand, Silt, Shell			
	Port Sutton Terminal Channel					
	Blind Pass		Sand			
Berthing Areas	Big Bend	IMC-Agrico	Sand, Silt, Shell			
	Intracoastal Waterway					
	Manatee Harbor					
	Manatee River					
	Port Sutton Terminal Channe	IMC-Agrico	Sand and Silt			
	St. Petersburg Harbor					
	Tampa Harbor					
Private Dredging	Hillsborough County	Residential canals		Metals and petroleum-based compound	Draft Residential Canal Dredging Manual, March 2000	
(Marinas, Finger Canals, Othe	Manatee County	Manatee County/Homeowners	Sand and Silt			
	Pinellas County					
	St. Petersburg County	Small Boat Channels A thru Q	Fine Sand			

Table 8. Tampa Bay Dredged Material Management Plan
Project Sponsors

Major Source	Major Bay Segment	Minor Bay Segment	Project Sponsor
Federal Channels	Tampa Harbor Project	Egmont 1	Tampa Port Authority
		Egmont 2	
		Mullet Key Channel	
		Cut A	
		Cut B	
		Cut C	
		Cut D	
		Cut E	
		Cut F	
		Cut G	
		Cut J	
		Cut J2	
		Cut K	
		Gadsen Point Cut	
		Cut A (Hillsborough Bay)	
		Cut C (Hillsboroug Bay)	
		Port Sutton Channel and Turning Basin	
		East Bay	
		Cut D (Hillsborough Bay)	
		Sparkman Channel	
		Ybor Channel	
		Seddon Channel	
		Alafia River	
	Intracoastal Waterway		Pinellas County
	Manatee Harbor		Manatee Port Authority
	Manatee River		Board of County Commissioners, Manatee County
	St. Petersburg Harbor		City of St. Petersburg
	John's Pass		Pinellas County
	Pas-A-Grill Pass		Pinellas County
Non-Federal Channels	Big Bend		Tampa Port Authority
	Port Sutton Terminal Channel		Tampa Port Authority
	Blind Pass		Pinellas County
Berthing Areas	Big Bend		
	Intracoastal Waterway		
	Manatee Harbor		
	Manatee River		
	Port Sutton Terminal Channel		
	St. Petersburg Harbor		
	Tampa Harbor		
Private Dredging	Hillsborough County		
(Marinas, Finger Canals, Other	Manatee County		
	Pinellas County		
	St. Petersburg County		

Table 9. Tampa Bay Dredged Material Management Plan					
Existing, Approved Placement Sites					
Site Name	Facility Operator	Restrictions on Material	Total Storage Capacity	Capacity Remaining	Site Type
Offshore Dredged Material Dispoal Site (ODMDS)	EPA/COE		Unlimited		Offshore open water
Confined Dredged Material Disposal Area 2D	TPA		15,700,000	441,000	Nearshore confined
Confined Dredged Material Disposal Area 3D	TPA		13,100,000	3,614,000	Nearshore confined
Cargill/Alafia River Site 'C'	Cargill, Inc.		900,000		Upland confined
Big Bend-IMC/Agrico	TECO/IMC/Agrico	Sand, silt, shell	385,000		Upland
Big Bend-TECO DA-1	TECO	Sand, silt, shell	75,000		Upland
Big Bend-TECO DA-5	TECO	Sand, silt, shell	427,000		Upland
Manatee Harbor	Port Manatee				Upland
Pinellas County Beaches	COE/Pinellas County	Beach quality			Beach
			Sum	4,055,000	
EPA=U.S. Environmental Protection Agency					
COE=U.S. Army Corps of Engineers					
TPA=Tampa Port Authority					

Table 10. Tampa Bay Dredged Material Management Plan					
New Placement Sites and Planned Expansions					
Site Name	Location	Facility Operator	Restrictions on Material	Additional Storage Capacity	New/Planned Expansion
CMDA-2D	Hillsborough Bay	TPA		10,000,000	Planned Expansion
CMDA-3D	Hillsborough Bay	TPA		10,000,000	Planned Expansion
			Sum	20,000,000	

Table 11. Tampa Bay Dredged Material Management Plan

Potential Fill Sites, Including Habitat Restoration and Other Beneficial Use Sites

Site Name		Facility Operator	Type	Quantity of Fill Required	Quality of Fill Required	Potential Permitting or Logistical Problems, and Notes
Shell mining pits	Central and Upper Tampa Bay					Locations of pits need to be determined
Seddon Channel	Hillsborough Bay		Deauthorized navigation channel			
Garrison Channel	Hillsborough Bay	Tampa Port Authority (leased to Audubon Society)	Deauthorized navigation channel			Raising bottom surface elevation to -12 feet MLLW planned as part of Ybor Turning Basin expansion
Ben T. Davis Beach	Hillsborough County					
Bay Point Dredge Hole	Hillsborough County		Subtidal borrow area			
Rocky Point East Dredge Hole	Hillsborough County		Subtidal borrow area			
Cypress Point Dredge Hole	Hillsborough County		Subtidal borrow area			
Culbreath Bayou North Channel	Hillsborough County		Subtidal borrow area			
Georgetown Dredge Hole	Hillsborough County		Subtidal borrow area			
Westinghouse Turning Basin	Hillsborough County		Subtidal borrow area			
MacDill AFB Runway Extension Dredge Hole	Hillsborough County		Subtidal borrow area			
MacDill AFB Beach Dredge Hole	Hillsborough County		Subtidal borrow area			
MacDill AFB Docks Dredge Hole	Hillsborough County		Subtidal borrow area			
McKay Bay Dredge Cuts	Hillsborough County		Subtidal borrow area			
Whiskey Stump Key Holes	Hillsborough County		Subtidal borrow area	950,000	Fine and coarse-grained	
TECO Rock Ponds	Hillsborough County		Subtidal borrow area			
Wolf Branch Creek	Hillsborough County	Hillsborough County				
Palm River	Hillsborough County	Southwest Florida Water Management District	Flood control channel			Federal feasibility study underway
Cockroach Bay	Hillsborough County	Southwest Florida Water Management District	Inland mines (shell pits)	5,000,000		5 pits total, a Federal feasibility study is underway for two of the pits (600,000 cy)
Sunken Island	Hillsborough County	Tampa Port Authority (leased to Audubon Society)		545,000		Migratory bird rookery, suggested for expansion
Highland Shores	Manatee County	Ellenton	Construction fill	9,600		One time fill only
Skyway Causeway South Hole	Manatee County		Subtidal borrow area			
Maximo Pit	Manatee County		Subtidal borrow area			
Booth Point Pits	Manatee County		Subtidal borrow area			
Port Manatee Upland Pits	Manatee County		Subtidal borrow area			
Terra Ceia Bay Upland Borrow Pit	Manatee County		Subtidal borrow area			
Manatee River Dolomite Pit	Manatee County		Subtidal borrow area			
Lena Road Landfill	Manatee County	Manatee County	Landfill	10,585,000	Class III landfill material	Landfill cover (1,000 cy daily until 2029)
Buckeye Pit	Manatee County					
Bay Colony Phase I and 2 Project	Manatee County	Palmetto	Construction fill	25,000		One time fill only
Northeast St. Pete Pits 1,2,3	Pinellas County		Subtidal borrow area	3,000,000		
Mangrove Bay Golf Course	Pinellas County	City of St. Petersburg	Borrow pit	87,800	Natural bay bottom sands	87,800 is remaining capacity
Harbor Isles Lake	Pinellas County	City of St. Petersburg		400,000	Natural bay bottom sands	
Clam Bayou	Pinellas County			1,000,000		
St. Petersburg Airport East 1 and 2	Pinellas County		Subtidal borrow area			
Ft. DeSoto Dredge Cuts	Pinellas County		Subtidal borrow area			
Shore Acres dredge hole	Pinellas County		Subtidal borrow area			
Venetian Islands South	Pinellas County		Subtidal borrow area			
Snug Harbor West Dredge Cut	Pinellas County		Subtidal borrow area			
Gandy Channel North	Pinellas County		Subtidal borrow area			
Howard Frankland Causeway Cuts South	Pinellas County		Subtidal borrow area			
Big Island Cut and Dredge Hole	Pinellas County		Subtidal borrow area			
Albert Whitted Muncipal Airport	Pinellas County		Construction fill			
Water site adjacent to Municipal Airport	Pinellas County					
Howard Frankland West	Pinellas County	Pinellas Co./Private				
Deep water disposal near St. Petersburg Harbor entrance channel	Tampa Bay					
Egmont Key	Western shoreline	FDEP/USFWS		3,000,000	Sand (some beach quality)	
Chateau Tower Lagoon Restoration Project						
Inland Sun City Shell Pit		SE corner of Cockroach Bay		1,000,000		
Sun City Shell Mine						
Kaul Fill Site at Old Tampa Bay						
Bullfrog Creek Marsh						Salt content of dredged material a possible constraint
			SUM	25,602,400		

Table 12 (Page 1 of 2). Tampa Bay Dredged Material Management Plan			
Capacity Shortfall			
Major Source	Major Bay Segment	Minor Bay Segment	Placement Options
MAINTENANCE			
Federal Channels			
	Tampa Harbor Project	Egmont 1	ODMDS
		Egmont 2	ODMDS
		Mullet Key Channel	ODMDS
		Cut A	ODMDS
		Cut B	ODMDS
		Cut C	ODMDS
		Cut D	ODMDS
		Cut E	ODMDS
		Cut F	ODMDS
		Cut G	3-D
		Cut J	
		Cut J2	
		Cut K	
		Gadsen Point Cut	3-D
		Cut A (Hillsborough Bay)	3-D
		Cut C (Hillsborough Bay)	3-D/2-D
		Port Sutton Channel and Turning Basin	2-D
		East Bay	2-D
		Cut D (Hillsborough Bay)	2-D
		Sparkman Channel	2-D
		Ybor Channel	2-D
		Seddon Channel	2-D
		Alafia River	C/3-D
	Gulf Intracoastal Waterway		Beach
	Manatee Harbor		Port Authority-Owned DA
	Manatee River		
	St. Petersburg Harbor		ODMDS, airport upland, nearshore adjacent to airport,
			deep water disposal in Tampa Bay
			(St. Petersburg entrance channel mile 2.25 to 4.5)
	John's Pass		Beach
	Pas-A-Grill Pass		Beach
Non-Federal Channels			
	Big Bend		Big Bend/IMC-Agrico site, TECO DA-1, TECO DA-5
	Port Sutton Terminal Channel		2-D
	Blind Pass		Beach
Berthing Areas			
	Big Bend		Big Bend/IMC-Agrico site, TECO DA-1, TECO DA-5
	Gulf Intracoastal Waterway		Beach
	Manatee Harbor		Port Authority-Owned DA
	Manatee River		
	Port Sutton Terminal Channel		2-D
	St. Petersburg Harbor		ODMDS, airport upland, nearshore adjacent to airport,
			deep water disposal in Tampa Bay
			(St. Petersburg entrance channel mile 2.25 to 4.5)
	Tampa Harbor		2-D, 3-D
	John's Pass		Beach
	Pas-A-Grill Pass		Beach
Private Dredging	Hillsborough County		
(Marinas, Finger Canals, Other)	Manatee County	Manatee County	Highland Shores, Bay Colony, Lena Road Landfill, various upland sites
	Pinellas County	Neptune Lagoon	Various upland sites
	St. Petersburg County	City of St. Petersburg arterial waterways and channels, Farragut Yacht Basin	Various upland sites, borrow pit, Harbor Isle Lake
	Miscellaneous	All counties	Various upland sites
			Sum

Table 12 (Page 2 of 2). Tampa Bay Dredged Material Management Plan			
Capacity Shortfall			
NEW WORK			
Federal Channels			
	Tampa Harbor Project	Egmont 1	
		Egmont 2	
		Mullet Key Channel	
		Cut A	
		Cut B	
		Cut C	
		Cut D	
		Cut E	
		Cut F	
		Cut G	
		Cut J	
		Cut J2	
		Cut K	
		Gadsen Point Cut	
		Cut A (Hillsborough Bay)	
		Cut C (Hillsborough Bay)	
		Port Sutton Channel and Turning Basin	CMDA 2-D
		East Bay	
		Cut D (Hillsborough Bay)	
		Sparkman Channel	
		Ybor Channel	Hooker's Point (264,000 CY) and Garrison Channel (215,000 CY): Beneficial use
		Seddon Channel	
		Alafia River	ODMDS (1,500,000), beneficial uses (Bird Island; 500,000:wetlands off 2-D;1,500,000)
		Anchorage Area	
	Intracoastal Waterway		
	Manatee Harbor		Buckeye Pit (Beneficial use
	Manatee River		
	St. Petersburg Harbor		
	John's Pass		
	Pas-A-Grill Pass		
Non-Federal Channels			
	Big Bend		September 1997 report places material in CMDA 3-D, construction subject to funding
	Port Sutton Terminal Channel		Upland site near channel (may no longer be practical-from 1985 study)
	Blind Pass		
Berthing Areas			
	Big Bend		In association with construction of Federal project
	Intracoastal Waterway		
	Manatee Harbor		
	Manatee River		
	Port Sutton Terminal Channel		In association with construction of Federal project
	St. Petersburg Harbor		In association with construction of Federal project
	Tampa Harbor		
Private Dredging	Hillsborough County		
(Marinas, Finger Canals, Other)	Manatee County		
	Pinellas County		
	St. Petersburg County		
			Sum

Dredged Material Volume		ODMDS	2-D	3-D	Beach	Beneficial	Other	Sum
						Use	(May include	(Check)
8,532,000	MAINTENANCE						beneficial use)	
0	Volume	10,308,000	5,060,000	10,305,000	1,799,000	0	5,800,410	33,272,410
0	NEW WORK							
936,000	Volume	1,500,000	655,000	3,695,000	0	4,443,000	0	10,293,000
0	TOTAL	11,808,000	5,715,000	14,000,000	1,799,000	4,443,000	5,800,410	43,565,410
0	Capacity-Present	Unknown	800,000	3,615,600	Unknown	Unknown	Unknown	
0	Capacity-With improvements		10,800,000	13,615,600				
0	Shortfall-Present		-4,915,000	-10,384,400				
0	Shortfall-With improvements		5,085,000	-384,400				
2,430,000								
0								
0								
0								
570,000								
3,120,000								
0								
1,140,000								
400,000								
0								
900,000								
900,000								
0								
4,185,000								
155,000								
1,904,000								
0								
840,000								
300,000								
84,000								
1,867,500								
500,000								
1,260,000								
0								
128,000								
0								
1,230,500								
0								
120,000								
0								
1100000								
0								
0								
0								
35,210								
0								
630,000								
5,200								
33,272,410								

245,000								
478,000								
3,000,000								
2,400,000								
3,500,000								
345,000								
195,000								
65,000								
10,228,000								

Develop a Long-Term Dredging and Dredged Material Management Plan for Tampa Bay

ACTION:

Develop a long-term management plan that coordinates the individual dredging and dredged material management plans of the bay's three major seaports, as well as utilities and industries and other users that rely on the bay's navigational channels.

BACKGROUND:

Tampa Bay serves three major seaports managed by independent port authorities. Various utilities and industries also share the bay's 40-mile-long deep-water transportation highway. This action calls for the development of a long-range plan to coordinate dredging and dredged material management for Tampa Bay to maximize shared disposal and beneficial use opportunities while minimizing the environmental impacts and costs associated with these activities in the future. The U.S. Army Corps of Engineers (USACOE), as the major coordinator and sponsor of dredging projects in the bay, has tentatively agreed to direct this comprehensive planning effort with funding assistance from the NEP.

With an average depth of only 12 feet, regular dredging of ship channels and berths is needed to serve area ports and industries. Ship channels, which are dredged to depths of up to 43 feet, must be cleared periodically to remove silty sediments.

Coordinated planning among ports and area industries will help ensure that the most environmentally sensitive and cost-effective strategies are pursued, especially in regard to long-range dredge material disposal, which has only been partially addressed. It also allows bay managers to explore options for beneficial uses of spoil material, minimize impacts to nesting birds on spoil islands, and promote best available technologies to reduce sediment resuspension during dredging.

In fact, local port authorities already have begun working together to examine mutual concerns and foster cooperation. A study conducted for Tampa Bay's port authorities and the Florida Department of Transportation (FDOT) in 1995 cited the establishment and maintenance of shared dredged material disposal sites as one of 13 recommendations adopted by the participants.

The Tampa Port Authority (TPA) estimates that about 840,000 cubic yards of material will be generated annually to maintain the upper part of the main ship channel, which extends south to the Gadsen Point widener. Long-term disposal needs will exceed the remaining capacity of the Port Authority's two spoil islands in Hillsborough Bay (estimated to be about 6 million cubic yards) in about seven years.

TPA has proposed to meet the shortfall by raising the islands' perimeter dikes from 20-30 feet, a strategy being reviewed by TPA's engineering department, as well as the Florida Department of Environmental Protection (FDEP) and the USACOE, which issues and periodically reassesses the port's maintenance dredging permit.

Maintenance dredging of the main ship channel between Gadsen Point and the mouth of Tampa Bay is expected to generate about another 200,000 cubic yards of material a year. Dredged material from the lower segment of that channel (below Cut B) will be placed at a recently approved ocean disposal site 18 miles from the bay's entrance. There are no long-term plans for disposal of the remainder of the material.

Port Manatee's development blueprint includes plans to enlarge its turning basin and widener, and dredge its harbor channel to maintain a 40-foot mean low water depth. A total of about 1.3 million cubic yards of material will be removed for these projects in order to keep pace with the anticipated shoaling of some 220,000 cubic yards of material each year. The Port Authority will contain all construction and maintenance dredging material at several upland sites on its property. These sites can accommodate material for at least another 25 years.

The Port of St. Petersburg, the smallest of the bay's three major seaports, will rely on the ocean disposal site for its sporadic dredging needs, unless cost-effective beneficial uses are identified for the material.

An unknown factor is how private facilities throughout the bay plan to dispose of their dredged material, an issue which should be addressed in long-term planning scenarios.

A strong emphasis on coordinated planning is reflected in 1996 guidance from the National Dredging Team, a consortium of federal agencies led by the EPA, Corps of Engineers and Department of Transportation. The draft guidance calls for the creation of regional planning committees to aid in the development of dredged material management plans.

STRATEGY:

This strategy calls for the development and implementation of a long-range plan to coordinate dredging and dredged material management for Tampa Bay, and highlights additional planning needs that must be addressed to complete this coordinated strategy.

STEP 1 Establish a Tampa Bay Dredging and Dredged Material Management Committee, directed by the Corps of Engineers and co-chaired by the FDEP, to develop and implement a long-term management plan. The Committee should include the bay's three major seaports, port-related industries and utilities, major commercial/private ports, government agencies, local governments, recreational and environmental interests and a representative of Egmont Key State Park. The Tampa Port Authority's existing Dredge Advisory and Migratory Bird committees, which include many of these same parties, may provide an initial membership base.

The Dredging and Dredged Material Management Plan for Tampa Bay should:

- coordinate existing port and industry plans for dredging and dredged material management; identify capacity short-falls; and develop a long-range strategy that integrates these plans to minimize costs and environmental impacts

- explore long-term options for the disposal of spoil material, including beneficial uses such as habitat restoration
- promote best available technologies to reduce sediment resuspension and nutrient releases during dredging, spoil disposal and containment

Responsible parties: USACOE and FDEP, in cooperation with local port authorities and the Committee

STEP 2 Develop a 25-year plan for the management of maintenance material removed from the southern segment of the main ship channel from the Gadsen Point widener to the point where the main shipping channel enters the bay. The Corps should develop the plan in consultation with the Committee established in step 1. The Plan should be consistent with 1996 draft guidance from the National Dredging Team.

As part of the overall plan:

- Determine status of long-term spoil disposal plans for privately maintained shipping channels in the Bay, particularly channels serving Big Bend and other utilities.

Responsible parties: USACOE, in cooperation with local ports and the Committee

SCHEDULE:

With funding assistance from NEP, the project is expected to get underway in Spring 1997.

COST:

The Tampa Bay NEP has set aside $40,000 to assist the Corps in developing a long-term management plan. The Corps is contributing a minimum of $5,000 in-kind services. In-kind support also is anticipated from the area's three port authorities, the FDOT and other entities serving on the Committee.

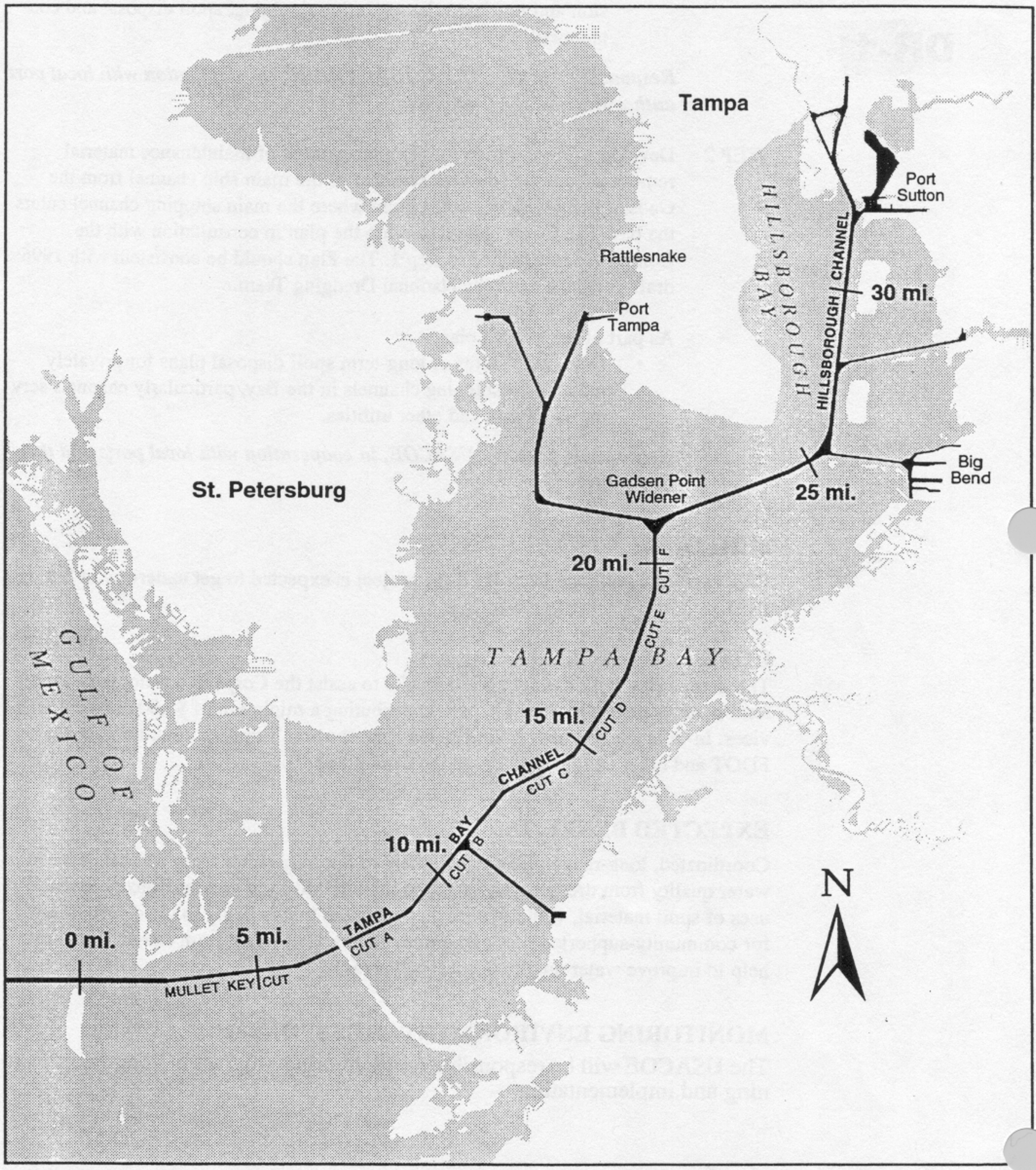
EXPECTED BENEFITS:

Coordinated, long-range planning will help to minimize impacts to bay habitats and water quality from dredging and dredged material disposal and maximize beneficial uses of spoil material, while fostering cooperation that is likely to yield cost-savings for community-supported port authorities. Removal of muck from channels also can help to improve water quality in localized areas.

MONITORING ENVIRONMENTAL RESPONSE:

The USACOE will be responsible for monitoring progress on long-range planning and implementation.

Tampa Bay Shipping Channels



SOURCE: TAMPA PORT AUTHORITY

REGULATORY NEEDS:
None anticipated.

RELATED ACTIONS:
BH-1

IDAHO—PM–10 NONATTAINMENT AREAS

Designated area	Designation		Classification	
	Date	Type	Date	Type
* * * *	*	*	*	
Shoshone County				
a. Northwest quarter of the Northwest quarter, Section 8, Township 48 North, Range 2 East; Southwest quarter of the Northwest quarter, Section 8, Township 48 North, Range 2 East; Northwest quarter of the Southwest quarter, Section 8, Township 48 North, Range 2 East; Southwest quarter of the Southwest quarter, Section 48 North, Range 2 East, Boise Base (known as ''Pinehurst expansion area'').	1/20/94	Nonattainment	1/20/94	Moderate.
b. City of Pinehurst	11/15/90	Nonattainment	11/15/90	Moderate.
* * * *	*	*	*	

[FR Doc. 95–11505 Filed 5–10–95; 8:45 am]

BILLING CODE 6560–50–P

40 CFR Part 228

[FRL–5204–6]

Ocean Dumping; Final Site Designation

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: EPA today designates an Ocean Dredged Material Disposal Site (ODMDS) in the Gulf of Mexico offshore Tampa, Florida, as an EPA-approved ocean dumping site for the disposal of suitable dredged material. This action is necessary to provide an acceptable ocean disposal site for consideration as an option for dredged material disposal projects in the greater Tampa, Florida vicinity. This site designation is for an indefinite period of time, but the site is subject to continuing monitoring to insure that unacceptable adverse environmental impacts do not occur.

EFFECTIVE DATE: This designation shall become effective on June 12, 1995.

ADDRESSES: Wesley B. Crum, Chief, Coastal Programs Section, Water Management Division, U. S. Environmental Protection Agency, Region IV, 345 Courtland St, NE., Atlanta, Georgia 30365.

FOR FURTHER INFORMATION CONTACT: Gary W. Collins, 404/347–1740 ext. 4286.

SUPPLEMENTARY INFORMATION:

A. Background

Section 102(c) of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972, as amended, 33 U.S.C. 1401 *et seq.*, gives the Administrator of EPA the authority to designate sites where ocean disposal may be permitted. On October 1, 1986, the Administrator delegated the authority to designate ocean disposal sites to the Regional Administrator of the Region in which the sites are located. This designation of a site offshore Tampa, Florida, which is within Region IV, is being made pursuant to that authority.

The EPA Ocean Dumping Regulations promulgated under MPRSA (40 CFR chapter I, subchapter H, § 228.4) state that ocean dumping sites will be designated by promulgation in this part 228. A list of ''Approved Interim and Final Ocean Dumping Sites'' was published on January 11, 1977 (42 FR 2461 (January 11, 1977)). The list established two sites for Tampa, Site A and Site B, as interim sites. Subsequent legal action by Manatee County and extensive field efforts have resulted in the identification of the now proposed site. The details of these events can be found in the ''Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Tampa, Florida.''

B. EIS Development

Section 102(2)(C) of the National Environmental Policy Act (NEPA) of 1969, as amended, 42 U.S.C. 4321 *et seq.*, requires that federal agencies prepare an Environmental Impact Statement (EIS) on proposals for legislation and other major federal actions significantly affecting the quality of the human environment. The object of NEPA is to build into the Agency decision making process careful consideration of all environmental aspects of proposed actions. While NEPA does not apply to EPA activities of this type, EPA has voluntarily committed to prepare EISs in connection with ocean disposal site designations such as this (see 39 FR 16186 (May 7, 1974)).

EPA, in cooperation with the Jacksonville District of the U.S. Army Corps of Engineers (COE), has prepared a Final EIS (FEIS) entitled ''Final Environmental Impact Statement for the Designation of An Ocean Dredged Material Disposal Site Located Offshore Tampa, Florida.'' On September 23, 1994, the Notice of Availability (NOA) of the FEIS for public review and comment was published in the **Federal Register** (59 FR 48878 (September 23 1994)). Anyone desiring a copy of the EIS may obtain one from the address given above. The public comment period on the final EIS closed on October 24, 1994. The closing date was extended for 15 days due to a request by the State of Florida.

EPA received 1 comment letter on the Final EIS. The letter was from the State of Florida (dated November 18, 1994) and stated that the proposed designation was found to be consistent with the Florida Coastal Management Program.

This rule permanently designates the continued use of the previously designated Site 4 near Tampa, Florida. The purpose of the action is to provide an environmentally acceptable option for the ocean disposal of dredged material. The need for the permanent designation of the Tampa ODMDS is based on a demonstrated COE need for ocean disposal of maintenance dredged material from the Federal navigation projects in the greater Tampa Bay area. However, every disposal activity by the COE is evaluated on a case-by-case basis to determine the need for ocean disposal for that particular case. The need for ocean disposal for other projects, and the suitability of the material for ocean disposal, will be determined on a case-by-case basis as part of the COE's process of issuing permits for ocean disposal for private/federal actions and a public review process for their own actions.

For the Tampa ODMDS, the COE and EPA would evaluate all federal dredged material disposal projects pursuant to the EPA criteria given in the Ocean Dumping Regulations (40 CFR parts 220 through 229) and the COE regulations (33 CFR 209.120 and parts 335–338). The COE then issues Marine Protection, Research, and Sanctuaries Act (MPRSA) permits after compliance with regulations is determined to private applicants for the transport of dredged material intended for ocean disposal. EPA has the right to disapprove any ocean disposal project if, in its judgment, the MPRSA environmental criteria (Section 102(a)) or conditions of designation (Section 102(c)) are not met.

The FEIS discusses the need for this site designation and examines ocean disposal site alternatives to this action.

Non-ocean disposal options have been examined and are discussed in the FEIS.

EPA proposed the designation of this site on January 13, 1995 (60 FR 3186). The public comment period expired on February 27, 1995. Only one letter was received on the proposed designation of the Tampa ODMDS. The letter, from the U. S. Department of the Interior (DOI), expressed concern that some of the material may come from portions of the channel that lie within the Federal Outer Continental Shelf (OCS) and the need to inform the DOI's Minerals Management Service (MMS) of such activities. The DOI also expressed concern that material coming from the OCS and used for activities such as beach nourishment could not be removed without a mineral lease issued by MSS. EPA believes that these comments are pertinent only to the COE's permitting action that is discussed previously and no response is needed.

C. Site Designation

The site is located west of Tampa, Florida, approximately 18 nautical miles (nmi) offshore. The ODMDS occupies an area of about 4 square nautical miles (nmi ^{2}), in the configuration of an approximate 2 nmi by 2 nmi square.

Water depths within the area average 22 meters (m). The coordinates of the Tampa site are as follows:

27°32′27″ N	83°06′02″ W;
27°32′27″ N	83°03′46″ W;
27°30′27″ N	83°06′02″ W; and
27°30′27″ N	83°03′46″ W.

D. Regulatory Requirements

Pursuant to the Ocean Dumping Regulations, 40 CFR 228.5, five general criteria are used in the selection and approval for continuing use of ocean disposal sites. Sites are selected so as to minimize interference with other marine activities, to prevent any temporary perturbations associated with the disposal from causing impacts outside the disposal site, and to permit effective monitoring to detect any adverse impacts at an early stage. Where feasible, locations off the Continental Shelf and other sites that have been historically used are to be chosen. If, at any time, disposal operations at a site cause unacceptable adverse impacts, further use of the site can be restricted or terminated by EPA. The site conforms to the five general criteria.

In addition to these general criteria in § 228.5, § 228.6 lists the 11 specific criteria used in evaluating a disposal site to assure that the general criteria are met. Application of these 11 criteria constitutes an environmental assessment of the impact of disposal at the site. The characteristics of the site were reviewed in the proposed rule in terms of these 11 criteria (the EIS may be consulted for additional information).

E. Site Management

Site management of the Tampa ODMDS is the responsibility of EPA as well as the COE. The COE issues permits to private applicants for ocean disposal; however, EPA/Region IV assumes overall responsibility for site management.

The Site Management and Monitoring Plan (SMMP) for the Tampa ODMDS was developed as a part of the process of completing the EIS. This plan, the result of partnering of the federal, state and local authorities who have an interest in ocean disposal and the protection of marine resources, provides procedures for both site management and for the monitoring of effects of disposal activities. The SMMP Team will meet regularly to review the site activities and make recommendations to EPA and the COE on future management and monitoring of the ODMDS. This SMMP is intended to be flexible and may be modified by the responsible agency for cause. Copies of the SMMP are available either separately or as part of the EIS at the address given above.

F. Site Designation

The EIS concludes that the site may appropriately be designated for use. The site is compatible with the 11 specific and 5 general criteria used for site evaluation.

The designation of the Tampa site as an EPA-approved ODMDS is being published as Final Rulemaking. Overall management of this site is the responsibility of the Regional Administrator of EPA/Region IV.

It should be emphasized that, if an ODMDS is designated, such a site designation does not constitute EPA's approval of actual disposal of material at sea. Before ocean disposal of dredged material at the site may commence, the COE must evaluate a permit application according to EPA's Ocean Dumping Criteria. EPA has the right to disapprove the actual disposal if it determines that environmental concerns under MPRSA have not been met.

The Tampa ODMDS is not restricted to disposal use by federal projects; private applicants may also dispose suitable dredged material at the ODMDS once relevant regulations have been satisfied. This site is restricted, however, to suitable dredged material from the greater Tampa, Florida vicinity.

G. Regulatory Assessments

Under the Regulatory Flexibility Act, EPA is required to perform a Regulatory Flexibility Analysis for all rules that may have a significant impact on a substantial number of small entities. EPA has determined that this action will not have a significant impact on small entities since the designation will only have the effect of providing a disposal option for dredged material. Consequently, this Rule does not necessitate preparation of a Regulatory Flexibility Analysis.

Under Executive Order 12866, EPA must judge whether a regulation is ''major'' and therefore subject to the requirement of a Regulatory Impact Analysis. This action will not result in an annual effect on the economy of $100 million or more or cause any of the other effects which would result in its being classified by the Executive Order as a ''major'' rule. Consequently, this Rule does not necessitate preparation of a Regulatory Impact Analysis.

This Final Rule does not contain any information collection requirements subject to Office of Management and Budget review under the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.*

List of Subjects in 40 CFR Part 228

Environmental protection, Water pollution control.

Patrick M. Tobin,

Acting Regional Administrator.

In consideration of the foregoing, subchapter H of chapter I of title 40 is amended as follows:

PART 228—[AMENDED]

1. The authority citation for part 228 continues to read as follows:

Authority: 33 U.S.C. 1412 and 1418.

2. Section 228.15 is amended by adding paragraph (h)(18) to read as follows:

§ 228.15 Dumping sites designated on a final basis.

* * * * *

(h) * * *

(18) Tampa, Florida; Ocean Dredged Material Disposal Site ________ Region IV.

(i) Location:

27°32′27″ N	83°06′02″ W;
27°32′27″ N	83°03′46″ W;
27°30′27″ N	83°06′02″ W;
27°30′27″ N	83°03′46″ W.

(ii) Size: Approximately 4 square nautical miles.

(iii) Depth: Approximately 22 meters.

(iv) Primary use: Dredged material.

(v) Period of use: Continuing use.

(vi) Restriction: Disposal shall be limited to suitable dredged material from the greater Tampa, Florida vicinity. Disposal shall comply with conditions set forth in the most recent approved Site Management and Monitoring Plan.

* * * * *

[FR Doc. 95–11678 Filed 5–10–95; 8:45 am]

BILLING CODE 6560–50–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

43–CFR Public Land Order 7142

[NV–930–1430–01; NV–56315]

Withdrawal of Public Land for Administrative Site; Nevada

AGENCY: Bureau of Land Management, Interior.

ACTION: Public Land Order.

SUMMARY: This order withdraws 40 acres of public land from surface entry and mining for a period of 20 years for the Bureau of Land Management to protect the Las Vegas Administrative Site in Clark County.

EFFECTIVE DATE: May 11, 1995.

FOR FURTHER INFORMATION CONTACT: Dennis Samuelson, BLM Nevada State Office, P.O. Box 12000, Reno, Nevada 89520, 702–785–6507.

By virtue of the authority vested in the Secretary of the Interior by Section 204 of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1714 (1988), it is ordered as follows:

1. Subject to valid existing rights, the following described public land is hereby withdrawn from settlement, sale, location, or entry under the general land laws, including the United States mining laws (30 U.S.C. Ch. 2 (1988)), to protect the Bureau of Land Management Las Vegas Administrative Site:

Mount Diablo Meridian

T. 20 S., R. 60 E.,
Sec. 22, SE¼NW¼.

The area described contains 40 acres in Clark County.

2. The withdrawal made by this order does not alter the applicability of those public land laws governing the use of the lands under lease, license, or permit, or governing the disposal of their mineral or vegetative resources other than under the mining laws.

3. This withdrawal will expire 20 years from the effective date of this order unless, as a result of a review conducted before the expiration date pursuant to Section 204(f) of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1714(f) (1988), the Secretary determines that the withdrawal shall be extended.

Dated: May 1, 1995.

Bob Armstrong,

Assistant Secretary of the Interior.

[FR Doc. 95–11639 Filed 5–10–95; 8:45 am]

BILLING CODE 4310–HC–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 675

[Docket No. 95026040–5040–01; I.D. 050595C]

Groundfish of the Bering Sea and Aleutian Islands Area; Pacific Cod by Vessels Using Hook-and-Line Gear

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Closure.

SUMMARY: NMFS is closing the entire Bering Sea and Aleutian Islands management area (BSAI) to directed fishing with hook-and-line gear for Pacific cod. This action is necessary because U.S. fishing vessels participating in the Pacific cod hook-and-line fishery in the BSAI have caught the second seasonal bycatch allowance of Pacific halibut.

EFFECTIVE DATE: 12 noon, Alaska local time (A.l.t.), May 7, 1995, until 12 noon, A.l.t., September 1, 1995.

FOR FURTHER INFORMATION CONTACT: Andrew N. Smoker, 907–586–7228.

SUPPLEMENTARY INFORMATION: The groundfish fishery in the BSAI exclusive economic zone is managed by NMFS according to the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutian Islands (FMP) prepared by the North Pacific Fishery Management Council under authority of the Magnuson Fishery Conservation and Management Act. Fishing by U.S. vessels is governed by regulations implementing the FMP at 50 CFR parts 620 and 675.

The second seasonal 1995 Pacific halibut bycatch mortality allowance for the hook-and-line Pacific cod fishery, which is defined at § 675.21(b)(2)(ii)(A), is 40 metric tons (60 FR 12149, March 6, 1995.

The Director, Alaska Region, NMFS, has determined, in accordance with § 675.21(d), that U.S. fishing vessels participating in the Pacific cod hook-and-line fishery in the BSAI have caught the second seasonal bycatch allowance of Pacific halibut. Therefore, NMFS is closing the entire BSAI to directed fishing with hook-and-line gear for Pacific cod.

Directed fishing standards for applicable gear types may be found in the regulations at § 675.20(h).

Classification

This action is taken under 50 CFR 675.21 and is exempt from review under E.O. 12866.

Authority: 16 U.S.C. 1801 *et seq.*

Dated: May 5, 1995.

Richard W. Surdi,

Acting Director, Office of Fisheries Conservation and Management, National Marine Fisheries Service.

[FR Doc. 95–11578 Filed 5–5–95; 4:24 pm]

BILLING CODE 3510–22–P

Comments raised during 4/19/2000 meeting and responses

1. The interest in the document is the alternatives analysis, to this end continued discussion is needed.

Response: Continued discussion is anticipated as well as additional revisions to the Dredged Material Management Strategy.

2. There is a need to identify specific beneficial uses.

Response: The 'Conclusions' section of the report contains a list of beneficial uses.

3. Information needs to be added on the proposed the anchorage area study.

Response: Information on the anchorage area study has been added to the report.

4. At the top of page 2, recommend changing the word "advising" to "directing".

Response: The word "advising" has been changed to "directing" on page 2.

5. Add Hillsboro County to the list of data contributors (p.3).

Response: Hillsborough County has been added to the list of contributors on p. 3.

6. Data is lacking on the quality of the dredged material. Data may be available from Tampa Port Authority (historical data and new data [Berths 30 and 26]), the City of Tampa, and the Florida Department of Environmental Protection (FDEP) (marinas, private canals).

Response: Data on quality has been requested and will be added to the DMMS when it is received.

7. On page 11, in the write-up on Table 7, elaborate on chemical testing for Corps projects. Mention the inland testing manual and other documents available for guidance on chemical testing.

Response: Reference to the chemical testing guidance has been added to both the table and the report.

8. Information on dredged material quality (Table 7) could be presented as "flagged chemicals of concern" or "no chemicals of concern identified". References to laboratory analysis reports or websites could be included, with a

contact person listed. Change the column heading in Table 7 to “Chemical Concerns”.

Response: The column heading has been changed. Additional columns have been added for report or website references and for points of contact. This information has been added where possible.

9. Add a discussion on turbidity monitoring.

Response: A discussion has been added on turbidity monitoring.

10. Check the general figures for material removed against the Tampa Port Authority dredged material management plan. Check the scope of this plan versus the Dredged Material Management Strategy. Is bulking a factor in the figures for removal and placement?

Response: Table 1 of the report contains columns with data for shoal estimates from the Jacksonville District dredging history database, the 1992 Jacksonville District Disposal Area Study, and the Tampa Port Authority Dredged Material Management Plan (DMMP). The DMMP covers “those portions of the Tampa Bay deepwater port system in Hillsborough county north of the Gadsden Point widener, including Hillsborough Bay, Old Tampa Bay, and the northernmost portion of Tampa Bay. The DMMS covers Tampa Bay as defined by the National Estuary Program, as shown in Figure 1. The coverage of the DMMP is a subset of the coverage of the DMMS, and the sum of the shoal estimates in the DMMP is less than that in the DMMS. The shoal estimates from the Jacksonville District dredging database are pay quantities wherever possible, as opposed to being bid volumes. As stated on page 5 of the DMMS, “pay quantities are determined subsequent to dredging and may be more accurate estimates of the quantity of material removed since they are computed after dredging has taken place.” Volumes of material presented in the DMMP are both pay quantities and bid volumes. Bulking should not be a factor for the pay quantities.

11. FDEP requires upland disposal for small projects. A copy of the regulation stating so would be a good addition to the DMMS. Should it be assumed that private dredging needs to find its own sites? Can sites be open to all?

Response: Dredging and disposal are regulated by international treaty, Federal law, and State law and policy. A section explaining these regulations could be included in the DMMS. A description of the permitting framework and process could be included, as well as a description of the permit application process. One of the items for further study is regulations and policy.

12. Verify that Clam Bayou is included in the DMMS as a restoration site (1 million cubic yards to be dredged in the next five years). If it is not, add it.

Response: Clam Bayou, St. Petersburg, Pinellas County, has been added as a restoration site along with the 1,000,000 cubic yard figure.

13. How often will the DMMS be updated. What funding mechanism will be used for the updates?

Response: No schedule has been set for updating the DMMS. Changes pertaining to Federal projects could be made using operations and maintenance funds as the changes occur.

14. Produce a better map showing all of the placement areas currently used. Include distances on the map.

Response: Figure 14 has been revised to show all the existing, approved placement areas. A scale is provided on the map.

15. Add the habitat restoration sites figure.

Response: Once the habitat restoration figure is made available it will be added to the plan.

16. Verify that Ben T. Davis beach is listed as a placement area. If not, add it.

Response: The entries in the table “Northshore Park” and “Northshore Beach”, Pinellas County, have been removed. The entry “Ben T. Davis Beach”, Hillsborough County, has been added.

17. Add a list of dredging research/information/publications websites.

Response: A list has been added.

18. Is a 30% shortfall common among other areas of the country?

Response: While the magnitude of shortfalls could not be determined, other areas expect to face shortfalls. Discussion on other areas of the country (San Francisco and New York) has been added to the report.

19. From where is the Tampa Bay shortfall coming (Federal projects, non-Federal projects)?

Response: The shortfall is anticipated for dredging done in areas north of Cut G of the Federal project. The shortfall affects both Federal and non-Federal projects.

20. Should the shortfall be a wakeup to the community?

Response: Yes, the shortfall should be a wakeup to the community. A shortfall might trigger inability to maintain sufficient depths for commerce.

21. Add to the syllabus that the 2-D and 3-D capacity figures take raising the dikes into consideration.

Response: In the syllabus the figures do not take raising the dikes into consideration. Such wording has been added to the syllabus.

22. Add to the logistical problems/permitting problems possible conflicts between filling holes for beneficial use and recreational fishing.

Response: Wording to this effect has been added to the main text of the report.

23. Redo the maps to show the Federal projects on current maps.

Response: Map revision would enable an accurate depiction of present conditions and would be expensive and time-consuming. The expense and duration of such a task are beyond the scope of the present effort.

24. Generate one map that shows sources of dredged material and placement areas.

Response: Refer to response for comment 23.

25. Give consideration to how far one can go from a potential placement area to obtain material for that area.

Response: Consideration is given when evaluating placement areas to determine a least cost method. Traditionally, material south of Cut G is most inexpensively placed in the ocean site, material between Cut G and Cut C (Hillsborough Bay) is most inexpensively placed in CMDA 3-D, and material north of Cut C (Hillsborough Bay) is most inexpensively placed in CMDA 2-D.

Comments from Roy R. Lewis III, Professional Wetland Scientist, in letter to Bill Fonferek, Jacksonville District Corps of Engineers, dated May 8, 2000

Response to comment 1. At this time the intention is to update the document periodically, however, no timeframe has been set.

Response to comment 2. ‘Offshore transverse bars to protect and restore seagrasses’ has been added as a beneficial use category.

Response to comment 3. Comment noted.

Response to comment 4. Comment noted.

Response to comment 5. The capacity figure was checked and revised.

Response to comment 6. Comment noted.

Comment from Sarah Watkins dated 5/19/2000

Response. Palm River is included in the list of habitat restoration sites (Table 11).

Comments from Gary Collins, by telephone on 4/12/00

Comment 1. On page 13 a draft Environmental Impact Statement (EIS) is mentioned. A final EIS was prepared and is dated September 1994.

Response to comment 1. This correction has been made.

Comment 2. Table 9. The site capacity of the ODMDS is unknown, not unlimited, as the dispersive nature of the are is not known.

Response to comment 2. All references to 'unlimited' have been changed to 'unknown'.

Comments from Dave Walker, Pinellas County, hand-delivered 4/19/00

Comment response. Data on dredging events has been added to the DMMS as appropriate.

Comment from David Glicksberg

Comment response. Bullfrog Creek has been added as a site to Table 11. The issue about salt content is included.

Comments from Brandt Henningsen, Southwest Florida Water Management District, hand-delivered 4/19/00

Response to comment 1. The entry for Cockroach Bay has been revised to reflect 5 shell pits and 5,000,000 cy.

Response to comment 2. These three Mangrove Bay borrow pits have been added.

Response to comment 3. The inland Sun City Shell Pit has been added as an entry to Table 11.

Letter from Ellie Montague, Sunset Park Area Homeowners Association, to Tracy Leeser, Jacksonville District Corps of Engineers, undated

Comment response. A line has been added to the appropriate tables to include Hillsborough County residential canals. Volumes were not given, however, since not enough information is available to determine a per year shoaling rate. This information could be added when available. The pages of the Residential Canal Dredging Manual included with Ms. Montague's letter have been included as a supplement to the DMMS. Figure 12 has been revised to include the canal locations.

Memorandum for Chief, Plan Formulation Branch, Jacksonville District Corps of Engineers, from Chief, Environmental Branch, dated 02 May 2000

Response to comment a. While minimization of environmental impacts is mentioned in the Tampa Bay Estuary Program's Action Plan as a reason for preparing the long-term management plan, the specific tasks to be accomplished in generating the plan do not include their identification. For this reason, a look at environmental impacts is a recommendation for further study in the 'Conclusions' section of the DMMS.

Response to comment b. Refer to response to comment a.

Response to comment c. Several paragraphs have been added that distinguish between the concept of beneficial uses of dredged material and the three Corps' programs typically used to fund studies and projects that involve beneficial use of dredged material.

Response to comment d. Wording has been added to clarify that this policy is not presently being used in the Tampa Bay area but is available and should be looked into for future use.

Response to comment e. Refer to response to comment c.

Response to comment f. Noted.

Response to comment g. Information added.

Response to comment h. Information added.

Response to comment i. Information added.

Response to comment j. Information added.

Comments from Engineering Division, Jacksonville District, to Planning Division, Coastal/Navigation Section, 5/17/2000, by e-mail from Christopher Brown through Joseph Gurule to Tracy Leeser

Response to comment 1. Noted. As information on the capacities becomes available it can be added to the report.

Response to comment 2. Noted.

Response to comment 3. The information is based on entries in the Jacksonville District dredging history database. The geotechnical information referenced in the comment can be added to the report if it is made available.

Response to comment 4. The possibility of raising the dikes at Cargill has been added to the report.

Response to comment 5. The concepts can be added to the report if information is made available.

Response to comment 6. Placement area capacities are taken directly from information provided by Engineering Division and reflect bulking to whatever extent has been included in the capacity computations.

Response to comment 7. Thin layering is a beneficial use of dredged material recommended by the plan for further study.

Response to comment 8. The numbers have been revised and should all be rounded to the nearest hundred thousand cubic yards.

Response to comment 9. Differences in the stated capacities (on pages 14 and 16) could not be verified. Refer to the response to comment 6.

Section II. Sediment Resuspension Due to Dredging

4-4. Factors Influencing Dredging Turbidity.

a. Occurrence and Extent. The nature, degree, and extent of sediment suspension around a dredging or disposal operation are controlled by many factors, as discussed in WES TR DS-78-13. Chief among these are: the particle size distribution, solids concentration, and composition of the dredged material; the dredge type and size, discharge/cutter configuration, discharge rate, and solids concentration of the slurry; operational procedures used; and finally the characteristics of the hydraulic regime in the vicinity of the operation, including water composition, temperature and hydrodynamic forces (i.e., waves, currents, etc.) causing vertical and horizontal mixing. The relative importance of the different factors may vary significantly from site to site.

b. Hopper Dredge. Resuspension of fine-grained maintenance dredged material during hopper dredging operations is caused by the dragheads as they are pulled through the sediment, turbulence generated by the vessel and its prop wash, and overflow of turbid water during hopper filling operations. During the filling operation, dredged material slurry is often pumped into the hoppers after they have been filled with slurry in order to maximize the amount of solid material in the hopper. The lower density, turbid water at the surface of the filled hoppers overflows and is usually discharged through ports located near the waterline of the dredge. In the vicinity of hopper dredges during maintenance operations, a near-bottom turbidity plume of resuspended bottom material may extend 2300 to 2400 ft downcurrent from the dredge. In the immediate vicinity of the dredge, a well-defined, upper plume is generated by the overflow process. Approximately 1000 ft behind the dredge the two plumes merge into a single plume (fig. 4-1). Suspended solid concentrations above ambient may be as high as

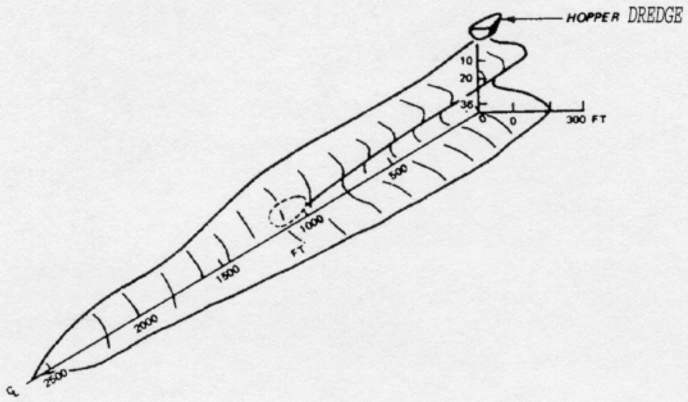


Figure 4-1. Hypothetical suspended solids plume downstream of a hopper dredge operation with overflow in San Francisco Bay (all distances in feet)*

several tens of parts per thousand (grams per litre) near the discharge port and as high as a few parts per thousand near the draghead. Turbidity levels in the near-surface plume appear to decrease exponentially with increasing distance from the dredge due to settling and dispersion, quickly reaching concentrations less than 1 ppt. However, plume concentrations may exceed background levels even at distances in excess of 4000 ft.

c. Bucket or Clamshell Dredge. The turbidity generated by a typical clamshell operation can be traced to sediment resuspension occurring when the bucket impacts on and is pulled off the bottom, turbid water spills out of the bucket or leaks through openings between the jaws, and material is inadvertently spilled during the barge loading operation. There is a great deal of variability in the amount of material resuspended by clamshell dredges due to variations in bucket size, operating conditions, sediment types, and hydrodynamic conditions at the dredging site. Based on limited measurements, it appears that, depending on current velocities, the turbidity plume downstream of a typical clamshell operation may extend approximately 1000 ft at the surface and 1600 ft near the bottom. Maximum concentrations of suspended solids in the surface plume should be less than 0.5 ppt in the immediate vicinity of the operation and decrease rapidly with distance from the operation due to settling and dilution of the material. Average water-column concentrations should generally be less than 0.1 ppt. The near-bottom plume will probably have a higher solids concentration, indicating that resuspension of bottom material near the clamshell impact point is probably the primary source of turbidity in the lower water column. The visible near-surface plume will probably dissipate rapidly within an hour or two after the operation ceases.

d. Cutterhead or Hydraulic Pipeline Dredge. Most of the turbidity generated by a cutterhead dredging operation is usually found in the vicinity of the cutter. The levels of turbidity are directly related to the type and quantity of material cut, but not picked up, by the suction. The ability of the dredge's suction to pick up bottom material determines the amount of cut material that remains on the bottom or suspended in the water column. In addition to the dredging equipment used and its mode of operation, turbidity may be caused by sloughing of material from the sides of vertical cuts; inefficient operational techniques; and the prop wash from the tenders (tugboats) used to move pipeline, anchors, etc., in the shallow water areas outside the channel. Based on limited field data collected under low current conditions, elevated levels of suspended material appear to be localized in the immediate vicinity of the cutter as the dredge swings back and forth across the dredging site. Within 10 ft of the cutter, suspended solids concentrations are highly variable but may be as high as a few tens of parts per thousand; these concentrations decrease exponentially from the cutter to the water surface. Near-bottom suspended solids concentrations may be elevated to levels of a few tenths of a part per thousand at distances of less than 1000 ft from the cutter.

Technical Note DOER-E6
March 1999 (Revised April 2000)

Estimating Dredging Sediment Resuspension Sources

PURPOSE: The technical note herein presents an approach for estimating the suspended-sediment source from cutterhead, hopper, and clamshell dredges. The approach involves modification of an existing method developed from limited field data. These estimates are needed to provide input to a numerical model called SSFATE (Suspended Sediment FATE) that is being developed under the Dredging Operations and Environmental Research (DOER) Program.

BACKGROUND: A need exists for numerical modeling tools to address questions related to environmental windows associated with dredging projects. One such question relates to where and in what quantity suspended sediment from dredging operations moves away from the dredging location. With this information, decision makers would be aided in determining reasonable start and end dates for environmental windows related to fish migratory pathways, sedimentation on sensitive benthic habitats, and other environmental issues. The SSFATE model is being developed under DOER to provide field offices with such a tool. The basic computations are based on a particle-tracking approach with each particle representing a certain amount of sediment mass that is generated at the location of the dredging operation. These particles are then diffused and transported throughout the water body of interest while undergoing settling. Suspended-sediment concentrations at any location at any time in the simulation can be determined from the number of particles occupying some volume surrounding the point of interest.

SSFATE will be a versatile model containing many features; for instance, ambient currents can either be imported from a numerical hydrodynamic model or "painted" using limited field data, and results can be animated over GIS layers depicting sensitive environmental areas. However, regardless of the sophistication and versatility of SSFATE, an integral part of the model will be the estimation of the amount of sediment at the dredging site that is released to the water column, i.e., the sediment-source strength and its vertical distribution. A review of existing literature on field measurements of suspended-sediment concentrations near dredges and proposed approaches for generating sediment sources resulted in the proposed simplified approach discussed in this technical note.

FACTORS INFLUENCING SOURCE STRENGTH: Generally, the major factors influencing the strength of the sediment source at a dredge are the sediment type being dredged, the type of dredge and the manner in which the dredge is operated, and ambient currents. If the sediment is primarily sand, material may be released to the water column, but it quickly settles out. However, if the material is primarily fine grained, it can remain in suspension for an extended time while being subjected to the processes of diffusion, settling, and transport. Different types of dredges typically release different percentages of the dredged volume of sediments into the water column. For example, clamshell dredges release a higher percentage of the dredged volume than generally occurs for a cutterhead dredge. Obviously, the size and manner in which a particular dredge is operated also influence the amount of sediment release. For example, for a hydraulic cutterhead dredge, sediment release increases with higher speed of cutterhead rotation, higher swing speed, and larger cutterhead diameter.

EXISTING APPROACHES FOR ESTIMATING SOURCE STRENGTHS: Two existing approaches for estimating the sediment mass released by a dredge can be found in the literature. The first is based on Nakai's (1978) concept of a turbidity generation unit (TGU), which varies with sediment type and dredge type (Table 1) and has the units of kilograms/cubic meter of dredged sediment. The parameter *d* in Table 1 is the sediment-particle diameter. Pennekamp et al. (1996) list a similar parameter for various types of dredges (Table 2). However, no indication of the sediment type is provided. The basic equation proposed by Nakai (1978) to compute the rate of sediment mass released by a given dredging operation is

Table 1
Turbidity Generation Unit Values from Nakai (1978)

Type of Dredge	Power or Bucket Volume	Dredged Materials			TGU kg/cu m
		d < 0.74 mm %	*d* < 0.005 mm %	Classification	
Hydraulic cutterhead	4,000 hp	99.0	40.0	Silty clay	5.3
	4,000 hp	98.5	36.0	Silty clay	22.5
	4,000 hp	99.0	47.5	Clay	36.4
	4,000 hp	31.8	11.4	Sandy loam	1.4
	4,000 hp	69.2	35.4	Clay	45.2
	4,000 hp	74.5	50.5	Sandy loam	12.1
	2,500 hp	94.4	34.5	Silty clay	9.9
	2,000 hp	3.0	3.0	Sand	0.2
	2,000 hp	2.5	1.5	Sand	0.3
	2,000 hp	8.0	2.0	Sand	0.1
Hopper	Two at 2,400 hp each	92.0	20.7	Silty clay loam	7.1
	1,800 hp	83.2	33.4	Silt	25.2
Mechanical grab	8 cu m	58.0	34.6	Silty clay	89.0
	4 cu m	54.8	41.2	Clay	84.2
	3 cu m	45.0	3.5	Silty loam	15.8
	3 cu m	62.0	5.5	Silty loam	11.9
	3 cu m	87.5	6.0	Silty loam	17.1
Mechanical bucket		10.2	1.5	Sand	17.6
		12.7	12.5	Sandy loam	55.8

$$M = (V)(\mathrm{TGU}) / (R74/Ro) \qquad (1)$$

where

TGU = turbidity generation unit, kg/cu m

M = mass rate of released sediment, kg/sec

V = volume rate of dredging, cu m/sec

Ro = fraction of dredged sediment that has a critical resuspension velocity smaller than the ambient current velocity

*R*74 = fraction of dredged sediment that has a diameter less than 0.074 mm

Table 2
Turbidity Generation Unit Values from Pennekamp et al. (1996)

Dredge Type	Production cu m/hr	Vertically Averaged Concentration Above Background, mg/ℓ	TGU kg/cu m
Hopper	5,500	400	14
	5,400	150	3
	1,750	15	1-5
	2,170	60	8-22
Open clamshell	90	35	3
Tight clamshell	166	100	19
Open bucket	714	110	18-21

Given the ambient current and the grain-size analysis of the dredged material, *R*74 can be determined from the grain-size analysis and *Ro* can be determined using typical values for critical resuspension velocity such as those given by Nakai (1978) in Table 3. With the production rate known and a value of TGU selected, the rate of sediment release can then be determined from Equation 1.

Table 3
Critical Resuspension Velocity

Soil Type	Particle Size, mm	Critical Resuspension Velocity, cm/sec
Clay	0.005	0.03
Silt	0.005-0.074	0.03-7.0
Fine sand	0.074-0.42	7.0-15.0
Rough sand	0.42-2.0	15.0-35.0

The second method is described by Averett and Hayes (1995) as the Correlation Method. This method consists of empirical models that have been developed based on observed resuspension rates, sediment characteristics, and dredge-operating parameters at a series of field sites (Vann 1983; Hayes 1987; Hayes, McLellan, and Truitt 1988; McLellan et al. 1989). At the present time, empirical models have been developed only for cutterhead and open-bucket dredges (Collins 1995; Kuo and Hayes 1991).

LIMITATIONS: Both methods are based on limited field data. Because of the highly variable nature of dredging operations, neither of the existing methods for estimating the strength of sediment sources yields highly accurate predictions. Collins (1995) presents a comparison of predicted and observed concentrations using an empirical model for a cutterhead dredge that is based on data collected in Calumet Harbor, Illinois (Figure 1). The two data sets labeled Savannah River are for partial cuts (P.C.) and buried cuts (B.C.) of the cutterhead. The results shown in Figure 1 illustrate that when the correlation method (empirical model) is applied to a dredging activity different from the one where field data were collected and used to determine model coefficients, the results can differ by 1-2 orders of magnitude. Thus, at this time, implementation into SSFATE of the more sophisticated empirical models over the use of the TGU method would not appear to result in better predictions of sediment sources.

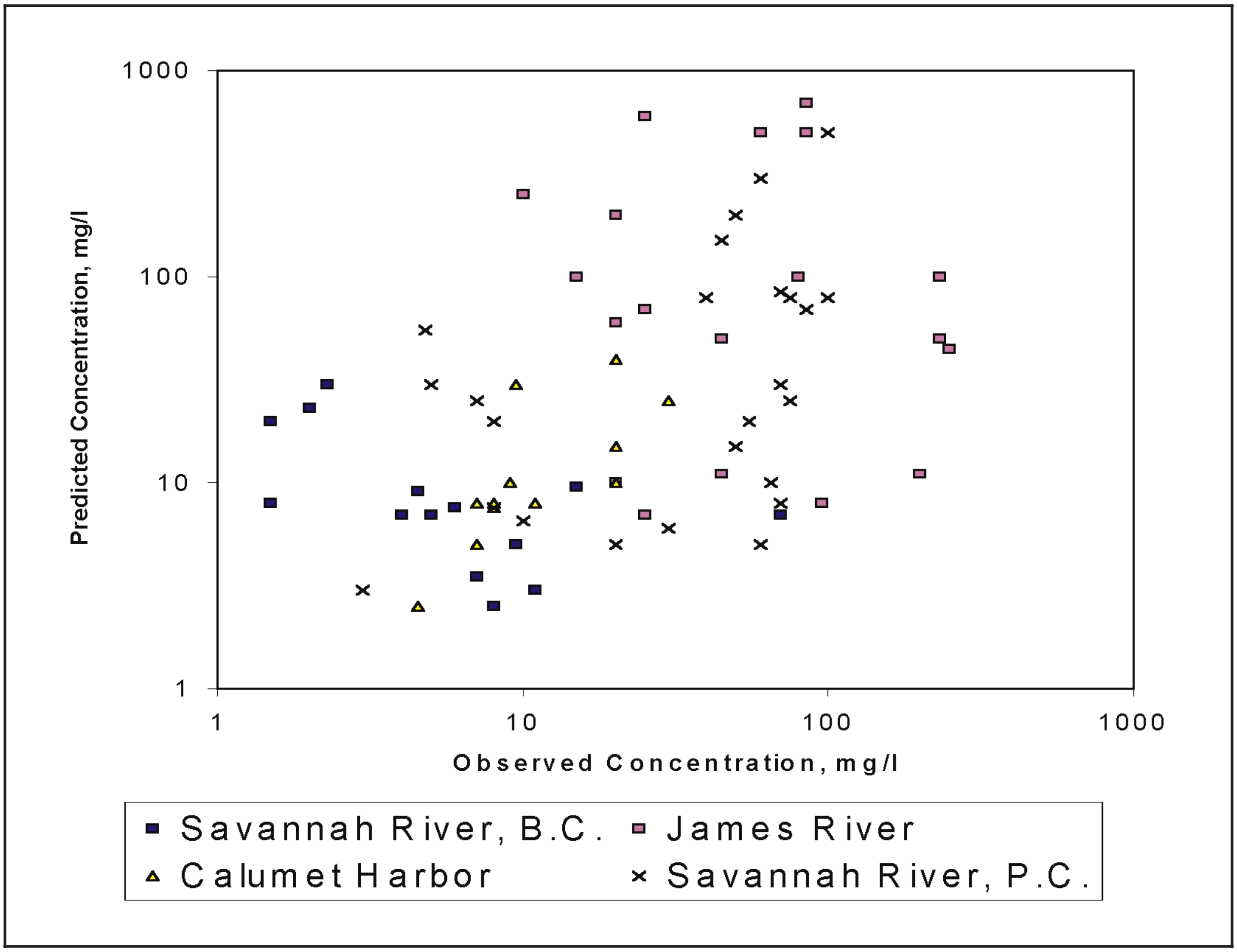


Figure 1. Sediment resuspension predictions for cutterhead dredges (from Collins 1995)

Although predictions using the TGU method must also be viewed with caution, it is the simpler of the two existing approaches. The data required are the dredge type, the grain-size analysis of bed material, the ambient current velocity, and the production rate of the dredge. Of course, the timing of the dredging operation, e.g., the time required for a hopper dredge to carry the dredged material to a disposal site and return to the dredging site, must also be known. The following use of the TGU method is proposed for implementation in SSFATE.

MODIFIED USE OF THE TGU METHOD: As previously noted, the type of dredged material, the type of dredge, and the operation of the dredge, e.g., taking a full cut versus a partial cut with a cutterhead dredge, are major factors influencing the appropriate value of the TGU for use in Equation 1. Much variability is in these factors for a particular dredging operation and thus in the value of the TGU to be selected. An inspection of Tables 1 and 2 reveals that the maximum values of the TGU for cutterhead, hopper, and clarnshell dredges are about 45, 25, and 90 kg/cu m, respectively. The basic problem is how to determine a TGU value for a particular dredging operation involving one of these three dredges. In the proposed approach, such a value is deter-mined by first selecting a typical suspended sediment concentration likely to be produced by the dredging operation.

Figures 2 and 3, which show a range of measured suspended-sediment concentrations near cutterhead and hopper dredges for different soil types, have been constructed from available field data. A good review of these data is provided by Herbich and Brahme (1991). Obviously the operating and ambient conditions under which these data were collected are highly variable. However, one should take into consideration the following general guidelines:

a. For a hydraulic cutterhead dredge, sediment resuspension increases with higher speed of rotation, higher swing speed, larger cutter diameter, and greater depth of cut.

b. For a trailing hydraulic hopper dredge, sediment resuspension increases with increased hopper filling speed and travel speed of dredge.

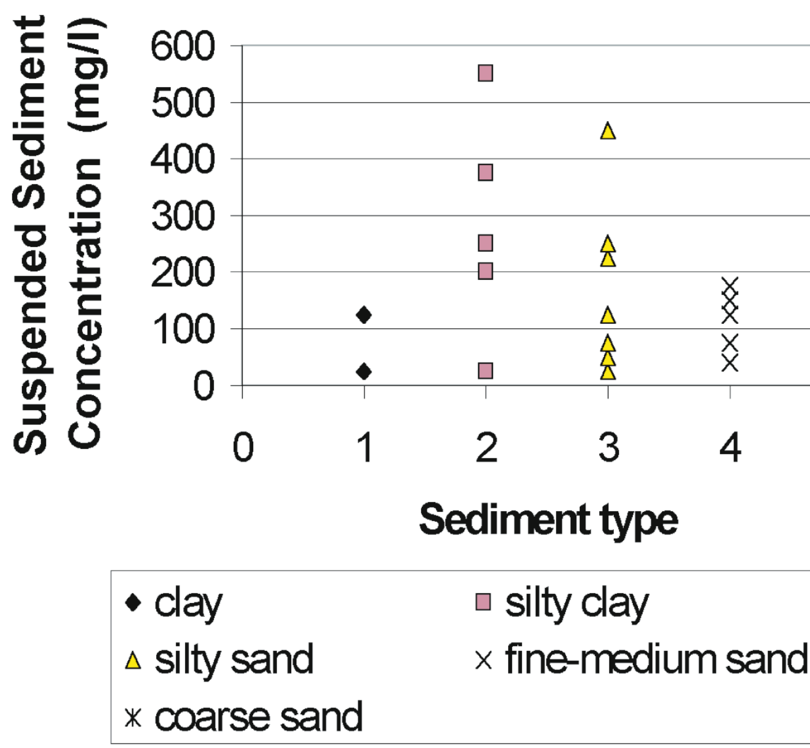


Figure 2. Observed resuspended-sediment concentrations versus soil type for a cutterhead dredge

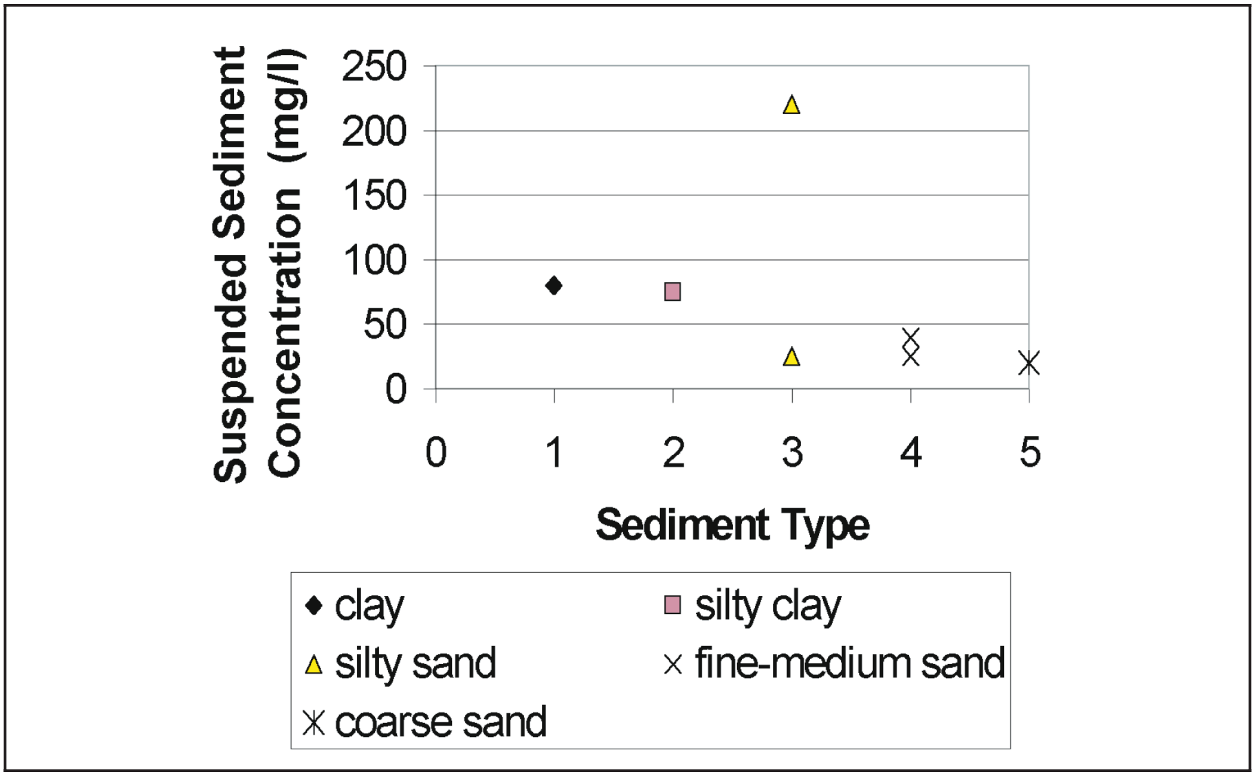


Figure 3. Observed resuspended-sediment concentrations versus soil type for a hopper dredge with no overflow

A typical concentration value can be selected from Figures 2 and 3 for the most predominant (greater than 70 percent) type of sediment being dredged from clay, silty clay (mixtures), silty sand (mixtures), fine-medium sand, and coarse sand.

Figures 2 and 3 are for cutterhead and hopper dredges, respectively. Clamshell dredging operations are slow, and the output rate is low compared with cutterhead and hopper dredges. In view of the limited use of clamshell dredges, few field data are available on the amount of sediment resuspension related to the type of sediment being dredged. However, general guidelines can be proposed. For example, clamshell dredges usually generate high turbidity while dredging fine sediments and stiff clays (McLellan et al. 1989). This turbidity can be distributed throughout the water column because of the action of raising the bucket from the bottom up through the water surface with subsequent disposal in a barge or scow. Based upon the limited data (Herbich and Brahme 1991) available, near-bed sediment concentrations may vary from 200-800 mg/ℓ. The following should be taken into consideration when selecting a value between those two bounds:

a. Loose clay layers will result in higher concentrations, whereas, stiff clays with high density will result in lower suspensions.

b. Greater impact of the bucket on the bottom results in higher sediment release to the water column.

c. Closed buckets generally result in lower suspended-sediment concentrations than those generated with open buckets.

After an appropriate concentration has been selected for the particular sediment type and dredge type, it is proposed that a corresponding value for the TGU be determined from a linear interpolation between a value of zero for no sediment release (zero concentration) and the maximum values shown for either a cutterhead (max TGU = 45 kg/cu m corresponding to max concentration of about 600 mg/ℓ), hopper (max TGU = 25 kg/cu m corresponding to max concentration of about 200 mg/ℓ), or clamshell (max TGU = 90 kg/cu m corresponding to max concentration of about 800 mg/ℓ) dredge. The assumption of a linear variation of the TGU with suspended-sediment concentration seems to be reasonable for concentrations occurring very near the dredge, but no data exist for confirmation. Maybe the variation of the TGU with suspended-sediment concentration has a different functional form, e.g., exponential. However, assuming a linear variation over an exponential variation gives the most conservative value, which is more desirable when predicting suspended-sediment concentrations for use in addressing environmental concerns. Assuming the dredging production rate is known (after the determination of the TGU, *Ro*, and *R*74 values), the rate of sediment mass released can be determined from Equation 1.

Another important part of the sediment source strength term for input to SSFATE is the vertical distribution of the sediment mass computed from Equation 1. Most field data collected near dredging operations are at locations some distance away from the dredge. Therefore, based upon data such as these, accurately assigning vertical distributions at the dredge where the sediment is released is difficult. For preliminary implementation in SSFATE, the sediment resuspended near the bottom by the cutterhead dredge and the hopper dredge is assumed to be released over the bottom 2.5 and 1.5 m of the water column, respectively. The vertical distributions shown in Figures 4 and 5 are assumed.

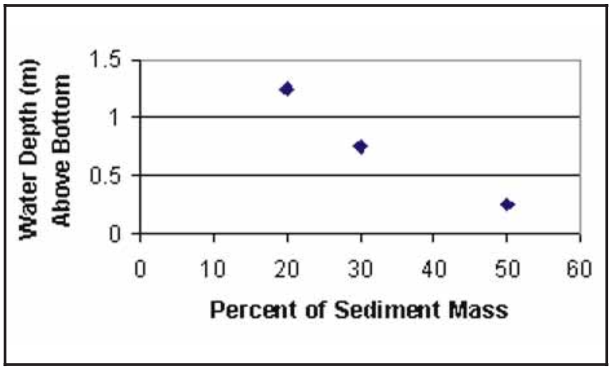


Figure 4. Assumed vertical distribution of bottom sediment source for a hopper dredge

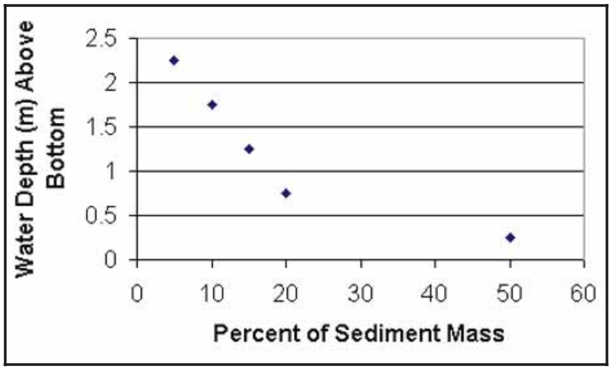


Figure 5. Assumed vertical distribution of bottom sediment source for a cutterhead dredge

Sediment released from a clamshell dredge will occur throughout the entire water column as the bucket is raised to the surface. Thus, the vertical distribution shown in Figure 6 is assumed for implementation in SSFATE. It should be stressed that although these distributions seem reasonable, field data are needed to verify the accuracy of the assumed distributions.

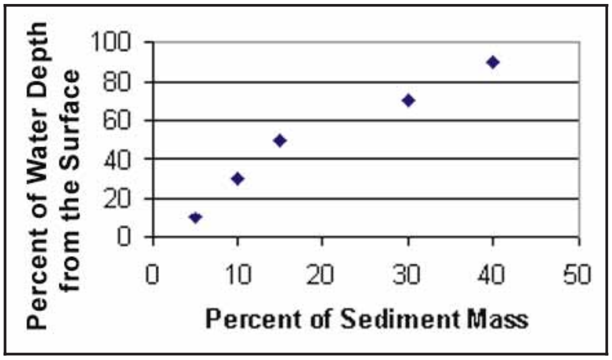


Figure 6. Assumed vertical distribution for sediment source for a clamshell dredge

All of the discussion above has focused on sediment sources that are associated with the removal of material from the bottom. However, when hopper or clamshell dredges operate with overflow from the hoppers or barges, sediment is released at or near the water surface. Typically, overflow dredging only occurs when the sediment being dredged is primarily sandy material. This allows for a higher accumulation of coarse-grained material in the hoppers with the small fine-grained fractions of silt and clay overflowing from the hopper bins into the surface water. Bartos (1977) reported that suspended-sediment concentrations in the upper water column resulting from an overflow operation in San Francisco Bay were several hundred milligrams/liter. The dredged sediment was inorganic clay, and 58 percent had a diameter less than 0.074 mm. Pennekamp et al. (1996) reported a vertically averaged suspended-sediment concentration of about 400 mg/ℓ for a hopper dredge operating with overflow at Rotterdam in The Netherlands. As a conservative estimate for implementation of a near-surface sediment source term for hopper overflow in SSFATE, the sediment mass rate released because of overflow will be computed to be the fraction of fine-grained material in the sediment being dredged times the production rate of the hopper dredge. It will be assumed that the sediment mass released will be uniformly distributed over the upper 2 m of the water column along the horizontal length of the overflow. If the overflow is collected and released below the water surface, the vertical location of the release will be the location of the sediment source in SSFATE.

CONCLUSIONS: An approach for estimating the strength and vertical distribution of sediment sources generated by cutterhead, hopper, and clamshell dredges has been proposed for inclusion in the SSFATE model being developed under DOER. It is believed that based upon available field data, the approach is reasonable and should provide conservative estimates of the amount of sediment released into the water column during dredging activities. As additional field data become available, assumptions such as the linear variation of the TGU with suspended-sediment concentrations and the vertical distributions for the released sediment may need to be modified.

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Dredged Material Characterization Tests for Beneficial Use Suitability

PURPOSE: The nature, magnitude, and distribution of contaminants in dredged material vary within and between sites, making consideration of the potential beneficial uses of dredged material more difficult. This technical note provides guidance on the nature and types of physical, engineering, chemical, and biological characterization tests appropriate for determining the potential for beneficial uses of dredged material in aquatic, wetland, and upland environments.

BACKGROUND: The U.S. Army Corps of Engineers (USACE) has the responsibility for maintaining and improving navigation in waters of the United States. More than 300 million cubic meters of sediment are dredged annually to accomplish this task. Most of the dredged material (approximately 90 percent) is considered uncontaminated. However, some waterways are located near areas that are highly industrialized or in urban settings, and the sediments have been contaminated by point and nonpoint sources of metals and anthropogenic organic chemicals [e.g., petroleum aromatic hydrocarbons (PAHs) and/or polychlorinated biphenyls (PCBs)]. Agricultural practices have also contributed to sediment contamination (pesticides, herbicides, fertilizers) in rural areas. Contaminated sediments, unacceptable for open-water placement, are usually placed in confined disposal facilities (CDFs) or confined placement facilities (CPFs). Because many existing CPFs are filled to capacity, finding additional suitable placement sites for dredged material is a growing concern. The USACE/U.S. Environmental Protection Agency (USEPA) technical framework describes the evaluation procedures established for the determination of beneficial uses of dredged material (USACE/USEPA 1992). A beneficial use component is included in that framework and is expanded in this technical note to give additional guidance on its implementation. Alternatives must be developed that can provide beneficial uses for both the contaminated and uncontaminated dredged material in CPFs so that these materials can be removed and used, resulting in the creation of additional CPF storage capacity for future dredging activities.

INTRODUCTION: Dredged material, like soil, is a complex matrix with many dynamic interacting components that can affect more than one property. Adequate assessments of the geotechnical, engineering, chemical, and biological properties must be considered in determining the potential beneficial uses of a dredged material. The properties of a dredged material must be matched to a particular beneficial use. Conditioning dredged material may also be required to produce a material that can perform a beneficial function. A number of physical, engineering, chemical, and biological tests are available to characterize and aid in making decisions about the potential beneficial uses of the dredged material. Appropriate characterization tests are listed in Tables 1-3 of this technical note. Even though most of these analyses were initially designed for soils, they can be applied to dredged material because of its soil-like nature. The terms “soil” and “dredged material” will be used interchangeably throughout this technical note.

Characterization of the dredged material is initiated by an evaluation of its physical properties including (a) grain-size distribution, (b) particle shape, (c) texture, (d) water content, (e) permeability,

Table 1
Appropriate Characterization Tests for Determining Physical and Engineering Properties of Dredged Material to Evaluate Its Suitability for Beneficial Uses

Physical Analysis	Source
1. Grain Size	
Standard Sieve Test	ASTM D422-63; COE V; DOD 2-III, 2-V, 2-VI; CSSS 47.4
Hydrometer Test	ASTM D422-63; CSSS 47.3; COE V
Pipette Test	CSSS 47.2
2. Particle Shape/Texture	ASTM D2488, D4791-95, and D3398-93
3. Water Content/% Moisture	ASTM D2216-92; COE I-1; DOD 2-VII
4. Permeability	ASA: 41-3 and 41-4; ASTM D2434-68
5. Atterberg Limits (Plasticity)	ASTM D4318-9 5; COE III; DOD 2-VIII
6. Organic Content/Organic Matter	ASTM D2487-93
Engineering Properties	**Source**
7. Compaction Tests	
Proctors	COE VI
Standard Compaction Test	ASTM D698-91
Modified Compaction Test	ASTM D1557-91
15 Blow Compaction Test	ASTM D5080-93
California Bearing Ratio	DOD 2-IX
8. Consolidation Tests	COE VIII; ASTM D2435-90
9. Shear Strength	
UU (unconsolidated, undrained)	COE X-18
CU (consolidated, undrained)	COE X-29
CD (consolidated, drained)	COE IX-38

Notes:
ASTM = American Society for Testing and Materials (ASTM 1996).
ASA = American Society of Agronomy/Soil Science Society of America. Method of Soil Analysis, Part-1, 1965.
COE = EM 1110-2-1906 (Headquarters, U.S. Army Corps of Engineers 1986).
CSSS = Canadian Society of Soil Science (Carter 1993).
DOD = U.S. Department of the Army, Navy, and Air Force 1987.

(f) plasticity, and (g) organic content. The engineering properties are used to determine the compactability, consolidation, and shear strength of the dredged material. An assessment of chemical properties can indicate the actions required to (a) obtain the desired pH or salinity, (b) determine a liming requirement to enhance buffering capacity or nutrient availability for plant growth, (c) improve texture, and (d) determine if inorganic (e.g., metals) or organic contaminants (e.g., PAHs, PCBs) are present. Finally, the biological properties must be assessed to (a) evaluate the bioavailability of contaminants to plants and animals, (b) determine the potential for adverse environmental impacts, and (c) determine if control measures or restrictions are required to prevent adverse environmental impacts.

Table 2
Appropriate Characterization Tests for Chemical Properties of Dredged Material to Determine Suitability for Beneficial Uses

Analysis	Source
10. pH	ASA 1996 :Ch 16; CSSS: 16.2.1
11. Calcium Carbonate Equivalents	ASA 1996:Ch 16; CSSS 14.2 and 44.6
12. Cation Exchange Capacity	ASA 1996: Ch 40; CSSS 19.4
13. Salinity	ASA 1996: Ch 14; CSSS:18.2.2
14. Sodium	ASA 1996: Ch 19
15. Chloride	ASA 1996: Ch 31
16. Sodium Adsorption Ratio (SAR)	CSSS: 18.4.3
17. Electrical Conductivity	ASA 1996: Ch 14
18. Total Organic Carbon	ASTM D2974; D2974-87; ASA 1982: 29-4.2; CSSS 44.3
19. Carbon:Nitrogen Ratio	Analyses 19, 23, and 25 in this table
20. Total Kjeldahl Nitrogen	EPA-CRL-468
21. Ammonium Nitrogen	EPA-CRL-324
22. Nitrate-nitrogen	EPA-SW846-9200
23. Nitrite-nitrogen	EPA-SW846-9200
24. Total Phosphorus	EPA-CRL-435
25. Orthophosphorus	EPA-CRL-435
26 Potassium	ASA 1996: Ch 19
27. Sulfur	ASA 1996: Ch 33
28. Diethylene Triamine Pentaacetic Acid (DTPA) Metals	ASA 1982: 19-3.3; CSSS:1.3; Lee, Folsom, and Bates 1983
29. Total Metals *	EPA-SW846-200.9; ASA 1996: Ch 18-30
30. Pesticides (chlorinated)	EPA-SW846-8080
31. Polynuclear Aromatic Hydrocarbons (PAHs)	EPA- SW846-8270
32. Polychlorinated Biphenyls (PCBs) Congeners	EPA-CRL-8081
33. Dioxins	EPA-SW846-8290 and 1630
34. Leachate Quality Test	Myers and Brannon 1988
35. Surface Runoff Quality	Skogerboe et al. 1987

Notes: * Metals = arsenic, cadmium, chromium, copper, lead, mercury, silver, nickel, and zinc; Use EPA 1986 Method 245.6 for mercury determinations.

Methods:
ASA = American Society of Agronomy/Soil Science Society of America (Page, Miller, and Keeney 1982 and 1996).
CSSS = Canadian Society of Soil Science (Carter 1993).
ASTM = American Society for Testing and Materials (ASTM 1996).
EPA = USEPA (1986).

Table 3
Appropriate Tests for Biological Properties of Dredged Material to Determine Suitability for Beneficial Uses

Analysis	Methods
36. Manufactured Soil Test	Sturgis et al. (1999)
37. Plant Bioassay	Folsom, Lee, and Preston 1981
38. Animal Bioassay	ASTM 1998, Standard Guide E 1676-97
39. Elutriate Bioassay	EPA 1991 (Method: 11.1.4) (USACE/USEPA 1991)
40. Pathogens (coliforms)	Standard Methods: 9221 E (Greensberg et al. 1992)

CHARACTERIZATION TESTS USEFUL IN DETERMINING PHYSICAL PROPERTIES

Grain Size, Particle Shape, and Texture. Grain size and particle shape are useful in determining the stability, resistance to shear, permeability, compressibility, and compactability of the dredged material. Grain size can be determined mechanically with sieves (direct) or indirectly with the hydrometer or pipette methods. Sieving is not practical for silt- or clay-sized particles since they tend to clog the screen. When conducting grain-size determinations on silt- or clay-sized particles, sedimentation in water (hydrometer or pipette methods) is preferred. Grain-size distribution and particle shape significantly impact on the weight-bearing capacity of soil or dredged material. Angular particles tend to interlock, forming a stable dense mass capable of bearing more weight than rounded particles, which tend to slide or roll past each other. Dense soils have greater weight-bearing capacities than loose soils. The strain required to reach failure is approximately twice as large for angular-shaped particles as that required to reach failure for spherical particles.

The texture of a soil is its appearance or "feel" and depends on the relative size and shape of the particles, as well as the range or distribution of those sizes. Soil texture is affected by the mineral content, organic matter, soil aggregates, and moisture present in the soil. Soil texture contributes to the water-storage capacity, water-infiltration rates, aeration, fertility, and ease of tilling, as well as compressibility. The texture of dredged material can limit its beneficial uses. For example, predominantly sandy dredged material can be used as a fill material or in dike construction, but might not be suitable for vegetation establishment because of its low nutrient content and water-holding capacity.

Water Content and Permeability. Water content and permeability are interrelated and have a significant influence on the suitability of a dredged material for use as a fill, subgrade, or foundation material. Water content (w) is one of the most important factors affecting the properties and behavior of dredged material. Water content is the ratio of the weight of water to the dry weight of the solids in a mass of dredged material, expressed as a percentage. Soil must be compacted to obtain the required strength and density while the water content is maintained at the optimum level during construction projects (e.g., embankments, highway subgrades). The behavior of fine-grained soils, like silt or clay, is influenced by the water content.

Permeability is one of the factors that determine shear strength and is a measure of water or air movement through the dredged material. Permeability is determined by mineralogical composition, particle size and distribution, void ratio, degree of saturation, and pore fluid characteristics. Very fine-grained materials (clayey) generally have low permeability rates to water, and this is a desirable feature when dredged material is used as fill or foundation material in landfills. However, if the material is to be used for revegetation projects, coarse-grained material would need to be added to clayey material to enhance aeration and root penetration.

Atterberg Limits (Plasticity Tests). Plasticity tests are conducted on dredged material that is finer than 0.425 mm to determine the range of water content in which plasticity is exhibited. The types and amounts of clay particles present and water content, as well as the physicochemical interactions of clay particles, determine the plastic behavior of a dredged material. The Atterberg Limits consist of the liquid limit (LL) and plastic limit (PL) and can be used to assess the amount of dewatering needed before a dredged material can be handled and processed. The Atterberg

Limits, either individually or with other soil properties, can be correlated to other properties such as compactability, compressibility, shear strength, or permeability. The water content above which a dredged material is in a semiliquid state is its LL. The water content that is the lower limit of the plastic state and the upper limit of the semisolid state is the PL. If the water content of the dredged material is below its PL, it becomes brittle and breaks into fragments when remolding is attempted.

The plasticity index (PI), liquidity index (LI), and activity index (AI) are derived from the PL and LL. The PI is the difference between the LL and PL. Materials with a large PI have more plasticity than those with a smaller PI. The PI is directly proportional to the clay content. The LI is some dimensionless number that indicates the ratio of the water content w of a cohesive soil minus the ratio of its PL to the PI ($LI = w - PL/PI$), and it normalizes the water content relative to the plasticity index. The following relationships are noted for remolded soil: (a) when the LI = 0, the soil is at its PL water content and is stiff, (b) when LI = 1.00, the soil is at the LL water content and is soft, and (c) when LI > 1.00, the soil is liquidlike (slurry). The AI is the ratio of the PI to the percentage of clay and is useful in identifying the type of clay minerals present in the dredged material: AI = 0.3-0.5 for kaolinite, AI = 0.5-1.0 for illite, and AI = 1-7 for montmorillonite. Each clay mineral has a unique behavior. Knowledge of the clay mineral type aids in determining the behavior and water-holding capacity of the dredged material.

Organic Content/Organic Matter. The organic content in a soil can contribute to high plasticity, high shrinkage, high compressibility, permeability, or low strength. Soils with significant amounts of organic matter generally have lower shear strength and higher compressibility than those composed mainly of inorganic minerals. An organic soil is one where the LL of the oven-dried soil is <75 percent of the LL of the soil before it was dried. While a certain amount of organic material can be desirable (e.g., enhanced buffering capacity, immobilizing contaminants), it can make characterization of dredged material more difficult since there are many forms of organic materials, and, depending on the origin, each has distinctive attributes.

CHARACTERIZATION TESTS USEFUL IN DETERMINING ENGINEERING PROPERTIES

Compaction Tests. One of the basic and least expensive construction procedures used for soil stabilization is compaction. Compaction mechanically increases the amount of solids per unit volume of soil. It improves the engineering properties of foundation material so that the required shear strength, structure, or void ratio are obtained, while decreasing the shrinkage, permeability, and compressibility. Compaction is often required when building subgrades or bases for airport pavements, roads, embankments, earthfill dams, or similar structures. The Proctor and California Bearing Ratio (CBR) are two commonly used compaction tests. Three basic Proctor (compaction) tests are used depending on the amount of compaction anticipated: the standard, the modified, and the 15-blow compaction tests. The standard compaction test is generally used in routine foundation and embankment design to simulate field compaction; the modified compaction test is used when a higher level of compaction is desired; and the 15-blow compaction test is used when lower levels of compaction are required. These tests aid in determining the percent compaction and water content necessary to obtain the desired engineering properties for construction. Before a dredged material is used as a fill for road bases, foundation pads, or embankments, it is vital that the amount of compaction needed to obtain the required shear strength, compressibility, and permeability is determined.

The CBR is used to determine resistance to penetration of a material (subgrades or bases) before its ultimate shearing modulus is reached. Its primary use has been in the design of flexible pavements for airfields located in areas where frost action is not a controlling factor. Since moisture content affects the results, tests must be conducted using a moisture content that approximates the moisture content anticipated at the site where the pavement is to be constructed. Values obtained usually range from 3 to 80 depending on the type of material tested.

Consolidation Tests. Consolidation tests are needed to estimate the readjustment or plastic deformation likely to occur when soil is subjected to increasing pressures or loads and to determine the compressibility of the dredged material (compressibility index C_c). It is a rate process based on the time required for pore fluid, either water or air, to flow out of soil pores (void-ratio reduction). The rate of consolidation is dependent on (a) the degree of saturation, (b) the coefficient of soil permeability, (c) the nature of pore fluid (air or water), and (d) the distance the pore fluid has to travel for equilibrium to occur. The amount of consolidation or settlement likely to occur must be determined before dredged material is used as a base or subgrade.

Shear Strength. The behavior of dredged material under a load is a measure of its shear strength. Before a dredged material can be used for construction purposes, its shear strength must be determined (e.g., weight-bearing capacity and stability of earthen slopes are directly related to shear strength). Three tests are generally used to determine shear strength: (a) the unconsolidated, undrained (UU) test, (b) the consolidated, undrained (CU) test, and (c) the consolidated, drained (CD) test. The methods and appropriate characterization tests for determination of geotechnical and engineering properties of dredged material are listed in Table 1.

CHARACTERIZATION TESTS USEFUL IN DETERMINING CHEMICAL PROPERTIES

pH. The chemical properties of dredged material are interrelated, but pH is one of the most useful and informative parameters in characterizing those properties. It is a measure of the concentration and activity of ionized hydrogen (H^+) in the dredged material/soil solution. The pH affects the chemical properties of dredged material, including (a) surface charge of organic matter, clay, or mineral particles, (b) solubility, mobility, and toxicity of contaminants (e.g., metals, organics), (c) relative binding of positively charged ions to the cation exchange sites, (d) calcium carbonate equivalents (liming requirements), and (e) nutrient availability. pH values are “beacons” that point to potential corrective actions: pH < 4.0 is indicative of the presence of free acids (e.g., sulfates or nitrates); pH < 5.5 indicates that toxic amounts of exchangeable aluminum, iron, or manganese may be present; pH values between 7.8 and 8.2 are indicative of large accumulations of bicarbonate ions. pH is a useful tool for determining the kinds of analyses or corrective action(s) needed before dredged material can be used in beneficial ways.

Calcium Carbonate Equivalent. The calcium carbonate equivalents (lime requirements) and pH are closely related parameters. The calcium carbonate equivalent is an indicator of the amount of lime required to neutralize any acidity present in order to maintain the desired pH. If large concentrations of sulfides are present in the dredged material, heavy lime application may be required to neutralize the acidity produced from the oxidation of sulfides to sulfates. The need for lime can usually be determined by the calcium carbonate equivalent, which is expressed in terms of lime ($CaCO_3$/100 g of dredged material). Agricultural lime is the most commonly used basic material because of its low cost and growth-enhancing qualities. Liming can reduce the bioavailability and toxicity often present in acidic soil when aluminum (Al), manganese (Mn), and other metals (zinc (Zn), copper (Cu), or nickel (Ni)) are present at elevated concentrations.

Cation Exchange Capacity (CEC). Cation exchange reactions in a soil are important because they alter soil physical properties, cause/correct acidity and basicity, affect soil fertility, and can purify or alter percolating waters. Electrostatic charges are inherent on soil particles. Some charges are permanent, while others are pH dependent. Exchangeable cations (positively charged ions) are attracted to the negatively charged surfaces and replace the cations on the particle surfaces. As the CEC increases, the amount of adsorbed cations increases. The CEC is pH dependent and directly proportional to the clay concentration, organic matter content, and particle-size distribution.

Salinity. Salinity is a measure of the concentration of soluble salts. Cations (sodium, potassium, calcium, and magnesium) and anions (sulfates and chlorides) are the predominant solutes that contribute to salinity. Salt accumulations in soil can adversely affect its structure (decreases the cohesiveness of particles), inhibit water and air movement, increase the osmotic potential, decrease the available nutrient content, induce toxicity to specific ions, and prevent the growth of many plants (except halophytes). Salinity is conventionally measured on aqueous extracts of a saturated paste. A saturated paste is prepared by adding just enough water to saturate the soil sample until it glistens and flows slightly when the container is tipped. The recommended ratio of soil:water in the paste is the smallest amount that can be easily removed with vacuum or pressure since this amount readily correlates to water content under field conditions. Other extraction ratios (1:1, 1:5, etc.) can be used but are not readily correlated to water content under field conditions. The method utilized should be based on the specific conditions and needs of the project. Vegetative responses to salt-affected soil are also influenced by the ratio of calcium to the other ions in solution. Yields are generally reduced when the ratio of calcium to other ions is less than 0.10 (the critical calcium ratio).

Sodium Adsorption Ratio (SAR). The SAR indicates the tendency for sodium to adsorb to the cation exchange sites at greater concentration than calcium or magnesium and is an index of the relative sodium content of the soil solution expressed in mmol l^{-1}. More specifically, it is the ratio of sodium ions to the sum of the calcium and magnesium ions ($SAR = (Na^{+})/(Ca^{2+} + Mg^{2+})^{0.5}$). Dredged materials with SAR values in the range of 10-13 or higher are generally considered sodic. The concentration of exchangeable sodium in a sodic soil is so high that the soil becomes dispersed and impermeable to water as the pores become clogged with dispersed or dislodged clay particles. Plant growth is adversely affected when sodium occupies a high proportion of the exchange sites because pH can become basic (8.5 to 10.5), and the soil aggregates required for plant growth disintegrate and disperse.

Electrical Conductivity. Electrical conductivity is another measure of the soluble salts (ionic strength) present in the dredged material/soil and is reported in decisiemens per meter (dS m^{-1}). It increases as the concentration of dissolved salts increases (electrical conductivity (dS m^{-1}) $\times$ 10 = mmol L^{-1} of soluble salts (total cations or anions)). The electrical conductivity is usually measured on a saturated paste extract of the dredged material using electrodes, and the value obtained can be related to the actual soluble salt concentration in the dredged material. Generally, plants respond in the following ways to electrical conductivity: <2, negligible; 2-4, slight reduction in yield of sensitive plants; 4-8, reduced yield in most plants; 8-16, satisfactory yield only in salt-tolerant plants; and >16, satisfactory yield only in plants that are extremely salt-tolerant. The information from salinity and electrical conductivity tests are somewhat similar but used for different purposes by different individuals. Either test can be used to meet the specific needs of the user.

Total Organic Carbon. Soil organic carbon is the fraction of total carbon that is derived from the organic matter in the soil and consists of plant, animal, and microbial residues (fresh and in all stages of decomposition) as well as the humus. Organic matter normally contains many of the nutrients required for plant growth: 95 percent of the dredged material nitrogen, 50 percent of the phosphorus, and when iron sulfides are not present, ≥80 percent of the sulfur. Organic carbon comprises 48-58 percent of the organic matter content of soil. Conversion factors can be used to obtain an estimate of the organic carbon (organic matter × 1.724 (surface soils) or 2.0 (subsurface soils)).

Total Phosphorus/Orthophosphorus. Phosphorus is an essential nutrient for all forms of life. Plants take it up primarily as the orthophosphate ion ($H_2PO_4^-$) from fertilizers or as it is released from organic matter decomposition. The other ionic forms, monophosphate ions (HPO_4^{2-}) or phosphate ions (PO_4^{3-}), are less available for plant uptake. Most metal phosphates are insoluble under neutral and alkaline conditions (except those of alkali metals) but are soluble under acidic conditions. The orthophosphate ion ($H_2PO_4^-$) is generally the soluble form of phosphorus occurring in dredged material/soils, but it can react quite rapidly with soluble iron or aluminum to form insoluble phosphates. pH affects phosphorus availability through its effect(s) on microbial growth and the solubility of calcium, iron, or aluminum. The optimum pH for phosphorus bioavailability to plants is 6.5 in mineral soils and 5.5 in organic soils.

Carbon:Nitrogen (C:N) Ratio. The C:N ratios present in dredged material/soil help determine if conditions are optimal for the growth of soil microbes, as well as plants. Bacteria require four pounds of carbon for every pound of nitrogen (4:1) in order to have optimum growth and metabolism (decomposition/recycling of organic matter). Decompositional activities of microbes can be increased by the addition of more nitrogen. Materials with a wide C:N ratio are low in nitrogen content. Bacteria are more abundant and in closer contact with soil particles than the root surfaces of plants. Therefore, if nitrogen is low, bacteria will use up available supplies before it ever becomes accessible to plant roots, resulting in nitrogen deficiency in plants.

Nitrogen. Nitrogen is the nutrient most likely to be limiting for plant growth. It can be lost from soil/dredged material by leaching, volatilization, denitrification, or immobilization. Ammonium nitrate is often used as a fertilizer because of its low cost. Half of its nitrogen content is in the form of ammonium and half is nitrate. The nitrate ions are quite mobile and bioavailable to plants when ammonium nitrate is added to soil. The ammonium cations tend to adsorb to the cation exchange sites and are bioavailable to plants but less mobile than the nitrate.

Potassium. The availability of potassium in the dredged material needs to be determined if vegetation establishment is the potential beneficial use. Most of the potassium requirements of vegetation is supplied by the exchangeable potassium ions in the soil CEC and from soluble potassium ions in the soil solution. If the CEC of the dredged material is low, as in sandy material, it may need to be amended with potassium fertilizers. Since potassium forms a positive ion, it has limited mobility through the soil and should be placed where it is most accessible for growing roots.

Sulfur. Sulfur is generally taken up by plants in the form of sulfates and is often supplied from the decomposition of organic matter or soluble minerals. Although sulfur-deficient soils are not very common, sulfur is a necessary constituent of three essential amino acids. The amount of sulfur required is dependent on the target vegetation.

Contaminants. The presence of contaminants (metals, pesticides, PAHs, PCBs) in dredged material is a concern. These substances generally sorb to the sediment particulates (i.e., organic matter, clay particles, aggregates, hydrous oxides) and settle out in the anaerobic (reduced) alkaline environment existing on the bottom of waterways. The solubility, mobility, and bioavailability of these contaminants are generally reduced under anaerobic alkaline conditions. However, the dredged material can become oxidized and more acidic during dredging and placement into CPFs. The potential then exists for sorbed contaminants to become solubilized, mobile, and bioavailable. Analyses need to be conducted to determine if contaminants have become solubilized and bioavailable (i.e., DTPA, biological screening tests). Then the appropriate corrective measures can be taken to prevent adverse environmental impacts.

Surface Runoff Quality and Leachate Quality Tests. The potential exists for solubilized contaminants in the dredged material to migrate offsite during and after placement into upland sites. As the dredged material dries out and becomes oxidized, the potential exists for contaminants to become soluble, mobile, and bioavailable. During precipitation events, water percolates through the dredged material, and contaminants can migrate in the runoff and be carried into surface-receiving waters. Chemical analyses are conducted on surface runoff waters when there is concern about contaminants that have established water quality criteria (WQC), and/or a biological evaluation is conducted for those contaminants that have no established WQC. The leachate quality test is used when the potential exists for contaminants to enter surface-receiving waters or groundwaters. The leachate quality test evaluates the potential for adverse impacts from (a) seepage from dikes into a receiving water body, (b) subsurface drainage into an aquifer used for drinking water, and (c) seepage into nonpotable subsurface water. The results of both tests should be compared with the quality of an appropriate reference surface water or groundwater source. Methods and appropriate characterization tests for determining chemical properties are listed in Table 2.

CHARACTERIZATION TESTS USEFUL IN DETERMINING BIOLOGICAL PROPERTIES: Biological tests are conducted to assess the potential for adverse effects to occur in biological indicator organisms as a result of exposure to contaminants in the dredged material. These tests integrate existing conditions in the dredged material and evaluate the bioavailability of contaminants in the dredged material. The chemical species (form) of contaminants determine their bioavailability and potential for uptake, bioaccumulation, and toxicity once they reach their site of action in living organisms, not simply their presence in dredged material. Elutriate bioassays are conducted to assess/evaluate the bioavailability and potential toxicity of contaminants that are either adsorbed on particle surfaces (can be easily washed off or eluted) or solubilized in pore waters. The manufactured soil test and plant/animal bioassay are designed to determine if adverse (toxicity) effects occur in test organisms as a result of exposure to contaminants in the dredged material. The responses of dicot and monocot plant species are evaluated during the plant bioassay, and the optimum combination of dredged material, carbon source, and organic waste amendments is assessed using the manufactured soil test. Test conditions can be controlled or varied to simulate those expected to be encountered under field situations (upland or wetland) so that the data obtained can be used to make realistic predictions and evaluations. The pathogen (coliform) analysis is used to detect the presence of disease-causing bacteria, usually of fecal origin. Table 3 lists methods and appropriate characterization tests for determining biological properties.

BENEFICIAL USES OF DREDGED MATERIAL: There are many potential beneficial uses of processed dredged material in upland, wetland, or aquatic environments (see Table 4). The properties, as well as the types and bioavailability of contaminants, will determine the beneficial uses of a dredged material and the amount of processing needed to reduce adverse environmental impacts. In addition, waste materials such as fly ash, alkaline wastes, and spent lime can be added to dredged material to engineer a soil product that can meet specifications required for a particular beneficial use. Examples are impermeable caps for landfills, superfund sites, and brownfields.

Table 4
Potential Beneficial Uses of Dredged Material

Upland Environments

Fill, subgrade construction:
    Highway/road/airport landing strip
    Asphalt, concrete, bricks
    Washouts/barren areas along highways
    Mine shaft fill
    Covers for landfills, brownfield, superfund and mining sites
    Earthen slopes
    Biomechanical erosion control structures
    Cemeteries
Manufactured soil products:
    Landscaping
    Bagged soil
    Recreational areas/parks/campgrounds
    Silviculture, horticulture, agriculture
    Covers for landfills, brownfield, superfund and mining sites

Wetland Environments
Constructed wetlands for water quality improvement Creation of mitigation, wildlife habitat wetlands, marshes, etc. Erosion control, bank stabilization Geotextile tube fill, berm construction Biofilters for landfill leachate/seepage Biofilters for acid mine drainage
Aquatic Environments

Capping open-water placement sites
Beach and shoreline nourishment
Solid structures for fish habitat
 	
Geotextile tube fill
 	
Creation of:
    Islands
    Tidal flats
    Sea grass meadows
    Oyster beds
    Fishing reefs
    Clam flats
Dike or berm construction

While habitats will develop from placement of dredged material into disposal sites, the enhancement and development of high-quality habitats require the utilization of sound management strategies.

Dredged material is an under utilized resource that can be used in a beneficial manner once appropriate physical, engineering, chemical, or biological properties are determined. Over 2,000 man-made islands have been created in the Great Lakes and coastal and riverine areas by the U.S. Army Corps of Engineers. These islands, along with additional ones, can provide nesting areas, protection from terrestrial predators, and the seclusion from humans needed by migratory or colonial nesting waterbirds and threatened or endangered species (e.g., pelicans, spoonbills, gulls, herons, terns). Additional beneficial uses in aquatic environments include habitat creation (reefs, tidal flats, sea grass meadows), erosion control (underwater berms made of geotextile tubes filled with dredged material, beach and shoreline nourishment), and construction (dikes). Dredged material can be used to augment decreasing wetland resources including freshwater and saltwater marshes, biofilters for landfill leachate, constructed wetlands for wastewater treatment, or fill for sloughs in riverine areas or denuded reservoir banks. There are a vast number of beneficial uses in upland areas including construction of roads or airport runways, landscaping (manufactured soil products), parks and recreational area development, cemetery development, and others. All products made from dredged material will have to meet the performance specifications established for existing material and will have to be cost competitive, available in a timely manner, and tested for performance.

A phased approach to testing should be employed in determining suitability for beneficial uses. It may not be necessary to conduct all of the characterization tests. An evaluation procedure for beneficial uses of dredged material is shown in Flowcharts 3-1 and 3-4 of the USACE/USEPA Technical Framework (USACE/USEPA 1992). First, the beneficial use needs and/or opportunities should be determined for the specific location. Next, an evaluation of the physical suitability of material for the proposed uses needs to be conducted using appropriate characterization tests for determining the physical and engineering properties in Table 1. If the physical properties do not meet desired specifications, processing the dredged material by addition of available materials such as spent lime, fly ash, or kiln dust should be considered. Many times the dredged material can be conditioned to meet desired specifications. Next, the logistical and management requirements are considered. The evaluation of environmental suitability is then considered. If there is reason to believe the dredged material is contaminated, either the chemical or biological or both characterization tests should be conducted. A modified version of the framework for testing and evaluating for beneficial use applications is presented in Figure 1. If the results of the chemical/biological screening tests indicate the potential for adverse impacts, the dredged material should be treated and then retested for adverse impacts. If adverse impacts are no longer indicated, or if there is no reason to believe the dredged material is contaminated, the beneficial uses can be realized, and the evaluation of socioeconomic, technical, management, and other environmental considerations, either as an Environmental Assessment or an Environmental Impact Statement, is conducted as shown in Flowchart 3-1 of the USACE/USEPA (1992) technical framework. If adverse impacts are still indicated, the dredged material should not be used for beneficial purposes.

SUMMARY: Dredged material can be a valuable resource with numerous potential beneficial uses. Although dredged material is analyzed prior to placement into CPFs, many physical, chemical, and biological processes can continue to occur depending on the prevailing environmental conditions (e.g., precipitation, temperature, biogeochemical factors) around the CPP. The results obtained

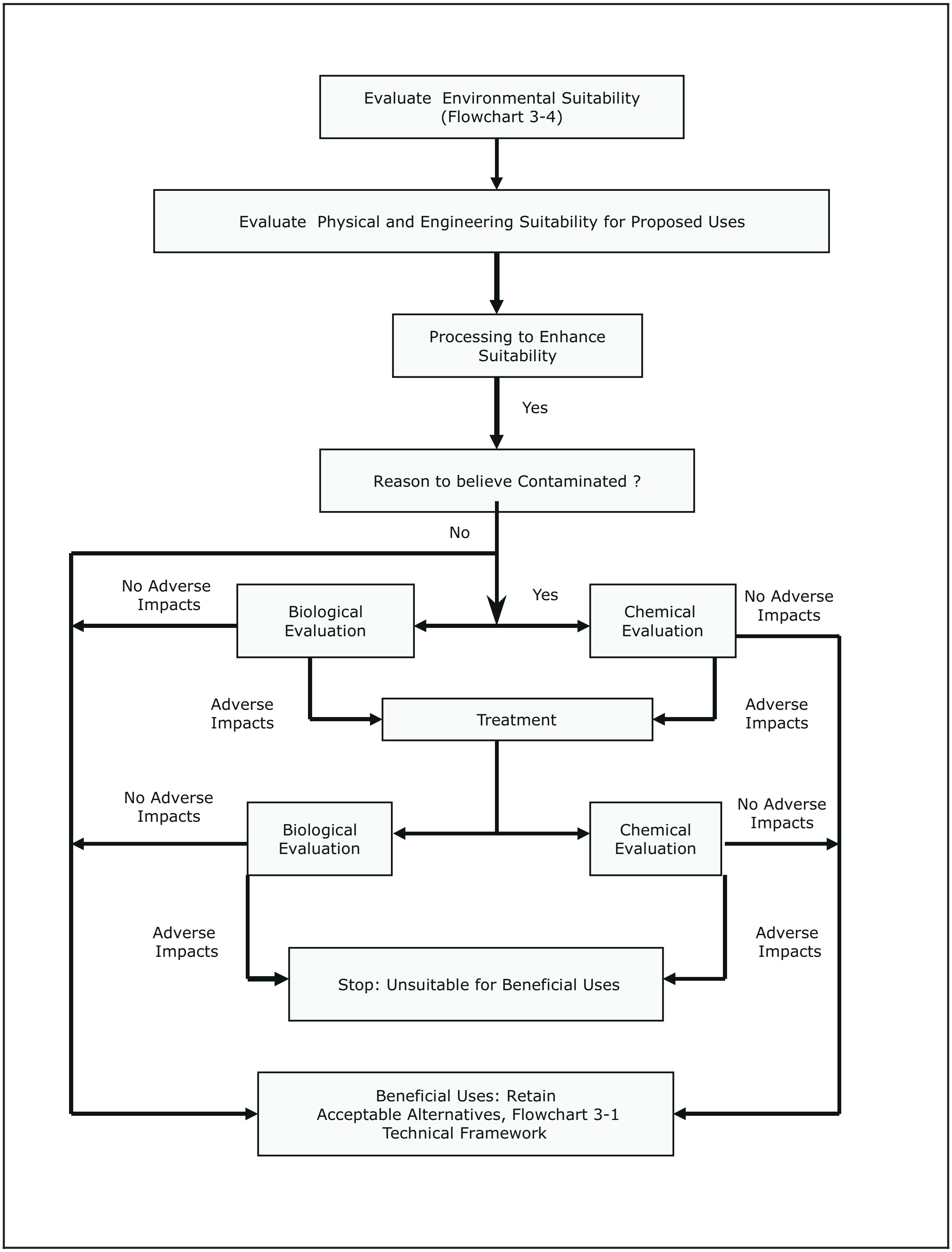

Figure 1. Framework for testing and evaluation for beneficial uses

from the appropriate characterization tests will provide information useful in determining the current physical, engineering, chemical, and biological properties of the dredged material. Knowledge of the properties and the limitations (e.g., contaminant bioavailability) of the dredged material will aid in determining the alternatives for beneficial uses.

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Technical Note DOER-N2
April 1998

Dredged Material Spatial Management, Analysis, and Record Tool (DMSMART)

PURPOSE: This technical note describes the Dredged Material Spatial Management, Analysis, and Record Tool (DMSMART), a personal-computer- (PC-) based software package being developed to assist Corps staff in managing their dredging and dredged material placement activities. Feedback on its features and implementation is requested. Also described is an existing software package, the Disposal Analysis Network for New York (DAN-NY), currently available from Science Applications International Corporation, which formed the basis for DMSMART.

BACKGROUND: Managing dredging and dredged material placement has become more complicated as the number of regulations applicable to these activities has increased, and resource agencies and environmental groups have subjected the Corps to greater scrutiny on dredging projects. A customized Geographic Information System- (GIS-) based software system can be used to greatly facilitate dredging project management. Recent advances in computer hardware and software have allowed the development of sophisticated, but easy-to-use GISs for PCs.

Challenges faced by the U.S. Army Engineer District, New York, in managing their open-water disposal site, the Mud Dump site, led to their funding development of a district-specific software package for site management, DAN-NY. Delivered in June 1997, DAN-NY was developed as a joint effort between two contractors (Science Applications International Corporation (SAIC) and Applied Science Associates (ASA)) and the U.S. Army Engineer Waterways Experiment Station (WES). Present users of DAN-NY (including the New York District, WES, and SAIC) have all been impressed with its ability to facilitate site management.

WES association with the New York District and DAN-NY development, along with general site management experience, led to the conclusion that a Corps-wide software package for managing various aspects of the dredging and placement process would be valuable. Under the Dredging Operations and Environmental Research (DOER) Program, WES is heading the development of DMSMART. Like DAN-NY, DMSMART will be a GIS-based software package customized for the dredging/placement application, and it will also include several WES models. To effectively use DMSMART once the initial software development is complete, Corps Districts need to begin developing databases of dredging project and placement site monitoring data.

This technical note consists of a description of dredging and placement site management challenges that are well-suited to the capabilities of a GIS-based software system. This is followed by descriptions of the New York District site management difficulties that led to DAN-NY development, DAN-NY specifications, a discussion of DMSMART, and finally a description of the DMSMART implementation plan.

SITE MANAGEMENT CHALLENGES

Federal regulations require that dredging and dredged material placement be done at minimum cost while being consistent with sound engineering principles and proper concern for the environment. Over the past two and a half decades, knowledge of the environmental impacts associated with dredging and dredged material disposal has increased. The emphasis has shifted from one that was most concerned with low cost to a much more balanced view with environmental concerns playing an increasingly larger role in dredging project management. Also, the awareness that dredged material should be considered a resource that can be used beneficially in an increasing number of ways has greatly influenced dredging project management.

For the reasons mentioned above, managing dredging projects is now much more complicated than in the past. In addition to the ever-increasing number of regulations and statutes that govern dredging and dredged material placement, many State resource agencies and environmental groups now subject dredging projects to greater scrutiny. Just doing a good job is no longer sufficient. To improve or maintain its credibility, the Corps must be able to conclusively demonstrate that dredging projects are being effectively managed.

Management of dredging and dredged material placement, referred to hereafter as dredging project management, has a number of facets. Dredging project management provides answers to the following questions:

- What is being dredged?
- How much is being dredged?
- When will dredging take place?
- Where did dredged material come from?
- Where will dredged material be placed?
- How will material be dredged and placed?
- What will happen to the environment at the dredging site? At the placement site?
- Was material dredged correctly? Placed correctly?
- Could dredged material be used more beneficially?
- Could project have been completed at a lower cost?

In more general terms, dredging project management is controlling the dredging project to meet regulatory guidelines of low cost, sound engineering, and environmental stewardship. A more detailed discussion of managing open-water dredged material placement can be found in Walls et al. (1994). An important facet of dredging project management is long-term planning, developing placement options that have sufficient site capacity for the next 20 to 50 years.

The increase in regulations, number of contaminants tested for, and projects for which tests are conducted has vastly increased the amount of data collected during execution of the dredging project. This has resulted in greater numbers of bioassay and bioaccumulation tests. At the placement site, tests for sediment chemistry and tissue chemistry are becoming more routine. Use of sediment profile imagery (SPI) is becoming more routine to detect layers of dredged material at thicknesses below those resolvable from bathymetric surveys.

Dredged material placement is now receiving much greater interest. Confirming that the contractor is meeting contract specifications for placing material in precise locations inside the disposal site (not outside the site, which could potentially damage nearby resources) is considerably more important and more practical. A related issue is the increased time and cost required to designate new sites. This makes controlling placement within the disposal site to maximize site capacity while minimizing environmental impacts even more significant.

The ability to manage all these diverse data and use them effectively meshes well with the strengths of a GIS-based system. A GIS is an excellent tool to archive, display, and analyze spatial data. Many of the difficulties of site management result from the inability to easily access the data and display it on a common datum. Using the spatial nature of the data, the GIS's database can contain the many different types of data in layers that can be easily retrieved and displayed.

In addition to dredging project management, resource agencies and environmental groups have become more involved in the dredging process, resulting in substantial increases in the number of requests for information. Also, the number of lawsuits associated with dredging projects has increased, adding to the number of requests Districts receive for information. Providing timely answers with a minimum of effort can be difficult. The relational database included as part of the GIS allows a range of queries to be made with minimal effort.

Concerns over the fate of dredged material during dredging and during and after placement in the disposal site are increasing. The ability to predict water column impacts during dredging and placement, the area of the bottom covered by a placement operation, the height of the mound created during a placement operation, and the long-term stability of a dredged material mound can all be crucial to obtaining resource agency permission to execute a given dredging project. Reliable prediction of long-term mound stability is critical to both maximizing site capacity and to creating effective site management plans.

Over the years, WES has developed or refined a number of numerical models that predict various aspects of dredged material fate that can be used to address concerns such as those just discussed. However, the ability of District staff to use these models has often been limited by less than user-friendly interfaces combined with difficulties in accessing the data needed to drive the models. A number of the WES dredged material fate models are to be included in DMSMART. Prior limitations on difficulty of use and access of input data will be overcome.

The above discussions show that a GIS software package with access to WES dredged material fate models could facilitate dredging project management. The following section describes the specific site management challenges faced by the New York District that prompted the development of a District-specific open-water site management software system.

DAN-NY

Background

Historically, the New York District has had a difficult open-water dredged material placement site to manage. The Mud Dump site, a 2.1- by 3.7-km rectangle located 11 km east of Sandy Hook, NJ, has been used since interim designation in 1973. The site's proximity to commercial and recreational fishing areas, historic disposal sites, and heavy shipping through the approaches to New York Harbor create a unique set of circumstances from a site management perspective. For most of the time since site designation, the site has received an average of 4.3 M m^3 per year of mostly fine-grained maintenance material (Massa et al. 1996) from an average of 20+ Federal and private projects.

Over the years, challenges in three different areas led the New York District to fund development of the first software package for managing open-water disposal sites, DAN-NY (Clausner, McDowell, and May 1997). The first management challenge was concern over site capacity. The desire to maximize site capacity (and not to exceed safe navigation depths) and contain the sediments inside the site was a major driving factor for developing a computerized GIS system to provide a more sophisticated level of site management. The second concern was the desire to improve capping of contaminated dredged materials placed in the Mud Dump site. The third major need resulted from the variety of locations and media on which the New York District stored information relevant to site management. It was difficult to access and display the data needed to make decisions.

Both WES and SAIC have supported the New York District in their site management activities for many years. SAIC collected a considerable amount of monitoring data at the Mud Dump site and assisted with operational details for capping operations, while WES assisted in capping project design (Randall, Clausner, and Johnson 1994) and computations of site capacity (Clausner and Greges 1995). In 1994, SAIC proposed joint development of a software system, DAN-NY, to assist the New York District with open-water site management. In the joint effort, SAIC's expertise in monitoring and data collection was combined with the strengths of ASA, a firm specializing in hydrodynamic numerical modeling using GIS, and WES' expertise in capping, fate modeling, and site capacity.

Phased Implementation

DAN-NY is being developed in phases. Phase 1 was a system design study, which defined data types, hardware, software, costs, and schedule for implementing subsequent phases. Phase 1 was completed in May 1996 (SAIC 1996). Phase 2 was to design and implement the system including developing and documenting data management systems and training of New York District and WES staff. Concurrent with Phase 2 was Phase 3, which selected the data needed and then populated the databases. Phases 2 and 3 were completed in June 1997. Phase 4, now underway, is to maintain the system, add enhanced software and analysis, and continue populating the database with additional data sets.

DAN-NY functions at two levels. It has quick access to maps and summary information for use by upper level management or in-depth (extended analysis) capabilities for the technical user. Quick access features (available by selecting one or two options from the opening menu) allow the user to view and print any bathymetric surveys in the database along with the more recent barge placement locations. In the extended capabilities mode, the user has access to an array of tools that will apply to many day-to-day activities as well as longer term planning and design related studies. Figure 1 shows the range of tasks that can be done in DAN-NY. In addition to the more obvious abilities to display bathymetric survey data in a wide range of options, DAN-NY can accomplish the following:

- Compute site capacity.
- Predict mound geometry using the Multiple Dump FATE of dredged material (MDFATE) model developed as part of the Dredging Research Program (DRP) (Moritz and Randall 1995).
- Display the mound created and compute volumes.
- Associate mounds with buoy locations.

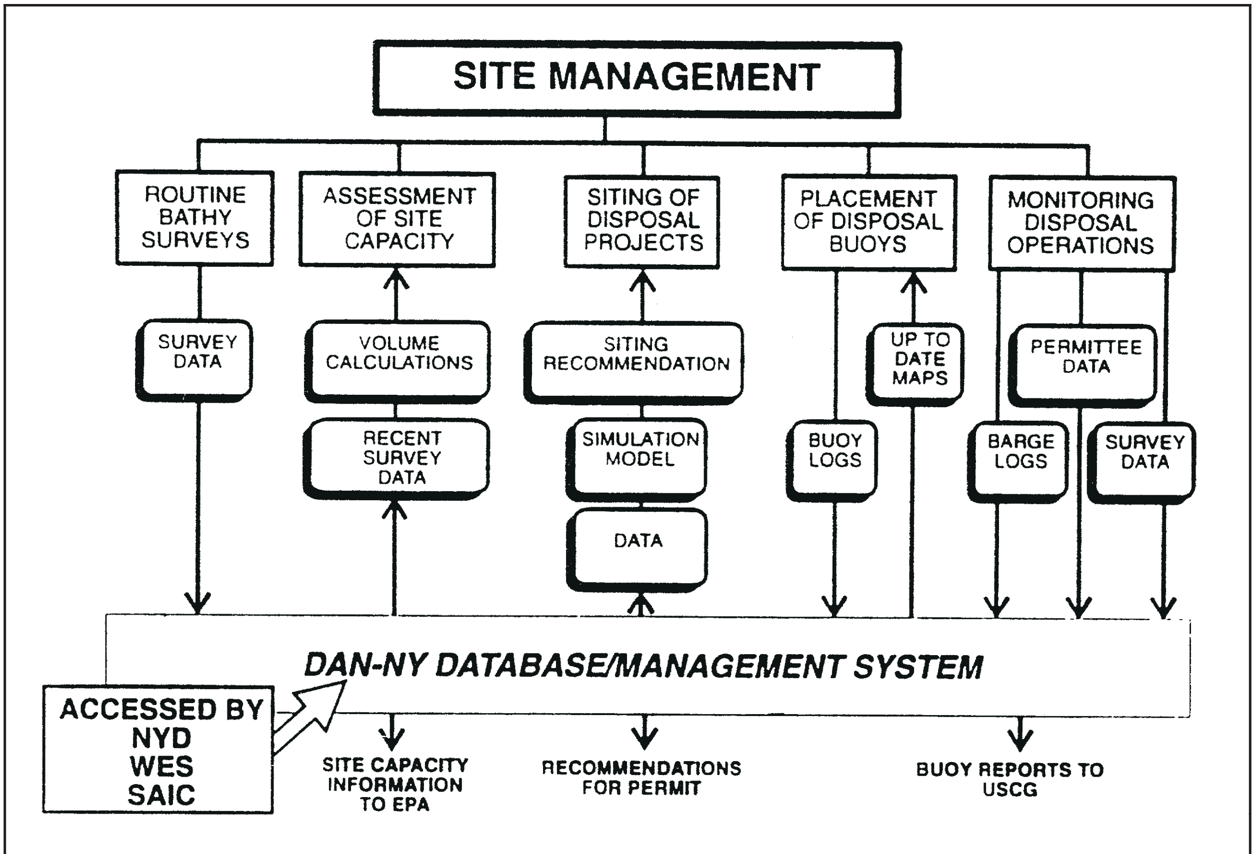

Figure 1. Site management activities supported by DAN-NY

- Review barge disposal logs.
- View SPIs.

DAN-NY Hardware and Software

With the exception of the specialized software applications developed by SAIC and ASA, all hardware and software for DAN-NY are nonproprietary and readily available. DAN-NY is used on a PC with minimum capabilities of a 166-MHz CPU, 32 Mbytes of RAM, 2-Gbyte hard drive, and 6x CD-ROM. All software is 32-bit to increase operating speed; the operating system is Windows NT 4.0; the GIS system is ArcView 3.0; and the database is Microsoft Access. A GIS expert is not required to operate DAN-NY. Most of the functions a site manager would require have already been built in. Present users of DAN-NY were proficient with the software after 2 days of training. Training for the quick access features takes 2-3 hr.

DAN-NY Databases

Table 1 lists the data types and the number of each type of data populated in DAN-NY during Phase 3. SAIC made a considerable effort to meet the METADATA standards now required. All data entered into the database met SAIC's quality assurance/quality control (QA/QC) specifications. All data are provided on CD-ROMs, with periodic updates via new CD-ROMs.

Table 1 **Data Types Initially Included in DAN-NY**
Bathymetry (>27 surveys)
Sediment profile imagery (10 surveys)
Sediment chemical and physical analyses (7 surveys)
Barge disposal logs (1,785 logs)
Side-scan sonar (2 surveys/1 image)
Planform photographs (5 surveys)
Tissue analyses (chemical and physical) (4 surveys)
Disposal buoy locations (645 logs)

DAN-NY Application to the 1997 Capping Project

The beta version of DAN-NY was used to assist in the design of the capped contaminated sediment mound project placed in the Mud Dump site during the summer of 1997 (Clausner et al. 1998). This early version of DAN-NY proved to be extremely valuable in designing the operational plan for placing 253 barge loads containing nearly 530 k m^3 of contaminated material (McDowell et al. 1998). The resulting mound was being capped with approximately 1.5 M m^3 of sand. During the 1997 capping project, DAN-NY's ability to display barge disposal locations, most of which were provided by a barge-mounted silent inspector, proved to be invaluable for managing the project (Pace et al. 1998).

DMSMART

Knowledge of dredging project management challenges and involvement with DAN-NY led WES to propose development of DMSMART under the DOER Program's Comprehensive Open Water Site Management System work unit. DMSMART will build on the experience gained with DAN-NY. Because of the complexity of site management problems, DAN-NY already has many features that will be helpful to other Corps Districts, and will be considered for DMSMART. However, DMSMART will be an improvement over DAN-NY in several key ways. DMSMART will include data on the dredging site in addition to the disposal site. This should greatly increase its utility. In addition to open ocean sites, the types of disposal sites allowed within DMSMART will be expanded to include riverine and estuarine sites. The ability to manage confined disposal facilities will also be included. DMSMART will include access to a greater number of WES models for predicting dredged material fate. DMSMART will be owned by the Corps; therefore, DMSMART software will be available without cost to Corps Districts. Corps Districts will be responsible for funding/developing databases.

Based on experience with DAN-NY and District input, the following concepts will guide DMSMART development. The initial version will be simple, concentrating on including dredging site data and expanding the fate models to include the Short Term Fate of Dredged Material (STFATE) (Schroeder and Palermo 1990, Johnson and Fong 1995) and Long Term Fate of Dredged Material (LTFATE) (Scheffner et al. 1995) models in addition to the MDFATE model. DMSMART will be flexible, so that additional models (e.g., some of the Automated Dredging and Disposal Alternatives Management System (ADDAMS) or DOER models) or other data types can be added later. In developing requirements for DMSMART, features that the majority of Districts agree are necessary will be included. However, if a District has a special requirement, the program and standards should be sufficiently documented so the feature can be added.

The key to maintaining flexibility is to develop standards for data and modeling. Standards will allow the software to be easily implemented Corps-wide, the program to be software independent, and allow the Districts to easily contract data collection and database creation. As part of the DMSMART effort, guidance documents with instructions for electronic formats and standards for data will be provided. Modeling standards will include methods for handling input and output files.

Additional models may be included in DMSMART based on the following principles. First, a significant number of Districts must indicate that a specific model will be useful. Second, a model must not require "in-depth" training for execution. For those models that may be useful to a District for managing dredging projects, but require WES staff for execution, an attempt will be made to include the capability to archive and display the model output file. If a District has developed software or specific applications for dredging project management that can be of general use, an attempt will be made to include the District development. For example, the Seattle District has demonstrated output of an ArcView-based application for tracking and displaying sediment contaminant concentrations. WES expects to use this or a similar application in developing DMSMART.

Another guiding principle is to continue to be aware of other databases and reporting requirements related to dredging project management and to allow DMSMART to extract or import data as necessary. Potential databases with which DMSMART might interact include the Dredging Information System (DIS), the contaminated sediments database, and the regulatory database RAMS (Regulatory Analysis and Management System).

Data Types and Analysis Capabilities Planned For DMSMART

For the dredging site, data types included in DMSMART will be bathymetry, project locations, channel dimensions, sediment grain size data, and project history data such as past contractors and equipment used. If possible, the DIS database will be accessed for project history data. Probably the major effort for dredging sites will be to include the vast amount of sediment chemistry and biological testing data routinely collected. Disposal site data included in DMSMART will be similar to those in DAN-NY listed in Table 1. One of the principal efforts over the next few months will be to finalize the data types and analysis capabilities. Any District staff members that desire a more complete list of data types or analysis capabilities are urged to contact the author directly. A future technical note will provide more details on the data types and capabilities selected for inclusion in DMSMART.

Database Development

Of equal importance to software development is creation of each District's database of dredging project history and the dredging and disposal site monitoring data. Without the data, DMSMART is useless. Districts must populate their own databases using the guidance developed by the work unit. Therefore, one of the early products of the contract to develop DMSMART will be guidance documents on how to create the database, along with cost estimates for creating the database. Based on the number of sites, time, and funds available, each District will be able to decide how much data will go into the database initially, and make plans to have additional historical data entered at a later date. Obviously, data recently collected in electronic format will very likely cost less and require less time to put into the database. Depending on the District's needs and staff, database creation can be done in-house, under contract, or with a combination of the two. One method would be to contract out an initial block of data required for database entry of ongoing projects, then create future databases in-house as funds permit. It is important to assure that data have been QA/QC'd and meet METADATA standards.

Maintaining an up-to-date database will be a continuing activity after DMSMART is on-line. As with the database creation, this could be done in-house or by contractor.

Compatibility with Silent Inspector Data

During the DRP, theory, procedures, and standards were developed for a Silent Inspector (SI) to monitor hopper dredging operations (Cox, Maresca, and Jarvela 1995). The SI facilitates contract monitoring. It consists of a set of standards for collecting information on the dredge, processing this information to obtain dredge state and load, storing the information, and providing the data via reports. Some of this reported information may be transferred in real-time via a cell phone or radio link to the District. The full data set is then downloaded periodically. Under the DOER Program, the SI for hopper dredges will be taken from the prototype system developed under the DRP to a working system for the Districts. In addition, plans to extend the SI to cutterhead and mechanical dredges/barge combinations are planned.

Some portions of the SI data will be quite valuable for inclusion into DMSMART. WES staff developing DMSMART and the SI are working closely so that the archived SI data can be accessed by DMSMART. Once again, a consistent set of standards and intelligent database design will be crucial for ensuring compatibility.

Schedule for Implementation

The present plan is to develop requirements for DMSMART through early CY98 with a scope of work (SOW) completed in spring of 98. A contract is expected to be awarded by early FY99, with delivery of DMSMART 1.0 during the summer of 99. Initial distribution to the Districts and training are planned for Sep-Nov 99.

As noted earlier, one of the first products from the contract will be a set of guidance documents describing how to create District databases. A training course is planned at WES to provide detailed instructions for District staff on database creation. The course would likely be offered in late winter or early spring of CY99.

Steering Committee/District Input

To assist WES staff in developing DMSMART, several different methods will be used. At the workshop, a steering committee was developed. The members are listed below:

- Dr. Tom Fredette (New England District)
- Mr. Paul Bradley (Mobile District)
- Mr. David Kendall (Seattle District)
- Mr. Don Borkowski (Buffalo District)
- Mr. Jim Aidala (Rock Island District)
- Mr. Tom Verna (Headquarters)

The steering committee members will be reviewing in detail the requirements, SOW, etc. Steering committee members will be asked to attend 1-2 meetings to assist in developing requirements. Other Corps District staff who would like to provide input are being solicited. These persons will be provided draft copies of the requirements, etc., and asked to provide comments.

To both inform District and Division staff of DMSMART and gain feedback, WES will be attending various meetings and providing briefings on DMSMART. In early August 1997, WES staff presented a DAN-NY demonstration and DMSMART overview to the Mobile District. In early September 1997, WES presented an overview of DMSMART to the East Coast Dredging Team meeting in St. Augustine, FL, and presented a DAN-NY demonstration and DMSMART overview to the Jacksonville District. Briefings on DAN-NY, DMSMART, and the SI were provided to

Seattle, Portland, and San Francisco Districts in December 1997. Other briefings are planned; interested readers should contact Mr. Clausner directly.

SUMMARY

Computer hardware and software have now advanced to the point where a GIS-based software package customized for managing dredging projects is a reality. The New York District has recently funded development of a District-specific software package (DAN-NY) for managing their open-water disposal site. DAN-NY has proved its value during a contaminated sediment capping project conducted during the summer of 1997. Under the DOER Program, a Corps-wide software package for managing dredging projects (dredging and disposal) is now being developed, the Dredged Material Spatial Management and Record Tool (DMSMART).

POINTS OF CONTACT: For additional information on DMSMART, contact the author of this technical note, Mr. James E. Clausner (601-634-2009, *clausnj@ex1.wes.army.mil*) or the DOER Program Managers, Mr. E. Clark McNair, Jr., (601- 634-2070, *mcnairc@ex1.wes.army.mil*), or Dr. Robert M. Engler (601-634-3634, *englerr@ex1.wes.army.mil*). This technical note should be cited as follows:

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DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

AUG 2 7 1999

REPLY TO
ATTENTION OF

Programs and Project Management Division
Project Management Branch

Honorable Jeb Bush
Governor of Florida
Tallahassee, Florida 32399-0001

Dear Governor Bush:

The U.S. Army Corps of Engineers is committed to examine future construction and maintenance projects in the Tampa Bay area to see if material can be used to construct a nearshore berm at Egmont Key. The material must be predominately sand to construct a berm that will stay in place and meet water quality requirements. Egmont Key must be the least cost method of disposal since the Corps does not have any funds to place material at Egmont Key.

We are currently examining an upcoming maintenance project at St. Petersburg Harbor to determine if any material can be used at Egmont Key. The sediment testing is underway and will be completed by September 1999. The results of the sediment testing will determine if the material can be placed at Egmont Key in an economically and environmentally acceptable manner.

Future projects will be examined to determine if material can be used to help ease the effect of erosion at Egmont Key. Any questions can be directed to myself or Mr. Richard E. Bonner, Deputy District Engineer for Project Management, at 904-232-2586.

Sincerely,

Joe R. Miller

Joe R. Miller
Colonel, U.S. Army
District Engineer

Copy Furnished:

Ms. Catherine Florko, Department of Environmental Protection, Marjory Stoneman Douglas Building, 3900 Commonwealth Boulevard, Mail Station 310, Tallahassee, Florida 32399-3000

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

JUN 0 1999

Programs and Project Management Division
Project Management Branch

Honorable Bob Graham
United States Senator
Attention: Ms. Kristen Kershner
2252 Killearn Center Boulevard
Third Floor
Tallahassee, Florida 32308

Dear Senator Graham:

The U.S. Army Corps of Engineers is committed to examine future construction and maintenance projects in the Tampa Bay area to see if material can be used to construct a nearshore berm at Egmont Key. The material must be predominately sand to construct a berm that will stay in place and meet water quality requirements. Egmont Key must be the least cost method of disposal since the Corps does not have any funds to place material at Egmont Key.

We are currently examining an upcoming maintenance project at St. Petersburg Harbor to determine if any material can be used at Egmont Key. The sediment testing is underway and will be completed by September 1999. The results of the sediment testing will determine if the material can be placed at Egmont Key in an economically and environmentally acceptable manner.

Future projects will be examined to determine if material can be used to help ease the effect of erosion at Egmont Key. If you have any additional questions or need additional information, please call me or have your staff contact Mr. Joseph Burns, Congressional Liaison, at 904-232-2243.

Sincerely,

Joe R. Miller

Joe R. Miller
Colonel, U.S. Army
District Engineer

CESAJ-CO (1130) FEB 1 2 1998

MEMORANDUM FOR STAFF CHIEFS AND SPECIAL ASSISTANTS

SUBJECT: Disposal of Sand at Beaches or Nearshore From Maintenance Dredging Projects

1. There has been concern raised as to whether we have a consistent policy dealing with disposal of sand from maintenance dredging projects. The basic policy is to place all Beach Quality Material (BCM) on beaches consistent with Federal Policy.

2. The purpose of this MFR is to confirm our policy and strategy for placing sand on the beach and confirm criteria to address additional costs.

3. Federal policy within the Corps of Engineers on dredging is defined by both the Code of Federal Regulations and Engineering Regulations. Within the Code of Federal Regulations, the Final Rule for Discharge of Dredged Material into Waters of the U.S. or Ocean Waters, is found at 33 CFR Parts 209, 335, 336, 337, and 338. Within the Engineering Regulations Dredging Policies and Practices, Interim Guidance is found at ER 1130-2-107.

4. Our interpretation of this National Policy guidance has been consistent with what we have interpreted to be the Federal Standard. The Federal Standard is defined at 33 CFR 335.7 as, "...the dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by 404(b)(1) evaluation process or ocean dumping criteria."

5. The least cost environmentally acceptable alternative has always been to place the material as close as possible to the channel in an environmentally acceptable manner. Placing sand on the beach has always been part of that policy and standard. In 1990 and 1991, we reiterated this policy in discussions with the State while discussing Long Range Dredged Material Management Strategies and Water Quality Certificate issues.

6. With this policy in mind, we have established a Base Plan for every project for disposal of dredged material. This Base Plan satisfies the environmental standards as expressed through the 404(b)(1) guidelines and the NEPA process. With environmental criteria satisfied, we always look for ways to dispose of dredged material for Beneficial Uses. As this relates to sand, we ALWAYS seek to place sand

on the beach as a first option and nearshore as a second option.

7. The placement issue arises when the disposal of sand on the beach or in the nearshore is not the least costly alternative, but is consistent with sound engineering practices and meets environmental standards. In these cases the non-Federal interest must contribute 100 percent of the added cost of disposal above the least costly method, unless a particular job for a project has been approved for cost sharing pursuant to Section 933 of WRDA 1986. In either case, the non-Federal interest must provide all necessary lands, easements, rights-of-way and relocations required for disposal of maintenance dredged material from the navigation project.

8. Sound engineering practice dictates that we place sand within the Littoral drift if environmentally acceptable and if environmental windows allow safe economical operation. Economical operation is a function of each dredging project and cannot be oversimplified. However, one of the economical rules of thumb is a 5-mile limit for pumping distance. Large, cutter-suction dredges can economically dredge and place material within a 5-mile radius of a dredging site.

9. Based on this, the following "rule of thumb" will be used:

a. If a beach placement area is located within 5 miles of the dredging site, we shall place sand as:

(1) First priority on the beach.

(2) Second priority in the nearshore.

(3) Third priority in upland Confined Disposal Area (CDA).

(4) Fourth priority in the Offshore Dredged Material Site (ODMDS).

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(4) Fourth priority in the Offshore Dredged Material Site (ODMDS).

US Army Corps Of Engineers

New York District

Dredged Material Management Plan for the Port of NY & NJ

FACT SHEET **February 2000**

DESCRIPTION: The Port of New York and New Jersey must be dredged to maintain navigation and commerce estimated to generate about $ 20 billion annually in direct and indirect benefits. Due to past and present pollution, managing dredged material from many areas of the Port has become increasingly difficult. This is due to either a lack of management options or the higher cost of the limited number of options currently available. In December 1998 the Corps prepared a Dredged Material Management Plan (DMMP) for the Port of New York and New Jersey. Since then the Corps has been working with the lead agencies in the region to develop a draft Implementation Report for the DMMP. It identifies primary and contingency options needed to meet the dredging requirements of the Port through the year 2040 giving special emphasis to beneficial uses.

AUTHORIZATION/PROJECT DESCRIPTION: New York Harbor encompasses approximately two dozen separately authorized and maintained Federal navigation channels. These projects, whose authorized depths vary from 8 feet to 45 feet, along with the privately operated berthing areas generate approximately 2 to 4 million cubic yards of dredged material annually from maintenance. Further, several of these channels are planned to be deepened in the upcoming years to allow for the larger classes of ships now in use. The construction of these deeper channels will also generate substantial amounts of dredged material. The DMMP process seeks to identify and implement options to manage the material generated from both the federal and non-federal maintenance and deepening of the Port through the year 2040.

STATUS: The DRAFT Implementation Report for the DMMP and its Programmatic Environmental Impact Statement were released to the public in September 1999 (noticed in Federal Register September 10, 1999). Now that the public review/comment period has closed, the DMMP reports are now being finalized for release to the public in early 2000. The DMMP as it currently is developed utilizes a wide variety of preferred and contingency management options for dredged material. These options include:

- Contaminant Reduction – With the states lead and Corps support, a multi-million dollar, multi-year data collection and analysis program is now underway to identify and track down the sources of pollution that are contaminating dredged material.
- Remediation of the Historic Area Remediation Site – Dredged material is being used beneficially to remediate the HARS (an impacted ocean site) and will likely require decades to complete.
- Habitat Creation/Restoration – Several different habitat applications are included in the DMMP (*e.g.*, restoring habitat by filling existing degraded pits, creating fish reefs, and creating shellfish & bird habitats).
- Land Remediation – Using amended (or treated) dredged material, several landfills and brownfields in the region are being remediated. Plans and demonstrations are also underway to remediate abandoned mines.
- Decontamination Technologies – Several innovative dredged material treatment methods are now being demonstrated by the USEPA, the Corps, and New Jersey. The products of the treatment have a wide array of potential uses (*e.g.*, construction material, or clean fill).
- Containment Options – Several inshore pit options are either in use or under consideration as contingency to meet the regions short and mid-term management needs. The pits are sited in existing impacted areas and near to the dredged material sources to avoid adverse environmental impact.

NOTE: New Lower Bay subaqueous contained aquatic disposal facilities and island confined disposal facilities are currently inactive and not included in the Recommended Plan.

CONTACT: Dr. Raimo Liias, NY&NJ Harbor Program Manager, 212-264-0110; Bryce Wisemiller, Project Planner, 212-264-5797

DRAFT

Residential Canal Dredging Manual

Prepared For:
City of Tampa
Department of Sanitary Sewers

Prepared By:
Gee & Jenson
E-A-P, Inc.

March 2000

1.0 Introduction

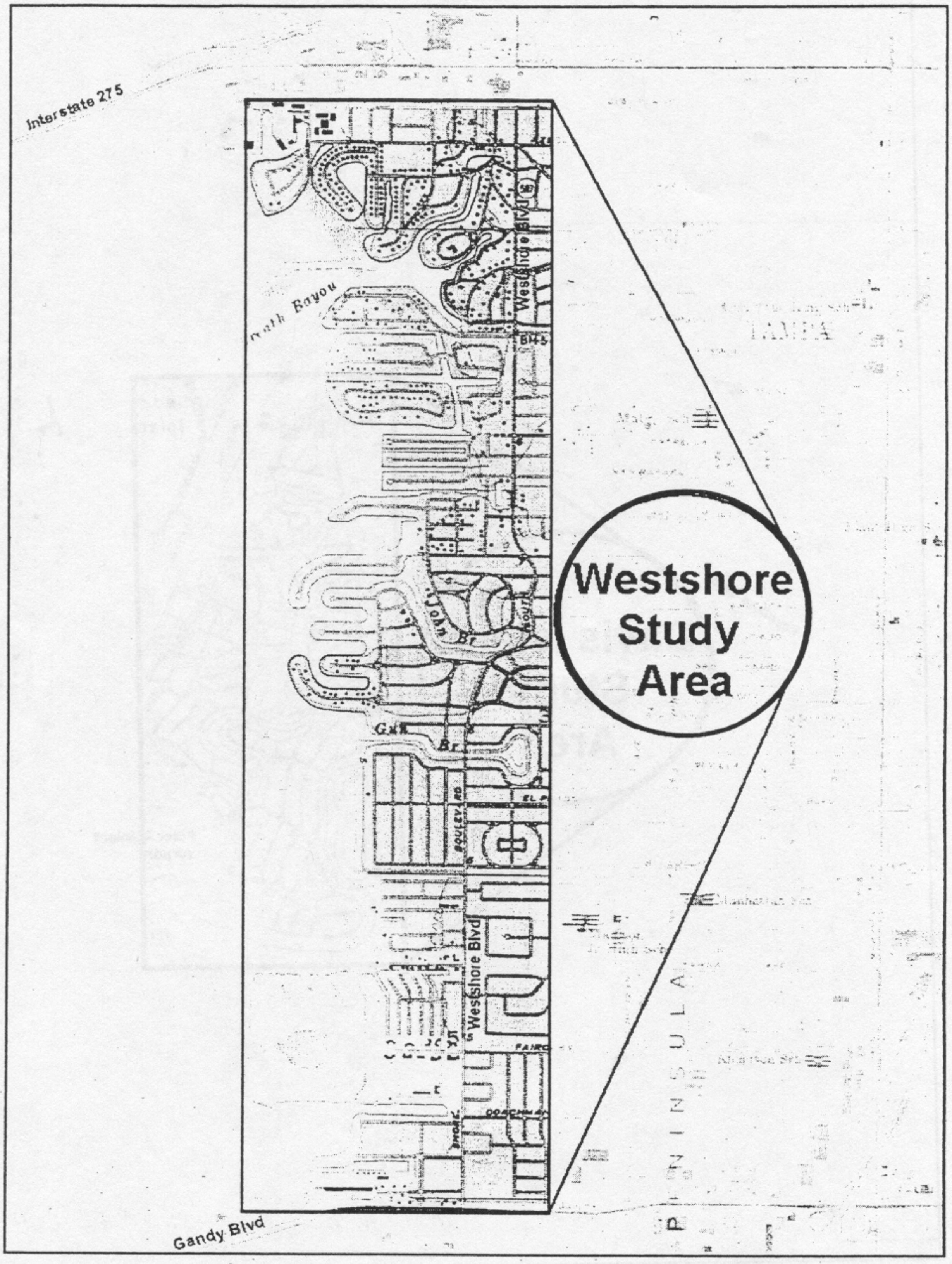
Gee & Jenson E-A-P Inc. has been retained by the City of Tampa, Department of Sanitary Sewers Stormwater Management Division to develop a Residential Canal Dredging Manual. The objective of the manual is to provide guidance on the regulatory agency requirements and construction planning aspects that are usually associated with the dredging of residential canals within the vicinity of Tampa Bay. Specifically, the manual addresses permitting processes, dredging methods, spoil disposal alternatives and estimated unit construction costs for the maintenance dredging of canals and lagoons of Davis Island and the Westshore area (see Project Location Maps - Exhibits 1-1 and 1-2).

Localized regions of the Westshore and Davis Island canal systems have been impacted by siltation to varying degrees over time. This has in turn created boat draft limitations to navigation in these areas of the canals. To assist area residents in the implementation of necessary maintenance dredging, this manual details the dredging process, from planning to construction through dredge spoil disposal. This manual also includes limited data collected specifically for this project (e.g., water depths, and physical and chemical sediment analysis). Much of this data, particularly the sediment analysis, may be utilized by the residents to augment other data when planning and permitting specific maintenance dredging activities

2.0 Summary

The design, permitting and performance of maintenance dredging in the Westshore and Davis Island residential canal systems will result in an improved navigational access for area residents. Permits will be required from the Tampa Port Authority, Florida Department of Environmental Protection and the U.S. Army Corps of Engineers. The identification of the most cost-effective dredging methodology and available spoil disposal area(s) are the single most important issues associated with this work. Due to the large volume of sediments to be removed to accomplish the desired navigational condition (estimated at approximately 387,724 cubic yards), coordination with owners of large tracts of undeveloped lands or existing spoil disposal facilities will be an integral part of the negotiations for project approval.

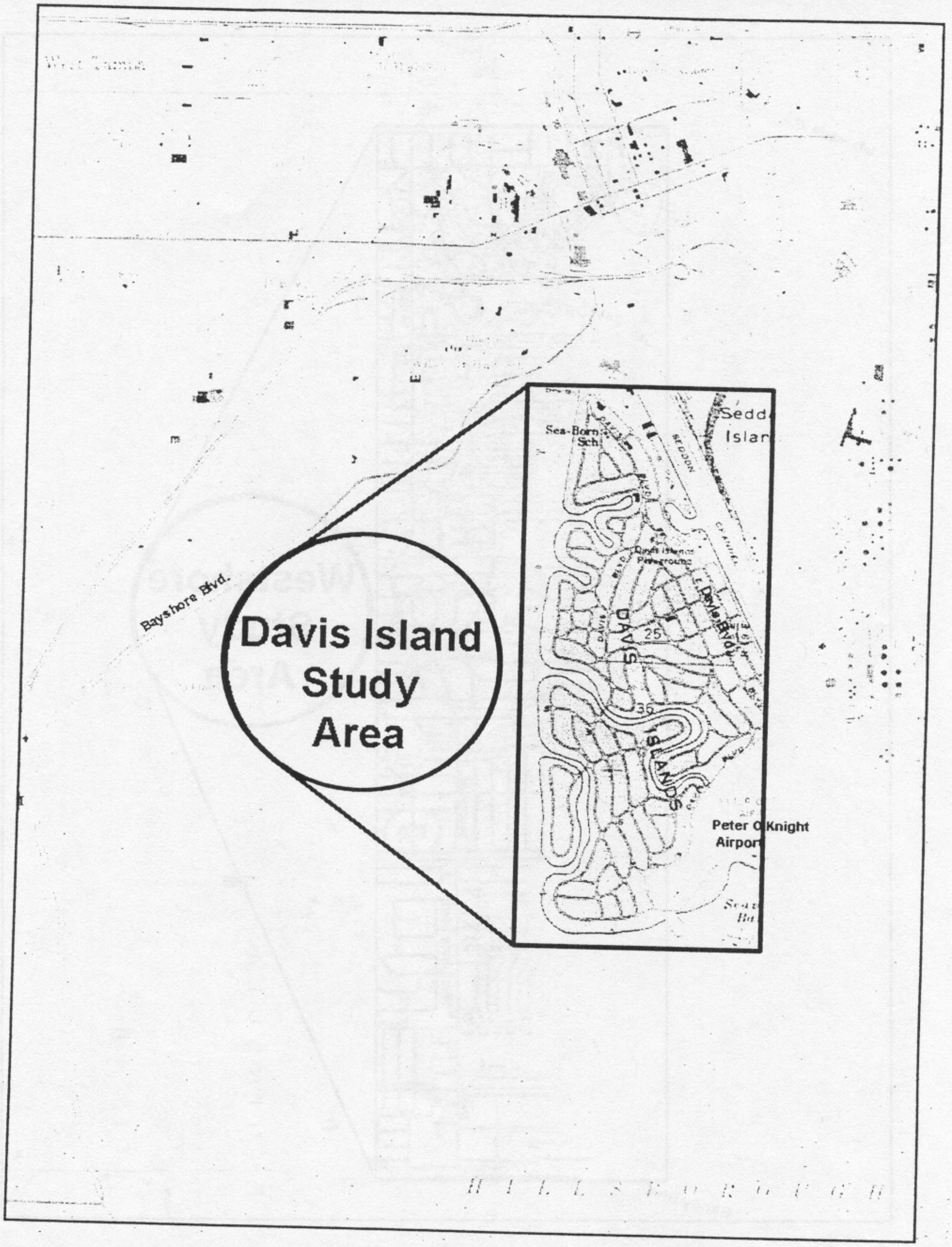
Preliminary studies conducted to assess the permittibility and overall feasibility of conducting this work indicate that the desired dredging can be accomplished within the existing regulatory guidelines. Evidence of elevated levels of metals and several petroleum-based contaminants suggest that some precautions will need to be taken during the removal and disposal of the spoil material. These may include monitoring of water quality



GEE & JENSON
Engineers - Architects - Planners, Inc.

Exhibit 1-2

Westshore - Project Location Map



GEE & JENSON
Engineers - Architects - Planners, Inc.

Exhibit 1-1

Davis Island - Project Location Map

during the dredging process and the selection of appropriate land development uses for the final disposal of dredged material.

Actual costs associated with the maintenance dredging are difficult to determine due to the high variability of factors associated with this type of project. These include factors such as project phasing (e.g., dredging completed as a single project or multiple projects), availability of and distance to an appropriate disposal site, dredge spoil quality, agency permit requirements and many others.

3.0 Typical Canal Sedimentation Factors

Residential canals in Florida and other coastal states were usually excavated from uplands or dredged from shallow wetlands. The excavated or dredged material was then deposited adjacent to the newly created canal to form suitable uplands for home construction. This was a common and seemingly practical solution to residential, waterfront development. Linear, low-flow waterways are often difficult to maintain. These Canal systems are often subject to a continual deposition and eventual accumulation of sediment material. The degree and rate of accumulation depends on many factors. The two primary factors which influence the rate of sedimentation are flushing characteristics and sediment input.

3.1 Flushing Characteristics (i.e., how well are the canals cleaned out by the movement of water in and out of the canal?)

The ability of a canal to "flush" sediments depends largely upon its' length, width, depth and points of connection to other surface waters or sources of water inflow. For example, does the canal have a "dead-end" with only one point of connection to a larger water body or does the canal act as a connection between two larger water bodies or connect to the same water body at two points (e.g., both beginning and end)?

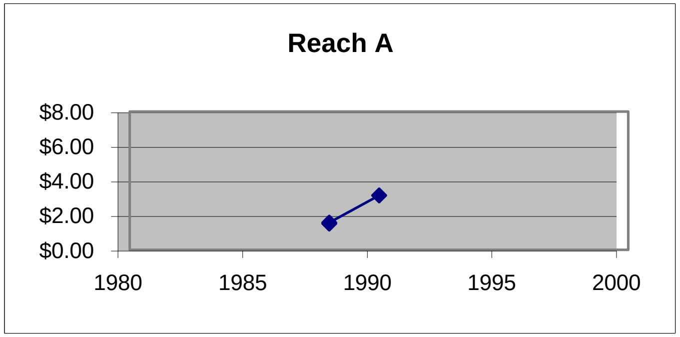
Canals with two or more points of connection will have better flushing characteristics. However, this advantage is negated when the canal is too long. In this situation there will be some horizontal movement of water within the canal, but not enough to completely flush or remove the sediments from the canal section.

Relating to tidal flow, long "dead-end" canals tend to flush less efficiently as water flow is somewhat static at the upper reaches of the canals. The water tends to rise and fall very slowly in response to the typical rise and fall of the tides. Horizontal movement of water and the resulting inflow and outflow are also sluggish. As canals become longer and narrower, the incoming tidal flow is met with more

Tampa Bay Dredged Material Management Strategy
Analysis of cost by reach

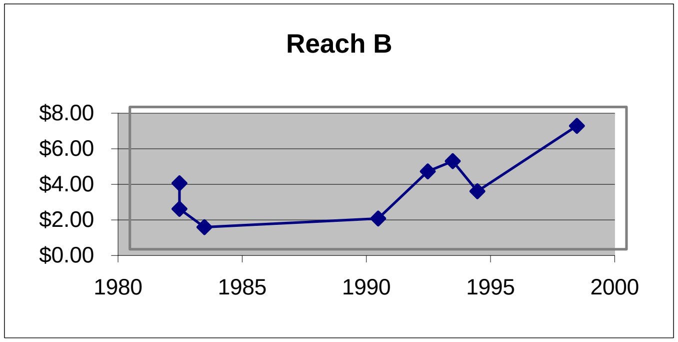
Reach A

Year	Volume	Final Cost	Cost Per CY
1988	2722343	$4,122,904	$1.51
1988	859703	$1,354,257	$1.58
1990	1686826	$5,298,871	$3.14
		Average	$2.08



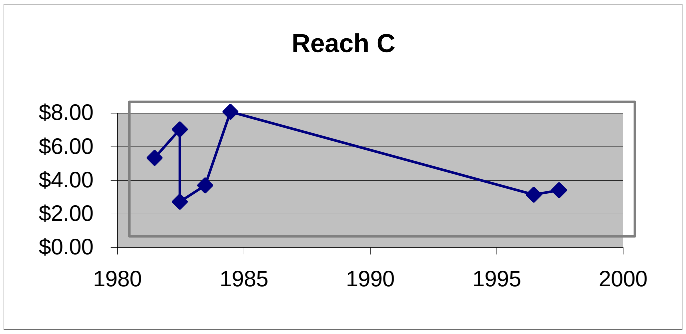
Reach B

Year	Volume	Final Cost	Cost Per CY
1982	662897	$2,463,794	$3.72
1982	964505	$2,193,240	$2.27
1983	516190	$645,237	$1.25
1990	642082	$1,115,765	$1.74
1992	885653	$3,880,849	$4.38
1993	785850	$3,899,977	$4.96
1994	363340	$1,187,179	$3.27
1998	721769	$5,009,785	$6.94
		Average	$3.57



Reach C

Year	Volume	Final Cost	Cost Per CY	Note
1981	3301060	$15,432,403	$4.67	
1982	1142250	$7,276,000	$6.37	
1982	5630652	$11,577,522	$2.06	
1983	3781222	$11,460,055	$3.03	
1984	3416254	$25,293,977	$7.40	
1996	1107696	$2,752,289	$2.48	
1997	1422000	$3,899,440	$2.74	a
		Average	$4.11	



Notes:
a.) Bid volume and price as pay volume and final cost not available.
b.) Data taken from Jacksonville District dredging history database.

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U.S. Army Engineer District, Jacksonville. Ybor Turning Basin, Tampa Harbor, Hillsborough County, Florida, Limited Re-evaluation Report. October 1999.

U.S. Environmental Protection Agency. Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Tampa, Florida. September 1994.

INTERNET RESOURCES FOR DREDGING

Address	Name and brief summary
dredging.seaport-net.com	Dredging network
www.navcen.uscg.mil/lnm/d7	U.S. Coast Guard Local Notice To Mariners, District 7
www.wrsc.usace.army.mil	U.S. Army Corps of Engineers Navigation Data Center Has a links section
www.mvr.usace.army.mil	U.S. Army Corps of Engineers Navigation Information Connection Has a very large links section
chl.wes.army.mil/research/dredging	U.S. Army Corps of Engineers Waterways Experiment Station Coastal and Hydraulics Laboratory Two parts: 1)DOTS 2)DOER
www.saj.usace.army.mil/conops/navigation/surveys/Hydro.htm#surveys	U.S. Army Corps of Engineers Jacksonville District Channel Condition Surveys